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VOLUME FOUR
DUODECIMAL—FÜNFKIRCHEN

THE BRITISH
ENCYCLOPEDIA
IN TEN VOLUMES
ILLUSTRATED

THE BRITISH ENCYCLOPEDIA

ILLUSTRATED

With an Introduction by
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VOLUME
FOUR

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KEY TO PRONUNCIATION

The method of marking pronunciations here employed is either (1) by marking the syllable on which the accent falls, or (2) by a simple system of transliteration, to which the following is the Key :

VOWELS

ā, as in *fate*, or in bare.

ä, as in *a*lms, Fr. â*m*e, Ger. Bahn = á of Indian names.

à, the same sound short or medium, as in Fr. bal, Ger. Mann.

a, as in *fat*.

ą, as in *f*all.

a, obscure, as in rur*a*l, similar to *u* in b*u*t, ė in h*e*r : common in Indian names.

ē, as in me = *i* in mach*i*ne.

e, as in m*e*t.

ė, as in h*e*r.

ī, as in p*i*ne, or as *ei* in Ger. m*ei*n.

i, as in p*i*n, also used for the short sound corresponding to ē, as in French and Italian words.

eu, a long sound as in Fr. j*eune* = Ger. long ö, as in Söhne, Göthe (Goethe).

eu, corresponding sound short or medium, as in Fr. p*eu* = Ger. ö short.

ō, as in n*o*te, m*oa*n.

o, as in n*o*t, soft—that is, short or medium.

ö, as in m*o*ve, t*wo*.

ū, as in t*u*be.

u, as in t*u*b : similar to ė and also to *a*.

u, as in b*u*ll.

ü, as in Sc. ab*u*ne = Fr. *û* as in d*û*, Ger. *ü* long as in grün, Bühne.

ú, the corresponding short or medium sound, as in Fr. b*u*t, Ger. M*ü*ller.

oi, as in *oi*l.

ou, as in p*ou*nd ; or as *au* in Ger. H*aus*.

CONSONANTS

Of the *consonants*, **b, d, f, h, j, k, l, m, n, ng, p, sh, t, v, z,** always have their common English sounds, when used to transliterate foreign words. The letter **c** is not used by itself in re-writing for pronunciation, **s** or **k** being used instead. The only consonantal symbols, therefore, that require explanation are the following :

ch is always as in ri*ch*.

d, nearly as *th* in *th*is = Sp. *d* in Ma*d*rid, etc.

g is always hard, as in *g*o.

h represents the guttural in Scotch lo*ch*, Ger. na*ch*, also other similar gutturals.

ŋ, Fr. nasal *n* as in bo*n*.

r represents both English *r*, and *r* in foreign words, which is generally much more strongly trilled.

s, always as in *s*o.

th, as *th* in *th*in.

th, as *th* in *th*is.

w always consonantal, as in *w*e.

x = ks, which are used instead.

y always consonantal, as in *y*ea (Fr. *ligne* would be re-written lēny).

zh, as *s* in pleasure = Fr. *j*.

THE BRITISH ENCYCLOPEDIA

VOLUME IV

DUODECIMAL SYSTEM, in numeration, a system of numbers the scale of which is twelve. *Duodecimals* is a term applied to an arithmetical method of ascertaining the number of square feet, &c., in a rectangular area or surface whose sides are given in feet, inches, and lines. The method is similar to that of ordinary decimals, the scale being twelve instead of ten.

DUODEC'IMO (often contracted 12*mo*) is that form of volume in which each leaf forms a twelfth part of the sheet.

DUODE'NUM (Lat. *duodeni*, by twelves), the commencement of the intestinal canal, the first of the smaller intestines, so called because its length is about twelve fingers' breadth.

DUPANLOUP (dü-pāṇ-lō), **Felix Antoine Philibert,** French prelate, born at St. Félix, in Savoy, 1802; became a French subject by naturalization in 1838; died at Paris 1878. He was ordained in 1825, appointed professor of theology at the Sorbonne in 1841, and Bishop of Orleans in 1849. From that time he took a prominent part in all the political and religious discussions in France. He belonged to the Gallican party, but submitted to the decisions of the council of the Vatican; and was a strenuous advocate of free education. He wrote: *La Pacification Réligieuse*, *De l'education*, and *De la haute éducation*.

DUPLEIX (dü-plā), **Joseph,** a French leader in India, born 1697, died 1763. He accumulated a fortune by commercial operations in India, and in 1742 was appointed Governor of Pondicherry for the French East India Company. He formed the project of founding a French Empire in India, and soon made himself master of the Carnatic partly by conquest and partly by political intrigue. He was opposed by Clive, and a long string of British successes caused the complete overthrow of all his plans. Recalled in 1753, he died in want and obscurity in Paris.

DUPONT (dü-pōṇ), **Pierre,** French poet and song-writer, born at Lyons 1821, died at St. Étienne (Loire) 1870. He was educated by his godfather, a priest, and began to write and compose songs at an early age. After issuing a volume of poems in 1844, he went to Paris and obtained a place in the office of the secretary of the Institute. Some of his songs, such as *Song of Bread* and *Song of the Workers*, had a Socialistic ring which proved obnoxious to the Government which came into power in Dec., 1852. He



Joseph Dupleix

was arrested, imprisoned, and condemned to be banished for seven years; but his release was soon procured. His poems have been collected under the titles *Cahiers de Chansons*, *La Muse Populaire*, *Chants et Chansons*, *Poésie et Musique*, and *Études Littéraires*.

DUPONT DE NEMOURS (dü-pōṇ dė nė-mör), **Pierre Samuel,** French political economist, born at Paris, Dec., 1739; died in America 1817. He early gained a reputation for his writings on commerce, and his exposition of the theories of the physiocrats, and was employed by Turgot and Vergennes in the public service. During the ministry of Calonne he became Councillor of State, and in 1787 was

secretary to the Assembly of the Notables. He was twice president of the National Assembly. During the Revolution he opposed the extreme republicans, and narrowly escaped the guillotine at the downfall of Robespierre. From 1798 to 1802 he was in America, and on his return to France he refused all public office. He finally returned to America in 1815. Among his writings are: *Philosophie de l'Univers*, *Vie de Turgot*, and a translation of Ariosto.

DÜPPEL (dŭp'l), a fortified village in Schleswig-Holstein, on the coast of the Little Belt. The place is of considerable strategical importance, and has been the scene of some severe struggles between the Danes, to whom it originally belonged, and the Germans. It was captured by the Prussians in 1864, but restored to Denmark by the plebiscite taken in 1920.

DUPUY, Charles Alexander, French statesman, born at Le Puy, Haute-Loire, in 1851. Educated at the Lycée of Le Puy and the Lycée Charlemagne in Paris, he was professor of philosophy at the colleges of Nantes and Aurillac, and afterwards vice-rector of the Corsican College at Ajaccio. He entered the Chamber of Deputies in 1885, was Minister of Public Instruction in 1889, and succeeded Ribot as Premier in 1893, but resigned and became President of the Chamber of Deputies. He was again Premier from 1894 to 1895, and from 1898 to 1899, and was elected to the Senate in 1900. He was Minister of Labour from 1912 to 1914. He died in July, 1923.

DUPUYTREN (dŭ-pŭ-ĭ-trăn), **Guillaume, Baron,** French surgeon and anatomist, born in 1777, died at Paris, 1835. In 1812 he became professor of surgery, and in 1815 first surgeon to the Hôtel Dieu, Paris. In 1823 he was appointed first physician to Louis XVIII, and retained the same situation under Charles X. He was considered the first French surgeon of his day, made important discoveries in morbid anatomy, and invented several useful surgical instruments.

DUQUESNE (dŭ-kān), **Abraham,** French admiral, born 1610, died 1688. In his seventeenth year he was in the sea-fight off Rochelle, and distinguished himself during and after the year 1637 in the war against Spain. In 1647 he commanded the expedition against Naples. In the Sicilian War he thrice defeated the combined fleets of Holland and Spain, under the renowned De Ruyter. After he had reduced Algiers and Genoa, Louis XIV conferred upon him the fine estate of Bouchet, and made it a marquisate, with the title of Duquesne. He was a Protestant, and the only person exempted from the banishment of his sect, occasioned by the repeal of the Edict of Nantes.

DURA'MEN, the name given by botanists to the central wood or heartwood in a tree trunk. It is harder than the newer wood that surrounds it, and is often dark-coloured from being impregnated with tannin and other antiseptic substances.

DURANCE (dū-rans), a river of France, which rises in the Cottian Alps, and after a course of about 180 miles joins the Rhone about 4 miles below Avignon. Marseilles is supplied with water from the Durance.

DURAN'GO, a town in Mexico, capital of the state of Durango, about 500 miles N.W. of Mexico, on an elevation 6,525 feet above the sea. It is well built, has a cathedral, a mint, manufactures of cotton and woollen goods and leather. Pop. 32,719.—The state (area, 42,272 sq. miles) is partly mountainous and unproductive but has valuable gold-, silver-, and iron-mines, and also fertile tracts. The census population in 1930 was 395,807.

DURANTE (dö-rän'tā), **Francesco,** Italian musician, born 1684, died 1755. He attained a high degree of eminence in vocal church music, and he trained the most celebrated musical masters of the eighteenth century in Naples—Pergolese, Sacchini, Piccini, Guglielmi, and Jomelli.

DURAZZO, or DURRES (dö-rät'sō; ancient **DYRRHACHIUM, or EPIDAMNUS**), a seaport of Albania, on the Adriatic, 49 miles south by west of Scutari. It is fortified, and has a good harbour. For four centuries the town remained under Turkish rule and lost all importance, but in 1912, during the Balkan War, it again came into prominence. It was occupied by the Serbians on 28th Nov., 1912, and in 1913 was incorporated in the newly created Principality of Albania. During the European War, Durazzo was captured by the Austrians in Feb., 1916, but was re-occupied by the Italians on 14th Oct., 1918. Pop. 8,739.

DUR'BAN, chief port of Natal, on a land-locked bay (Port Natal). It is well laid out, has a fine town hall, electric tramways, and parks and gardens, and is connected by railway with Maritzburg and the interior. The harbour now admits large vessels. Founded in 1834, it was named after a governor of the Cape. Pop. (1921), 146,310 (57,095 white); white pop. 1931, 86,271.

DURBAR (dŭr-bär'; Pers. *dar*,

door, and *bar*, court, admittance), a term signifying the court, council-chamber, or audience-room in the palaces of the native princes of India; hence, a general reception by a ruler in British India or by any officer of rank. Durbars were held on a ridge at Delhi on the proclamation of Queen Victoria (1877), of King Edward VII (1903), and of King George V (1911).

DÜREN (dü'ren), a town in the Rhine province, on the right bank of the Roer, 16 miles E. by N. of Aix-la-Chapelle. It has important manufactures of woollens, paper, leather, rails, and hardware, and an extensive trade. Pop. 37,176.

DÜRER (dü'rér), **Albrecht**, German painter, designer, sculptor, and engraver on wood and metal, born at Nürnberg 1471, died there 1528. His father was a skilful goldsmith of Hungary. In 1486 he left his father's trade and became an apprentice of Michael Wohlgemuth, then the best painter in Nürnberg. Having finished his studies, he entered upon his 'wanderjahre,' the usual course of travels of a German youth. On his return to Nürnberg he married Agnes, the daughter of Hans Frey, a mechanic, who has been falsely accused for centuries of embittering his life and bringing him to his grave.

In 1505 he went to Venice to improve himself in his art. His abilities excited envy and admiration. He painted the *Martyrdom of Bartholomew* for St. Mark's church, which painting was purchased by the Emperor Rudolph and removed to Prague. He also travelled to Bologna, to improve his knowledge of perspective. On his return to Nürnberg his fame spread far and wide. Maximilian I appointed him his court-painter, and Charles V confirmed him in this office. All the artists and learned men of his time honoured and loved him, and for many years he was one of the chief burghers of his native town. Profound application and great facility in the mechanical part of his art were the characteristics of Dürer, and enabled him to exert a great influence on German art.

He was the first in Germany who taught the rules of perspective, and of the proportions of the human figure. He not only made use of the burin, like his predecessors, but was also among the first to practise etching. He also invented the method of printing woodcuts in two colours.

Works. Among his masterpieces in painting are a *Crucifixion*, *Adam and Eve*, an *Adoration of the Magi*, and portraits of Raphael, Erasmus, and Melanchthon, who were his friends. Among his best engravings on copper are his *Fortune*, *Melancholy*, *Adam and Eve in Paradise*, *St. Hubert*, *St. Jerome*, and *The Smaller Passion*, in sixteen plates. Among his best engravings on wood are *The Greater Passion* (so called), in thirteen plates; *The Smaller Passion*, with the frontispiece, thirty-seven pieces; *The Revelation of St. John*, with the frontispiece, fifteen plates; *The Life of Mary*, two prints, with the frontispiece. Dürer has also much merit as a writer, and published works on *Human Proportion*, *Fortification*, and the *Use of the Compass and Square*.—BIBLIOGRAPHY: Thausing, *Dürer, Geschichte seines Lebens und seiner Kunst* (2 vols.; English translation by F. A. Eaton); L. Cust, *Albrecht Dürer: a Study of his Life and Works*; F. Nüchter, *Life and Selection from Works*.



Durga

DU'RESS (Lat. *duritia*, severity, from *durus*, hard), in law, restraint or compulsion, is of two kinds: *duress of imprisonment*, which is imprisonment or restraint of personal liberty; and *duress* by menaces or threats (*per minas*), when a person is threatened with loss of life, or with some kind of injury. An act done under duress is voidable or excusable.

D'URFEY (dur'fi), **Thomas**, an English poet and wit, the grandson of a French Protestant refugee, was born at Exeter in 1653, and died in 1723. He abandoned law for literature, and wrote a large number of comedies of a licentious character. His bombastic tragedy *The Siege of*

Memphis appeared in 1676. D'Urfey's name is now principally remembered in connection with his *Pills to Purge Melancholy*, a collection of songs and ballads, partly his own, and many of them coarse or licentious. His society was generally courted by the witty, and he enjoyed the favour of four successive monarchs.

DURGA (dur'gä), a Hindu divinity, one of the names given to the consort of Siva. She is generally represented with ten arms. In one hand she holds a spear, with which she is piercing Mahisha, the chief of the demons, the killing of whom was her most famous exploit; in another a sword; in a third the hair of the demon chief; and in others, the trident, discus, axe, club, and shield. A great festival in her honour, the *Durga puja*, is celebrated annually, lasting for ten days.



Durham Cathedral

DURHAM, Simeon of, English chronicler of the twelfth century; wrote *Annals of England to the Reign of Henry I*, particularly valuable for events connected with the north of England. They were continued by John of Hexham.

DURHAM (dur'am), an ancient city, capital of the county of the same name, on the River Wear, which is crossed here by four bridges, 15 miles S. of Newcastle. The principal public buildings are the ancient castle—now appropriated to the uses of the university—the cathedral and other churches, the town hall, county prison, and grammar school. The educational institutions comprise the university, opened in 1833, the grammar school, a training-school for schoolmistresses, and other schools. There are manufactures of carpeting and mustard. The Cathedral occupies a height overlooking the Wear. The larger portion of it is Norman in style, with insertions in all the English styles. Three magnificent and elaborately ornamental towers spring up from the body of the building, one from the centre 212 feet high, and two together from the west end each 143 feet high; the entire length is 420 feet. It was founded by William de St. Carilef, assisted by Malcolm, King of Scotland, in 1093. A parliamentary borough until 1918, Durham returned two members to the House of Commons from 1673 to 1885, and one member from 1885 to 1918. Pop. (1931), 16,223.

DURHAM BOOK, a Latin text of the gospels written by Bishop Eadfrith of Lindisfarne, with an interlinear Saxon gloss, finished in the year 720; now in the British Museum.

DURHAM, COUNTY OF, a county on the N.E. coast of England, having on the E. the North Sea, on the N.

Northumberland, from which it is divided by the Rivers Tyne and Derwent, Cumberland on the w., and Yorkshire on the s., the River Tees parting the two counties. Its area is 649,420 acres, of which two-thirds are under cultivation. The western portion of the county is hilly, enclosing fertile valleys, the eastern portion is more level, and the centre contains extensive coal-fields.

Durham is the chief coal county in England, and also produces fire-clay. The chief crops are wheat, oats, turnips, and potatoes. The cattle are esteemed both for the dairy and for fattening. In connection with the commerce of the county may be noticed its foundries, ironworks, potteries, glass-houses, iron-shipbuilding, engine and machine works, and chemical works. For parliamentary purposes it is divided into eleven divisions, each of which sends one member to the House of Commons. It was formerly one of the three counties called counties *palatine*. The chief towns besides Durham are Sunderland, Gateshead, South Shields, Stockton, Darlington, and Hartlepool. Pop. (1931), 1,486,175.—Cf. *Victoria History of the County of Durham.*

DURHAM UNIVERSITY, founded in 1832, opened in 1833, incorporated by royal charter in 1837. It is connected with the bishopric of Durham, the office of warden being annexed to the deanery of Durham, and a canonry in the cathedral being annexed to each of the professors of divinity and classical literature. There are also professors of mathematics, Hebrew, medicine, &c. The students mostly reside within the university buildings, but in 1870 a regulation was passed dispensing with the necessity of residing in any college, hall, or house connected with the university in order to be admitted as a member.

The management of the university is entrusted, under the Bishop of Durham as visitor, to the dean and chapter of the cathedral as governors, and to the warden, senate, and convocation, the last including all persons regularly admitted since the opening of the university to the degrees of Doctor in Divinity, Civil Law, and Medicine, and to the degree of Master of Arts. The academical year is divided into three terms—Michaelmas, Epiphany, and Easter. For the degree of B.A., or a licence in theology, a residence of two years (of six months each) is necessary. The M.A. degree may be obtained by a graduate who is of the standing of nine terms since taking his degree of B.A. Armstrong College, founded in 1874, and the College of Medicine, both at Newcastle-on-Tyne, form part of the University of Durham.

DURIAN, or **DURION** (*Durio zibethinus*), a large and lofty tree growing in the Malayan Archipelago. The largish flowers, of a yellow-green colour, are produced on the stem or main branches, and are followed by the large fetid fruit, which is of the size of a man's head, and is a favourite food of the natives during the time (May and June) when it is in season. There is usually a second crop in November. The smell is offensive, like putrid animal matter, but with this is associated the most delicious flavour, which places it, notwithstanding the odour, in the opinion of many, in the foremost place among tropical fruits.

DÜRKHEIM (dürk'hīm), an old town in Rhenish Bavaria (the Palatinate), 6 miles w.s.w. of Mannheim, well known for its mineral water. The town was destroyed by the French in 1689. Pop. 7,220.

DURKHEIM, Émile, French philosopher and sociologist, born at Les Vosges 15th April, 1858, died in Paris 15th Nov., 1917. Educated at the École Normale Supérieure, he travelled in Germany, where he studied social conditions. In 1887 he founded the first French chair in sociology at the University of Bordeaux. Durkheim's merit consists in having separated sociology from mere psychology, and in having made a distinction between individual mental phenomena and Folk-psychology.

In 1898 he founded and published annually *L'Année Sociologique.* His other works include: *De la division du travail social* (1893); *Les règles de la méthode sociologique* (1894); *Le Suicide* (1897); *Les formes élémentaires de la vie religieuse; Sociologie et sciences sociales* (1910); *Le système totémique en Australie* (1912); *La Sociologie* (in *La Science Française,* 1915); *Qui a voulu la guerre?; Les Origines de la guerre, d'après les documents diplomatiques* (1915).

DURLACH (dur'lăh), a town in Baden, 2½ miles by rail E.S.E. of Carlsruhe, at the foot of the Turmberg, with manufactures of machinery, chemicals, and leather. Pop. 17,529.

DURMAST, a species of oak, *Quercus sessiliflora,* or according to some, *Q. pubescens,* so closely allied to the common oak (*Q. robur*) as to be reckoned only a variety of it. Its wood is, however, darker, heavier, and more elastic, less easy to split, not so easy to break, yet not so difficult to bend. It is highly valued,

therefore, by the builder and cabinet-maker.

DUROC (dū-rok), **Michel Géraud Christophe,** Duke of Friuli, a distinguished general under Bonaparte, born at Pont-à-Mousson in 1772, killed, 1813, at the battle of Bautzen. He served as aide-de-camp to Napoleon in the Italian and Egyptian campaigns. In 1805 he was made grand-marshal of the palace, and was frequently employed in diplomatic missions, though he still took his full share in the wars of France till the time of his death. He was a great favourite of Napoleon, and was killed by his side.

DURRA, or **DHURRA,** Indian millet, the seed of *Sorghum vulgāre*, after wheat the chief cereal crop of the Mediterranean region, and largely used in those countries by the labouring classes for food. Varieties are grown in many parts of Africa, one of them being known as Kaffir corn.

DÜRRENSTEIN (dür'en-stīn), a village in Lower Austria, on the Danube, 41 miles west by north of Vienna. Here are the ruins of the castle in which Leopold, Duke of Austria, imprisoned Richard Cœur-de-Lion on his return from Palestine, 1192.

DURUY (dū-rū-ē), **Victor,** French historian and educationist, born at Paris 1811, died in 1894. His father was a workman in the Gobelins tapestry works, and the boy did not begin his education until he was grown up. He was admitted to the École Normale Supérieure in 1830, graduated in 1833, and was appointed successively teacher of history in the Lycée Henri IV, then at the Normal School and the Polytechnic School, inspector of the Academy of Paris, inspector-general of secondary education, and Minister of Public Instruction (1863–9).

Works. He is author of *Géographie Politique de la République Romaine et de l'Empire, Géographie Historique du Moyen Age, Histoire Romaine, Histoire de France, Histoire Grecque, Histoire Populaire Contemporaine,* &c. Some of these are simply school-books, but his *Histoire des Romains* (translated into English) and his *Histoire de la Grèce Ancienne* (translated into English) are extensive and important works, the former especially.

DUSE, Eleonora, Italian actress, born at Vigevano, near Venice, in 1859. At the age of thirteen she made her first appearance on the stage, and in 1883 she acted at Rome, when she was recognized as one of the greatest Italian, and even one of the greatest living actresses. From that time her career was one of uninterrupted success, and she gained a world-wide reputation. Duse is one of the dramatic artists who discards the customary mannerisms of the stage, and all that is conventional but unreal in modern acting. Some of d'Annunzio's best plays were specially written for her. Among her most remarkable impersonations are those of Francesca da Rimini, Marguerite Gautier in *La Dame aux Camélias,* Magda, La Tosca, Paula in *The Second Mrs. Tanqueray,* and Nora in Ibsen's *A Doll's House.* She appeared for the first time in London in 1897. She died in 1924.

DÜSSELDORF (düs'sel-dorf), a town of Germany, in the Rhine province, beautifully situated among villas and gardens on the right bank of the Rhine, 22 miles N.N.W. of Cologne, one of the handsomest towns in the valley of the Rhine. It is a great focus of railway and steamboat communication, and has a number of handsome public buildings, and several remarkable churches. Among the public institutions particular notice is due to the Academy of Art, founded in 1767, by the Elector Theodore, and afterwards directed by Cornelius, Schadow, and Bendemann. It has the honour of having founded a school of painting, which takes the name of Düsseldorf, and has had a large number of distinguished pupils. The industries embrace iron, machinery, railway plant, cotton, leather, chemicals, and beer, and the trade is large. Pop. 464,543.

DUST, solid matter in a fine state of division. Spores of plants, bacteria, &c., are found in the atmosphere; but, in general, organic particles are numerous only over thickly populated districts. Inorganic particles are derived from various sources. Where the soil is dry, dust is whirled aloft by the winds, this cause giving rise to the great sand-storms of tropical desert regions. Volcanoes in eruption eject large quantities of dust.

It is estimated that millions of meteors are encountered by the earth per day. Most of these are excessively minute. They are speedily disintegrated, and generally entirely reduced to dust at high levels. Evaporation is almost always proceeding over seas and oceans, and from foam thrown up and swept along by the winds the dissolved salts are liberated as solid particles. Again vast quantities of dust are produced in the consumption of fuel.

The late Dr. John Aitken, F.R.S., of Falkirk, Stirlingshire, contrived a means of gauging the dust contents of the atmosphere. This consists of a

glass box about a centimetre in thickness. Two pieces of wet filter paper inside serve to keep the contained air damp. The bottom of the box is a micrometer plate, divided rectangularly in millimetres. It can be examined from above by a lens. An air-pump can withdraw definite volumes of air as desired. When the air is partially withdrawn, the expansion of the remainder produces cooling. The dust particles form nuclei for condensation of the vapour. They are thus precipitated on the plate and counted, leaving the air dust-free.

A measured quantity of the air to be tested is next drawn in and shaken up. Further operation of the air-pump causes its expansion, and the deposition of its dust particles, which can then be counted. Dr. Aitken found the proportion of dust on Ben Nevis to vary at different times from under 100 particles to over 14,000 per cubic centimetre. Over oceans the numbers were from about 500 on the Indian to 2,000 on the Atlantic; but over cities 100,000 per cubic centimetre are frequently present. A puff of cigarette smoke was estimated to contain 4,000,000,000 particles.

Many phenomena are connected with the existence of dust in the atmosphere. As a result of Dr. Aitken's discoveries the belief largely prevailed that the formation of fog, of rain, and other varieties of precipitation, was necessarily dependent on dust particles as nuclei of condensation. Though they certainly function to a preponderating extent, it has been shown that gaseous particles can act similarly, particularly when air is ionized.

Dust is the main cause of the scattering of the sun's rays which produces twilight, the blue of the sky, the gorgeous red and golden hues of sunrise and sunset, and the purple lights of advancing dusk. After the great Krakatoan eruptions of 1883, dust was carried in the upper atmosphere several times round the earth, and caused extraordinary colour effects. To a lesser degree similar phenomena followed the West Indian eruptions of 1902. The unusual sunlessness of the summer of 1912 was attributed to dust expelled in the preceding great eruptions at Katmai, Alaska.

DUTCH AUCTION, form of auction in which the salesman at first offers objects at prices higher than he is prepared to accept. He lowers the price gradually until reaching one which a purchaser accepts, the object being knocked down to the first bidder at that price. Should no bid result on reaching his minimum the object is withdrawn.

DUTCH CLOVER, *Trifolium repens*, commonly called white clover, a valuable pasture plant. It has a creeping stem; the leaflets are broad, obovate, with a horse-shoe mark in the centre; the white or pinkish flowers are in a globular head.

DUTCH EAST INDIES, forming a large and important colonial possession of the Netherlands Government, lie between 6° N. and 11° S., and 95° E. and 141° E. The colony includes Java and Madura, with the 'Outposts,' which comprise Sumatra, the south-east and west portions of Borneo, Banca, Billiton, Celebes, the Timor and Riau-Lingga Archipelagos, the Lesser Sunda Islands, and the north and west of New Guinea. The total area is about 733,296 sq. miles; the population of about 60,731,025 is composed of natives of Malay race, Arabs, Chinese, and other Orientals, and some 80,000 whites.

The origin of the colony may be traced to the treaty made by the Dutch with the Sultan of Bantam in Sumatra (1595), which was followed by the formation of the Dutch East India Company (1602), the establishment of Batavia (1619) on the ruins of the native town of Jacatra, and the settlement in Sumatra (1677). The Dutch East India Company was dissolved in 1798, since which date the colony has been administered from the Netherlands by a Governor-General, who, assisted by a Council of five members nominated by the queen, has the power to pass laws, subject to the general regulations adopted in 1854. Some of the outlying islands are, however, administered by their native princes under the 'advice' of a Netherlands Resident.

Batavia (population about 290,000), a town in the province of the same name on the north-west coast of Java, is the administrative capital and an important centre of trade. Java and Sumatra, containing about three-fourths of the total population of the colony, are self-supporting as regards food, besides producing for European consumption large quantities of tobacco, tea, coffee, sugar, cinchona, tin, rubber, and copra.

The colonial army numbered (1931) 1,247 officers and 36,679 men; compulsory service for white men within certain age-limits was adopted in 1918. There is also a small naval force.—BIBLIOGRAPHY: Bemmelen and Hooyer, *Guide to the Dutch East Indies*; W. Cool, *With the Dutch in the East*; J. M. Brown, *The Dutch East.*

DUTCH METAL, an alloy containing 84·5–84·7 per cent of copper

and 15·5–15·3 per cent of zinc, with a fine golden-yellow colour, ductile, malleable, and tenacious. When beaten out by a process analogous to that for gold-leaf, until the sheets are less than $\frac{1}{300000}$th part of an inch thick, it constitutes Dutch leaf or Dutch foil, and is used as a cheap substitute for gold-leaf for ornamental purposes.

DUTCH PINK, a bright yellow colour used in distemper, for staining paper-hangings, and for other ordinary purposes. It is composed of chalk or whiting coloured with a decoction of birch leaves, French berries, and alum.

DUTCH RUSH, *Equisetum hyemale*, one of the plants known as horse-tails, with a firm texture and so large an amount of silica in the cuticle that it is employed as a fine sand-paper for polishing delicate woodwork. The plant is found in marshes and woods in Britain; but for economic use it is imported from Holland, whence its popular name.

DUTCH WARS, naval wars between England and the United Provinces. The first war broke out in 1652, ostensibly because of Holland's diplomatic rebuffs to England, really because of the intense commercial rivalry between the two countries, especially in the North Sea and the East Indies. The First and Second Dutch Wars, 1652–54 and 1664–67, were purely trade wars. In the first, Admiral Tromp considerably injured English naval prestige until Admiral Blake defeated him in 1653. The wars ended with the Treaty of Westminster (1654) and the Peace of Breda (1667) respectively. The Third War (1672–74) was bound up with continental politics, and the Dutch, under William of Orange, eventually forced England to make peace.

DUTROCHET (dü-tro-shā), **René Joachim Henri,** a French physiologist, born in Poitou in 1776, died at Paris in 1847. He served for some time as medical attendant to Joseph Bonaparte during the Spanish campaign 1808–9; but afterwards returned to France, and retired to the estate of Châteaurenault, where he devoted himself exclusively to physical and physiological studies. His chief works have been published in a collective form with the title *Mémoires pour servir à l'Histoire Anatomique et Physiologique des Végétaux et des Animaux* (1837, 2 vols.).

DVINA, NORTHERN, a Russian river formed by the union of two small streams in the government of **Vologda.** It flows in a north-westerly direction, and falls by four mouths into the White Sea. At Archangel, before it divides, it is 4 miles broad. It is navigable as far as Suchona, and is connected with the Volga and Neva by canal.

DVOŘÁK (dvor-shäk'), **Anton,** a Bohemian musical composer, born in 1841, died in 1904. He studied at the Prague Conservatoire, and composed several operas on national Bohemian subjects, songs, orchestral arrangements of Bohemian dances, several symphonies, a *Stabat Mater*, a cantata (*The Spectre Bride*), and an oratorio (*St. Ludmila*). In 1892 he was director of the New York National Conservatory, and after 1895 he lived in Prague, where he wrote, in 1889, the opera *Der Teufel und die wilde Kätze.*

DWARF, a term applied to any animal or plant greatly below the usual size of its kind, particularly to a human being of small dimensions. Strictly speaking, the term should be used with reference to individuals and not to races. When a whole population consists of people of small stature, the proper term to apply to them is pigmies, not dwarfs. Accounts of pigmy tribes have been common from early times, such tribes being located especially in Africa; and it would appear from the accounts of Du Chaillu, Schweinfurth, and other travellers that there are several pigmy tribes throughout this continent. The Obongo, a race of dwarfs, are described as living in woods near the Okanda River, in wretched huts made of branches. Other races are the Mabongo, and the Akka dwarfs of Central Africa (*see* AKKAS); and a race exists in the Congo State, not as a distinct community, however, but mixed with other tribes.

Individual dwarfs occur in all races, and were formerly a fashionable appendage to the courts of princes and the families of nobles. Jeffery Hudson, the favourite dwarf of Charles I, at the age of thirty is said to have been only 18 inches high, though he afterwards grew to 3 feet 9 inches. Bébé, the celebrated dwarf of Stanislas of Poland, was 33 inches; Wybrand Lolkes, a Dutch dwarf, when sixty years of age was only 27 inches; Charles H. Stratton, 'General Tom Thumb,' was 31 inches high at the age of twenty-five; Francis Flynn, 'General Mite,' was only 21 inches at sixteen. In most of the extreme cases the dwarfing is the result of some defect in the ductless glands which regulate the normal growth of the body. Stories of dwarfs and brownies are to be found in the folk-lore of many tribes on earth.—BIBLIOGRAPHY: E. J. Wood, *Giants and Dwarfs*; E. Tyson, *Philological*

Essay concerning Pygmies of the Ancients.

DWARFING, the process of training up trees or shrubs for ornament in houses so as to cause them never to reach more than a very small size, by keeping them in poor soil, giving them little water, pinching off strong shoots, &c. It is much practised among the Chinese and Japanese.

DWIGHT (dwīt), **Timothy**, American divine, born in Massachusetts 1752, died 1817. His father was Colonel Timothy Dwight, and his mother was a daughter of Jonathan Edwards. He served as chaplain in the revolutionary army, and ultimately became president of Yale College. His *Theology Explained and Defended* (1818) was for long a standard work both in Britain and in America.

DY'AKS, the aborigines of Borneo, chiefly inhabiting the interior of the island. They are a finely formed race, of a yellow complexion, and are described as docile, industrious, and superior to the Malays. The more advanced of them practise agriculture and dwell in neatly-constructed and tolerably comfortable houses. In Sarawak they have made considerable advances in civilization. The practice of head-hunting (hunting their enemies to make trophies of their heads) is practised among them, but has been abolished where European influence prevails.—Cf. Hose and M'Dougall, *The Pagan Tribes of Borneo* (2 vols.).

DYAUS (dyous), the god of the sky in the older mythology of the Hindus. His name is etymologically connected with that of the Greek Zeus.

DYCE (dīs), **Alexander**, Shakespearean editor, born at Edinburgh 30th June, 1798, died 15th May, 1869. He was educated at Edinburgh and Oxford, but in 1827 settled in London, where most of his life was passed. He first became known by his editions of Collins, Peele, Webster, Marlowe, and Skelton, accompanied by notes and biographies of the authors. His chief work was an edition of Shakespeare in six volumes, with notes (1853–8).

DYCE, William, painter, born at Aberdeen in 1806, died near London, 1864. He studied in London and Rome, and practised his art in Edinburgh. In 1840 he became director of the School of Design in London, and in 1844 was appointed professor of fine art in King's College, London. He was elected a Royal Academician in 1848. Amongst his chief works are: *Francesca da Rimini* (1837); *Joash shooting the Arrow of Deliverance* (1844); *King Lear in the Storm* (1851); *Christabel* (1855); *The Good Shepherd* (1856); *The Baptism of Ethelbert*, a large fresco for the Houses of Parliament, and a series of frescoes illustrative of the legends relating to King Arthur, for the same. He also executed for the Prince Consort, at Osborne, the fresco *Neptune giving the Empire of the Sea to Britannia.*

DYEING is the art of colouring textile and other materials in such a way that the colours are not readily removed by the action of light, washing, &c. Like spinning and weaving, it was originally a home industry, as it still is in many places. The natural dyes formerly employed are now largely displaced by dyes derived from coal-tar products, the first discovery of which was made by Perkin in 1856; a few mineral colours are employed in cotton dyeing. Before dyeing, the materials have generally to be cleansed or bleached to get rid of undesirable colouring matters or impurities; and frequently a textile material is subjected to some subsidiary treatment in order to obtain special effects. For example, cotton yarn may be subjected to the action of strong caustic soda ('mercerizing' process) while in a state of great tension, in order to give it a permanent silky lustre. Dyeing is not only an art, it is also a branch of applied chemistry. One fundamental principle is, that the colouring matter and other necessary substances must be applied in a state of solution, and while in direct contact with the fibre they must be rendered insoluble, so that they are precipitated within or upon the fibre and fixed permanently. The method of effecting this varies greatly, according to the fibre and the colouring matter employed. As a rule, the vegetable and the animal fibres are dyed by very different methods. The affinity of the animal fibres for certain colouring matters is often so great that they are readily dyed by simple immersion in hot colour solutions; but this simple process is not generally sufficient.

According to the method of their application in dyeing, the following groups of dye-stuffs may be distinguished: *Acid Dyes, Basic Dyes, Direct Dyes, Developed Dyes, Mordant Dyes, Vat Dyes.* A dye is *substantive* to a particular fibre when it dyes that fibre directly, and *adjective* when the presence of a third substance known as a *mordant* is necessary.

Acid dyes. The *acid dyes* are so called because they are of an acid character and are applied in an acid dye-bath. As a rule, they are only suitable for dyeing the animal fibres,

e.g. wool and silk, also leather, horn, feathers, &c., and they are substantive to these materials. The purple vegetable dyestuff *orchil* belongs to this class. The acid dyes derived from coal-tar are very numerous, and yield a great variety of hues—red, orange, yellow, green, blue, violet, brown, and black.

Basic dyes.—The *basic dyes* are so called because their essential constituents, to which they owe their dyeing power, are organic bases. The bases themselves are colourless and too insoluble in water to be of use, hence they are employed in the form of their soluble coloured salts, usually the hydrochlorides of the colour-bases. Their solutions are precipitated by tannic acid, because it combines with the colour-bases to form insoluble tannates. Wool, silk, and animal substances generally have a direct attraction for colour-bases, and hence these fibres are readily dyed by simple immersion in hot aqueous solutions of the basic dyes. Cotton and linen, on the other hand, are not dyed so readily; they need first to be mordanted or impregnated with the *mordant* tannic acid. Most of the colours of this class are fugitive to light, and all but one, viz. *barberry root*, are derived from coal-tar products.

Direct dyes.—The *direct dyes* are so called because they dye cotton without the aid of any mordanting process. The first of this class derived from coal-tar was *congo red*, discovered in 1884; at present this group includes a very great variety of fast colours, and forms, indeed, one of the most important and valuable series of dye-stuffs employed. Cotton, linen, and the vegetable fibres generally are dyed in the simplest possible manner by merely boiling them in a solution of the dye-stuff, with or without the addition of a little soap, carbonate or sulphate of soda, &c. Wool and silk are frequently dyed in the same manner as cotton. Very few vegetable dye-stuffs belong to the direct colours, e.g. *Safflower*, *Turmeric*, *Saffron*, *Annatto* (*see* the articles). They are all fugitive, and are now of little or no importance to the dyer. The coal-tar colours of this class, on the other hand, are extremely numerous.

Developed dyes.—The *developed dyes* are formed *in situ* upon the fibre by the successive application of two or more substances. They include *aniline black*, a permanent black produced by the oxidation of aniline, and the *ice colours*, which are *azo dyes* derived from certain coal-tar products containing nitrogen.

Mordant dyes.—The *mordant dyes* form one of the most important classes of colouring matters, for they include not only most of the vegetable dye-stuffs, e.g. madder, logwood, fustic, &c., but also many valuable fast coal-tar colours, commonly known as the *alizarin dyes*, after their typical representative, alizarin. These mordant dyes have by themselves very little colouring power, as a rule, and if employed alone in dyeing give little or no result. If applied, however, in conjunction with metallic salts, notably those of chromium, aluminium, iron, tin, and copper, they each yield a variety of colours, according to the metallic salt employed. In employing them two distinct operations are usually involved: first, that of applying the metallic salt or *mordant*, called the *mordanting process*; and second, that of *dyeing* proper, in which the mordanted material is boiled in a solution or decoction of the dye-stuff. During the dyeing operation the colouring principle of the dye-stuff combines with the metallic salt already upon the material, and the colour is thus produced and fixed upon the fibre. The method of mordanting varies with the fibre and the metallic salt employed. The vegetable dye-stuffs of this class include *Madder*, *Sapanwood*, *Camwood*, *Barwood*, *Old Fustic*, *Young Fustic*, *Quercitron Bark*, *Persian Berries*, *Weld*, *Logwood* (*see* these separate articles). *Madder* was formerly the most important and highly valued of the dye-stuffs of this class, being especially employed to produce the fine 'Turkey-red' dye; but it is now entirely superseded by the coal-tar colour alizarin. Similarly, the employment of *cochineal* (an insect dye) has also greatly diminished through the introduction of the cheaper colours. *Camwood* and *barwood* are almost entirely used in wool-dyeing, either in conjunction with the indigo-vat or for the purpose of dyeing various shades of brown. *Old fustic* is the most important of the yellow mordant dye-stuffs, and the colours are fast although not very brilliant. *Quercitron bark* is an excellent dye-stuff employed by wool-dyers for the production of bright orange and yellow colours. *Persian berries* and *weld*, a species of wild mignonette, are both excellent dye-stuffs, but their employment is now limited. *Logwood* is largely employed by wool, silk, and cotton dyers for dyeing black and dark-blues, which, although fast to washing, are only moderately so towards light. The important vegetable dye *catechu* (q.v.) is used in dyeing cotton and wool brown. On wool, catechu yields *khaki* browns in single bath by using copper sulphate as the mordant. On silk, it is

largely employed for weighting purposes in the process of dyeing black. Although dyewoods are still much employed, they are being steadily replaced by coal-tar colours.

Vat dyes.—The *vat dyes* are insoluble in water, but yield reduction products which are soluble in aqueous alkali, and can be readily reoxidized to the dye-stuff. In this class may be included the *sulphur dyes*, substances of uncertain composition obtained by fusing certain compounds containing nitrogen with sulphur and sodium sulphide, which are now extensively and increasingly employed, especially as direct dyes for cotton. *Indigo*, a typical vat dye, is prepared both artificially and from natural sources. It is a dark-blue powder quite insoluble in water, but when reduced it yields *indigo-white* which dissolves in aqueous alkali, the solution thus obtained being called an *indigo-vat*. Cotton, wool, or silk steeped for some time in the clear yellow solution of such a vat, and then exposed to the oxidizing influence of the air, is dyed a permanent blue. The indigo-white absorbed by the fibre loses its acquired hydrogen, and thus insoluble indigo-blue is regenerated within and upon the fibre.

In the classification adopted above, the following *mineral colours* employed in cotton dyeing belong to the group of developed dyes, since they are formed on the fibre: *chrome yellow*, obtained by immersing cotton successively in solutions of acetate of lead and bichromate of potash; *iron buff* (oxide of iron), produced by the successive application of sulphate of iron and carbonate of soda; *Prussian blue*, developed by passing the buff-dyed cotton through an acidified solution of potassium ferrocyanide; *manganese brown* (oxide of manganese), deposited similarly to iron buff. The mineral colours are very useful for certain purposes, and are very fast to light.—BIBLIOGRAPHY: Crookes, *A Practical Handbook of Dyeing and Calico-printing*; W. P. Dreaper, *Chemistry and Physics of Dyeing*; Knecht, Rawson, and Loewenthal, *Manual of Dyeing*; Rawson, Gardner, and Laycock, *A Dictionary of Dyes, Mordants, &c.*

DYER, John, English poet, born in Carmarthenshire about 1700, died in 1758. Educated at Westminster School, he became a painter, but, not succeeding in that vocation, took orders and was appointed to a small living. In 1727 he published his poem of *Grongar Hill*, in 1740 *The Ruins of Rome*, and in 1757 *The Fleece*, a didactic poem in five books.

DYER'S-BROOM, a European and now also N. American shrub (*Genista tinctoria*), formerly used with woad for dyeing green.

DYER'S-WEED, *Reseda luteola*, a British plant of the same genus as mignonette, otherwise called *Yellow-weed*, *Weld*, or *Woad*, nat. ord. Resedaceæ. This plant grows in waste ground; it affords a beautiful yellow dye, and is cultivated for that purpose.—*Dyer's Greenweed* is *Genista tinctoria*.

DYING DECLARATION, a deposition made by one who is in prospect of death. Such declarations are as a general rule admissible as evidence only in criminal and not in civil cases, and must be made, according to English, though not Scottish law, in the full consciousness of the danger of death.

DYKE. Term applied to an embankment erected on a river bank or on the sea shore to prevent the flooding of the adjacent land. These are seen in low-lying countries, such as Holland, the fen districts of England and the Mississippi region in N. America. In Holland the sea dykes are of great size and length, and are strengthened by blocks of granite and basalt, while the river dykes of lesser size are supported in places by piles or masonry.

Offa's Dyke, a dyke of another kind, was built probably by Offa, King of Mercia, to keep out the Welsh.

DYNAM'ICS is the science which deals with the laws of force in their relation to matter at rest or in motion, and as such it is differentiated from *kinematics*, which considers motion mathematically, and apart from the forces producing it. Dynamics is divided into two great branches: *statics*, which treats of solid bodies at rest under the action of forces; and *kinetics*, which treats of the action of forces in producing motion in solid bodies. Formerly the latter alone was called dynamics, and to this, in conjunction with statics, the general name *mechanics* was given. In the wide sense dynamics includes also hydrodynamics.

Primary laws of force.—It is to Newton that we owe the clear statement of the three primary laws of force on which the science of dynamics is based. These are: (1) that every body remains in a state of rest, or of uniform motion along a straight line, unless it is compelled by force to change that state; (2) that rate of change of momentum is in proportion to the force employed, and occurs along the straight line in which the force acts; (3) that, as the result of every action, there is always an equal

and opposite reaction. These laws, which were formulated from experiment, involve the conception of force as a primary influence or action expressed in terms of space, time, and matter.

Now, in dealing with the laws of force, a standard of measurement is required which shall be applicable to all forces at all times, and we therefore require to begin by establishing units of space, time, and mass. There are two systems of units in use, the one British, the other French. In the British system the foot is taken as the unit of length, and the second as the unit of time. In the French the centimetre is the unit of length, the second the unit of time; the unit velocity in the one case being that of one foot per second, in the other one centimetre per second. The British unit of mass is the pound (the mass of a certain lump of platinum deposited in the Exchequer Office, London); the French the gramme; and accordingly the French units of space, mass, and time are commonly known as the C.G.S. (centimetre, gramme, second) units. As the weight of a pound (or a gramme) is not the same at all parts of the earth's surface, it cannot give us of itself an absolute or dynamical unit of force, that is, an invariable unit; but taking it in conjunction with unit time and unit velocity. we do obtain such a unit.

Two absolute units of force are in common use in dynamics, the *poundal* and the *dyne*; the latter being the absolute unit in the C.G.S. system. The former is *that force which, acting on the mass of one pound for one second, generates in that mass a velocity of one foot per second.* The latter is *that force which, acting on the mass of one gramme for one second, generates in that mass a velocity of one centimetre per second.* It is important in dynamics to distinguish between *mass* and *weight.* The *mass* of one pound is the quantity of matter equal to a certain standard quantity (a certain lump of metal) and is quite independent of force. The *weight* of one pound is the force with which the mass of one pound is attracted to the earth's surface by the force of gravity. Another important term is *momentum*: the momentum of a body in motion at any instant is the product of the mass of the body and the velocity at that instant. *See* COUPLE; ELASTICITY; ENERGY; FORCE; HYDRODYNAMICS; KINEMATICS; KINETICS; STATICS; THERMODYNAMICS; WAVES.—BIBLIOGRAPHY: Kelvin and Tait, *Natural Philosophy*; A. Gray, *Dynamics*; P. G. Tait, *Dynamics*; S. L. Loney, *Mechanics and Hydrostatics for Beginners.*

DYN'AMITE. *See* EXPLOSIVES.

DY'NAMO. *See* GENERATOR.

DYNAMOM'ETER, an apparatus for measuring the power or rate of working of a machine. There are two types, the transmission dynamometer, which measures the power of the machine without sensibly diminishing it; and the absorption dynamometer, which measures the power by using it all. The instrument is generally employed to determine the horse-power transmitted by a shaft or by belting.—Cf. Aspinall Parr's *Electrical Engineering Testing.*

DYRRHACHIUM. *See* DURAZZO.

DY'SART, a royal and municipal burgh of Scotland, in Fife, on the Firth of Forth. It is an old place, and is a member of the Kirkcaldy district of parliamentary burghs. Pop. 4,593.

DYS'ENTERY is a disease of an acute type, due to the action of a bacillus, characterized by pain and frequent passage of blood and mucus. Owing to improved sanitation, dysentery has become less frequent. In temperate countries sporadic cases occur from time to time, and occasional epidemics break out, but in the tropics widespread epidemics occur, and the disease is a serious menace. It is a very frequent camp disease, and has been the scourge of all armies in tropical and semi-tropical regions. The bacilli are widely spread by the feces of infected persons, and usually the infection takes place by the mouth. The onset is rapid, and marked by fever, pain in the abdomen, and frequent stools. At first mucus only is seen in the stools, but soon blood appears. In very acute cases the patient is seriously ill in forty-eight hours, and may die on the third or fourth day. Moderate cases may go on for several weeks, with resulting convalescence. Some cases become chronic in type, and a person may have chronic dysentery for years. Bismuth in large doses is given, and morphia is a most useful drug to relieve the pain and quieten the bowel. Normal saline solution is given by rectum after the acute stage, whenever possible. Chronic dysentery requires dietetic treatment for the persistent dyspepsia and irritability of the bowel. Amœbic dysentery, due to the *Amœba dysentericæ*, is a distinct disease.

DYS'ODILE, a yellowish or greenish foliated carbonaceous substance found in Sicily originally, and derived from the decay of minute organisms. When ignited, it burns and emits a very unpleasant smell.

DYSON, Sir Frank Watson, F.R.S., LL.D.(Edin.), British astronomer, born at Ashby 8th Jan., 1868, the son of a Baptist minister. Educated at Bradford Grammar School and Trinity College, Cambridge, he became chief assistant at the Royal Observatory, Greenwich, in 1894, and secretary of the Royal Astronomical Society in 1899. Astronomer Royal for Scotland in 1905, he was Astronomer Royal for England from 1910 to 1933. He was knighted in 1915.

DYSPEP'SIA, or GASTRITIS, may be either acute or chronic. **Acute dyspepsia** may follow when more food is taken than the stomach can digest, or when unsuitable articles are taken. The symptoms are headache, depression, nausea, vomiting, with pain, varying from a feeling of discomfort in the abdomen to marked tenderness. The tongue is furred, and usually there is diarrhœa, while in the more severe attacks the onset is marked by chill and a rise of temperature. An attack may last from one day to four days. Treatment for mild cases is simply a dose of castor-oil (children) or blue pill (adults), but in severe cases vomiting should be promoted by warm water, or the stomach tube if necessary, and a dose of calomel (3 grains), followed by salts, should be given. Absolute rest to the stomach is necessary, and only small quantities of water allowed. Repeated attacks lead to the establishment of the chronic form. **Chronic dyspepsia** is a condition of disturbed digestion due to the prolonged use of unsuitable, or improperly prepared, foods. Hot cakes, excess of tea, coffee, or alcohol, rapid and irregular meals are all common causes. It may also arise in the course of diseases like anæmia, chronic tuberculosis, gout, Bright's disease, chronic heart disease, cirrhosis, and in diseases of the stomach itself, as cancer, gastric ulcer, and gastric dilatation. The most common symptoms are a feeling of oppression after food, tenderness over the stomach, headache, nausea, flatulence, constipation, and occasionally vomiting. Treatment consists of dietetic measures, regulated exercises, change of air and surroundings, and avoidance of depression. Milk should be used freely, and in severe cases should be given alone till improvement sets in. Fats and greasy dishes should be avoided. Fruits are sometimes well borne, and at other times the reverse. Drugs do not play so important a rôle, but bitter tonics, like nux vomica, quassia, gentian, &c., are the best. Constipation should be treated when necessary.

DYSPHO'NIA is difficulty in speaking, and is the result of some forms of laryngitis. The condition is aggravated by attempts to use the voice, and complete rest is necessary to bring about an early and satisfactory recovery. Tonics, moderate exercise, and a holiday hasten recovery.

DYSPNŒA (dis-pnē'a) is difficult or laboured breathing. It is a symptom of diseases of the heart or lungs, and is produced by any condition which interferes with normal respiration. It is sometimes present in nervous disturbances.

DZE'REN, or **DZE'RON,** the Chinese antelope, a remarkably swift species of antelope (*Procapra gutturōsa*) inhabiting the dry arid deserts of Central Asia, Tibet, China, and Southern Siberia. It is nearly 4½ feet in length, and 2½ feet high at the shoulder.

DZIG'GETAI, or **KIANG** (*Equus hemiōnus*), a species of wild ass native to Central Asia, allied both to the horse and ass. Its head is large like that of the ass, but in form resembles that of the horse. The ears also resemble those of the horse. It runs with a rapidity exceeding that of the best Arabian horses.

DZUNGARIA, or **ZUNGARIA,** a Chinese territory in Central Asia, stretching from about 43° to 48° N. lat. and from about 82° to 86° E. long. It has an area of 147,950 sq. miles, and pop. 600,000. It is administratively connected with Kuldja, and since the surrender of Kuldja by the Russians in 1880 is again under Chinese rule. Dzungaria, once the centre of an independent empire, was first conquered by the Chinese in 1757.

E

E, the second vowel and the fifth letter of the English alphabet. It occurs more frequently in English words than any other letter of the alphabet. Its long or natural sound in English coincides with the sound of *i* in the Italian and French languages, as in *here, mere, me.* It has also another principal sound, a short one, heard in *met, men.* It has besides a sound like *a* in *bare,* as in *there, where,* &c., and the obscure sound which is heard in *her.* As a final letter in English it is generally silent, but it serves to indicate that the preceding vowel is to have its long sound, as in *mane, cane, plume.* When two *e*'s



African Sea-Eagle

come together the sound is generally the same as that of the single *e* long, as in *deem, esteem, need* (compare, however, *pre-exist,* &c.).

E, in music, is the third note or degree of the diatonic scale, answering to the *mi* of the Italians and French.

EADIE (ē'dĭ), **John,** D.D., a Scottish preacher and theologian, born 1810, died 1876. He was educated at Glasgow University, and entered the ministry of the Secession Church, becoming in 1843 professor of biblical literature in the Divinity Hall of the Church, a post which he continued to hold after the Secession body was merged in the United Presbyterian Church (in 1847). Among his works are *Biblical Cyclopædia*; *Analytical Concordance to the Scriptures*; *Ecclesiastical Cyclopædia*; *Commentary on the Greek Text of Ephesians,* and similar works on *Colossians, Philippians,* and *Galatians*; and *The English Bible.* He was one of the scholars engaged on the Revised Version of the New Testament.

EAD'MER, an English monk, the friend and biographer of St. Anselm. In 1120 he was chosen Bishop of St. Andrews; but as the Scottish king refused to recognize the right of the Archbishop of Canterbury to consecrate him, he returned to England and died a simple monk about 1124. Besides the life of St. Anselm, Eadmer wrote lives of St. Wilfrid, St. Dunstan, St. Odo, and other English saints, as well as a valuable history (*Historiæ Novorum*) of events in England and the English Church from 1066 to 1122.

EAGLE (Lat. *aquila,* Fr. *aigle*), the general name of raptorial birds that form a group or sub-family (Aquilinæ) of the great family Falconidæ, which includes the eagles, falcons, and hawks. The eagle is popularly regarded as the noblest and most courageous of the rapacious birds. It soars to a greater height than any other European bird, from which circumstance the ancients considered it as the bird or messenger of Jove.

The genus Aquila, which includes the most typical eagles, is distinguished by its long and powerful bill, the curve commencing at the cere, by its wings reaching to the tip of the tail, and by its tarsi being feathered to the toes.

The imperial eagle (*A. mogilnik*) of Central Europe, North-East Africa, India, and China, is probably the species to which the popular belief

in the courage, strength, and nobleness of eagles is to be traced.

A. chrysaëtus, the golden eagle, is the chief British species. It measures over 6 feet from tip to tip of the expanded wings, and 3 feet from the



Imperial Eagle

beak to the end of the tail. The adults have the body brownish, becoming darker with age; the feathers of the head and neck pointed, and of a golden-red hue. This species is found all over the northern hemisphere. It was once common in the Highlands of Scotland, but is now becoming rare. The Kirghis and other tribes of Central Asia use the golden eagle to kill antelopes, foxes, and even wolves. Another British eagle is the erne or sea-eagle (*Haliaetus albicilla*) found near the sea-coast or lakes, and feeding largely on fish. The general colour is greyish-brown, the head pale-coloured, the tail white.

The bald eagle (*Haliaëtus leucocephalus*), found in North America and North-East Asia, is the symbol of the United States, though Franklin deplores the selection on account of its mean and dishonest habit of robbing the industrious osprey of the fish caught by it. Like all members of the genus, its diet is less restricted than that of the true eagles; and it even takes carrion. See also *Harpy Eagle*.

Eagle, as a symbol. The eagle first appears as a war standard amongst the Persians, through whom it reached the Egyptians. As the standard of the Roman armies it was first used by Marius, and afterwards took the place of all the other emblems at the head of the legions. It was first made of wood, then of silver, and finally, under Cæsar and his successors, of gold. In the Mediæval Ages the eagle became the heraldic emblem of the Holy Roman Empire, and was made double-headed in the fourteenth century. When the Holy Roman Empire fell to pieces in 1806, the double-headed eagle was retained by Austria. The double-headed eagle was assumed by Tsar Ivan III in 1472, and became the national military symbol of Russia; the single-headed eagle was assumed by the modern German Empire in 1871, and by the United States of America. The American eagle stands with outspread wings guarding a shield, with the motto *E pluribus unum*. The eagle was also the badge of several orders, the chief of which were the order of the *Black Eagle*, founded by the Elector of Brandenburg in 1701, and the highest order in Prussia; the order of the *Red Eagle*, also a Prussian order, and founded in 1705; and the Russian order of the *White Eagle*, originally Polish, and instituted in 1325.



Roman Standard

EAGLE, a gold coin in the United States of the value of ten dollars, or £2 sterling, first coined in 1795. There are also half-eagles, quarter-eagles, and double-eagles.

EAGLE-HAWK, a name sometimes applied to small South American eagles (genus Morphnus), with short wings and long legs.

EAGLEHAWK, a gold-mining town in Victoria, Australia, 4 miles from Bendigo. Pop. 8,130.

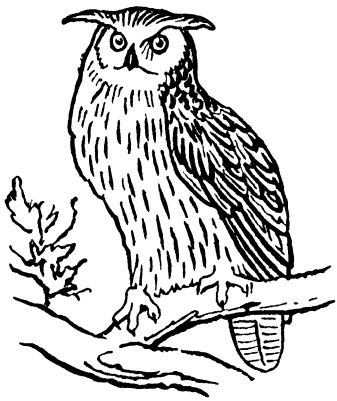
EAGLE-OWL, a name for several large horned owls, such as *Bubo ignavus* (the great horned owl), little inferior in size to the golden eagle, found in many parts of Europe and sometimes in Britain. An allied species, the Virginian horned owl (*B. virginicnus*), is common in the United States.

EALING, a municipal and parliamentary borough of Middlesex, the former a few miles west of London. Pop. (1931), 117,688.

EAR, the organ of hearing. In the higher vertebrates it is divided into the outer, middle, and inner ear.

The external ear, which is a cartilaginous funnel for collecting the sound

waves and directing them inwards, is composed of the *concha*, or projecting part, and of the *auditory canal*, which extends from the *concha* to the membrane of the *tympanum* or *drum*. This



Eagle Owl

membrane is a partition stretched obliquely across the bottom of the auditory canal, which it separates from the middle ear or tympanum; it is semi-transparent and very delicate. It vibrates with the waves of sound which strike against it, and transmits the vibrations to certain little bones of the cavity of the tympanum. These bones, which have been named respectively the hammer (*malleus*), the anvil (*incus*), and the stirrup (*stapes*), transmit the vibrations to the internal ear, forming a chain communicating at one end with the membrane just mentioned, and at the other with the inner ear.

The internal ear consists of a complicated system of tubes known as the *membranous labyrinth*, containing fluid in which waves are set up by the vibrations transmitted to it by the little bones from the drum membrane. The lower part of the labyrinth is coiled like a snail shell, and is called the *cochlea*. It is the real organ of hearing. The upper part consists of three *semicircular canals*, the function of which is to record the position and movements of the body in space.

The middle ear communicates with the pharynx by the Eustachian tube, through which air from the mouth may be introduced into the tympanic cavity, so as to permit vibrations of the drum membrane. In the external auditory canal of the ear is produced the cerumen or ear-wax. The cut shows P the concha, E.C the external canal, D the drum membrane partly removed, S the stirrup, A the anvil and H the hammer, the small bones communicating with the drum and vestibule, C cochlea, S.C semicircular canals, E Eustachian tube.—Cf. Sir Thomas Wrightson, *An Enquiry into the Analytical Mechanism of the Internal Ear*.

EAR-COCKLE, a disease in wheat caused by the presence in the grain of worms belonging to the genus Vibrio. It is called in some parts of England *purples*.

EARL (A.Sax. *eorl*; Dan. *jarl*), a degree of the British nobility between marquess and viscount, the title of highest antiquity in England. The title was made hereditary by William the Conqueror, and for a time was used interchangeably with that of *count*, the corresponding title on the Continent. The wife of an earl is still called a *countess*. The earl was the highest in rank of the nobility until Edward III created a duke in 1357, and Richard II a marquess in 1385. The first earl of England is the Earl of Arundel. An earl's coronet is composed of eight pearls raised upon points, with small leaves between, above the rim. *See* PEER.

EARLE, John, English bishop and writer, born about 1601, died 1665. He was educated at Oxford, and, after writing some short poems, gave to the world anonymously in 1628 *Microcosmographie, or a Piece of the World discovered in Essays and Characters*—a work full of wit, humour, and admirable character-painting. He was tutor to Charles II, accompanied him

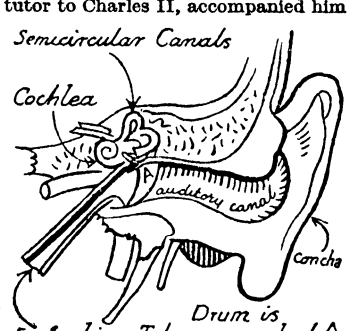


Diagram of the Ear

during his exile, and was held by him in the highest esteem. In 1662 he was consecrated Bishop of Worcester, and next year was translated to Salisbury.

EARLE, Rev. John, Anglo-Saxon scholar, was born in 1824, and died in 1903. He studied at Oriel College,

Oxford, where he obtained first-class honours in classics, and was elected a fellow (1848). In the following year he took orders, and was appointed for five years university professor of Anglo-Saxon. In 1857 he became rector of Swanswick, near Bath, and in 1871, a prebendary of Wells. The five years' rule having been rescinded, he was re-elected professor of Anglo-Saxon at Oxford in 1876, and continued to hold the position, together with the rectory of Swanswick, until his death. Among his contributions to the study of Anglo-Saxon and modern English are the following: *Two Saxon Chronicles Parallel* (1865); *The Philology of the English Tongue* (1871); *A Book for the Beginner in Anglo-Saxon* (1877); *English Plant Names from the Tenth to the Fifteenth Century* (1880); *Anglo-Saxon Literature* (1884), a very useful and informing little manual; *Handbook to the Land Charters and other Saxonic Documents* (1888); *English Prose : its Elements, History, and Usage* (1890); *The Deeds of Beowulf* (1892), a translation of the well-known Anglo-Saxon epic; *The Psalter of* 1539 (1894); and *A Simple Grammar of English now in Use* (1898). He also wrote a book on *Bath, Ancient and Modern* (1864).

EARLESTOWN, a town of Lancashire, England, 14 miles east of Liverpool. There are here engineering-works, sugar-works, and other establishments. Pop. 10,077.

EARL-MARSHAL, a great officer of England, who had, anciently, several courts under his jurisdiction, as the court of chivalry and the court of honour. He is the head of the College of Arms (Heralds' College), grants armorial bearings, and determines all claims in connection with them. Since 1672 the office is hereditary in the family of Howard (Dukes of Norfolk). There was also an earl-marshal of Scotland, the office being hereditary in the Keith family until 1716, when it was abolished.

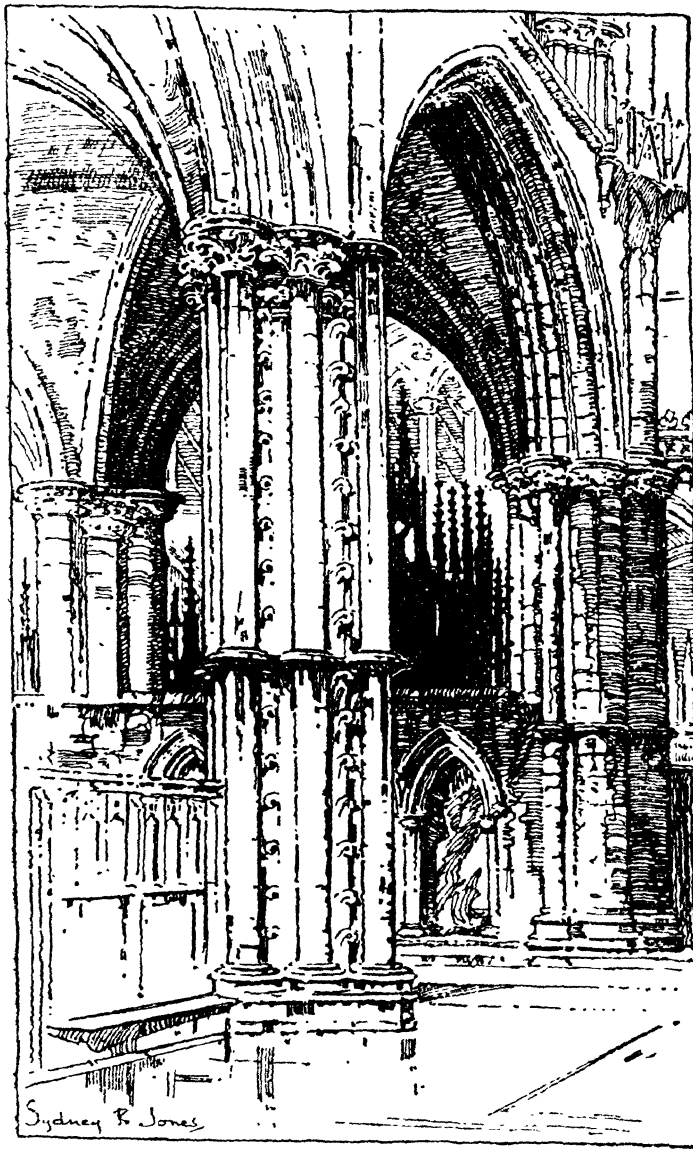
EARLOM, Richard, English mezzotinto engraver, born 1743, died 1822. His engravings from Reynolds, Hogarth, Van Huysum, &c., and from Claude's *Liber Veritatis*, are exceptionally fine, and are standard works in their department.

EARLSTON (originally Ercildoun), a village of Scotland in Berwickshire. Near it are the ruins of the ancient tower, which belonged to Thomas the Rhymer. Pop. (parish, 1931), 1,689.

EARLY CLOSING. Term chiefly used in connection with shops. Acts were passed limiting the number of hours during which shop assistants could be employed, one being the Shops Act of 1912, providing a weekly half holiday, but earlier closing in the evenings was not made compulsory until 1928. In Great Britain shops must close not later than 8 p.m., except one evening in the week, when they may remain open until 9. Exceptions are where tobacco, sweets and certain foodstuffs are sold. There is an **Early Closing Association** at 34–40 Ludgate Hill, London, E.C.4. *See* SHOP.

EARLY ENGLISH ARCHITECTURE, the first of the Pointed or Gothic styles of architecture that prevailed in England. It succeeded the Norman in the reign of Richard I (1189), and continued to the end of the reign of Henry III in 1272, a period of 83 years, when it gradually merged into the Decorated style. One of the leading peculiarities in this style is the form of the windows, which are narrow in proportion to their height, and terminate in a pointed arch, resembling the blade of a lancet (and therefore often called the *Lancet* style). Throughout the early period of the style they are very plain, particularly in small churches; but in cathedrals and other large buildings the windows, frequently combined two or more together, are carried to a great height, are richly and deeply moulded, and the jambs ornamented with slender shafts. On the eastern and western fronts of small churches the windows are often combined in this manner, with a circular window above and a richly moulded door below; but in large buildings there is often more than one range of windows, and the combinations are very various. Though separated on the outside, these lancets are in the interior combined into one design, thus giving the first idea of a compound window.

The doorways are in general pointed, and in rich buildings sometimes double; they are usually moulded, and enriched with the tooth-ornament. The buttresses are often very bold and prominent, and are frequently carried up to the top of the building with but little diminution, and terminate in acutely pointed pediments, which, when raised above the parapet, produce in some degree the effect of pinnacles. In this style, likewise, flying-buttresses were first introduced (*see* BUTTRESSES), and the buttresses themselves much increased in projection owing to the comparative lightness of the walls, which required some counter-support to resist the outward pressure of the vaulting. The roof in the Early English style appears always to have been high pitched, and the towers surmounted by lofty pointed spires,



EARLY ENGLISH ARCHITECTURE

Lincoln Cathedral—Early English Pillars in the Eastern Transept

as at Salisbury Cathedral. In the interior the arches are usually lancet-shaped, and the pillars often reduced to very slender proportions. As if to give still greater lightness of appearance, they are frequently made up of a centre pillar, surrounded by slight detached shafts, only connected with the pillar by their capitals and bases, and bands of metal placed at intervals. These shafts are generally of Purbeck marble, the pillar itself being of stone, and from their extreme slenderness they sometimes appear as if quite inadequate to support the weight above them.

Early examples. — The earliest example of Early English architecture is the choir of Canterbury, followed by the choir of Lincoln Cathedral, but some of the best examples are to be



Early English Capital, Salisbury

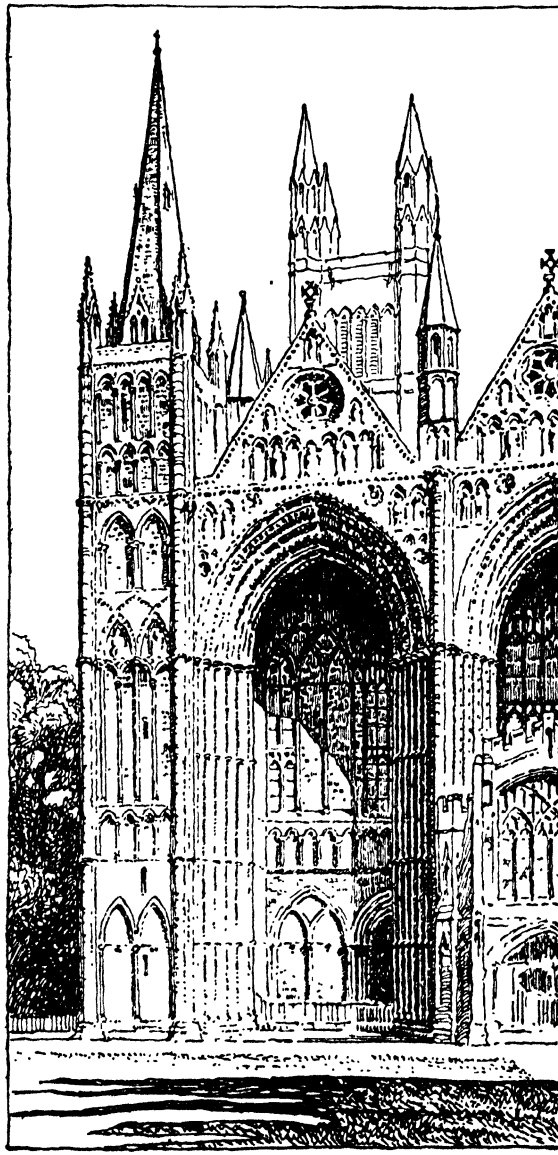
seen in Salisbury Cathedral. The architects of this style carried their ideas of lightness to the utmost limits of prudence, and their successors have been afraid to imitate their example. The abacus of the capitals is generally made up of two bold round mouldings, with a deep hollow between. The foliage is peculiar, generally very gracefully drawn, and thrown into elegant curves; it is usually termed *stiff-leaved*, from the circumstance of its rising with a stiff stem from the neck-mould of the capital. The trefoil is commonly imitated, and is very characteristic of the style. The mouldings of this style have great boldness, and produce a striking effect of light and shade. They consist chiefly of rounds separated by deep hollows, in which a peculiar ornament, called the *dog's-tooth*, is used, whenever ornament can be introduced. This ornament is as characteristic of the Early English as the zigzag is of the Norman. *See* DOG'S-TOOTH.—Cf. F. Bond, *An Introduction to English Church Architecture, from the 11th to the 16th Century.*

EARNEST, in law, any sum paid in advance, to bind parties to the performance of a verbal agreement, or something given by a buyer to a seller as a pledge of adherence to a bargain. The party is then obliged to abide by his bargain, and is not discharged upon forfeiting his earnest. In England the general view is that the sum paid as earnest, however small, is part of the price.

EAR-RING, an ornament for the ear, consisting of a ring or hook passing through the lobe, with a pendant of diamonds, pearls, or other jewels frequently attached. Ear-rings were commonly worn amongst the Oriental nations, and by both sexes, especially in Babylonia and Assyria, from the earliest times. Amongst the Greeks and Romans the wearing of ear-rings was usually confined to women. In England the Romanized Britons and the Anglo-Saxons wore them, but the fashion declined in the tenth century, and was again introduced in the sixteenth century, in Queen Elizabeth's time.

EARSDON, an urban district or town of England, South Northumberland, several miles north-west of Tynemouth, with productive collieries. Pop. (1931), 13,086.

EARTH, the planet which we inhabit, a nearly spherical body which every twenty-four hours rotates from west to east round an imaginary line called its axis—this axis having as its extremities the north and south poles —while in the course of a year it completes a revolution round the sun. To an observer whose view is not obstructed, the visible part of the earth appears as a circular and horizontal expanse, on the circumference of which the heavens appear to rest. Accordingly, in remote antiquity, the earth was regarded as a flat, circular body, floating on the waters. But even in antiquity the spherical form of the earth began to be suspected. It is only on this supposition that we can explain how the horizon of vision grows wider and wider the higher the position we choose, how the tops of towers and mountains at a distance become visible before the bases, how the hull of a ship first disappears as she sails away, and how, as we go from the poles towards the equator, new stars become visible. Besides these proofs there are many others, such as the circular contour of the earth's shadow seen on the moon during an eclipse. The mere fact that the earth can be circumnavigated does not, as is sometimes assumed, prove it to be globular. But its surface, land and ocean, has been almost all explored and accurately mapped, and the relative distances



EARLY ENGLISH ARCHITECTURE

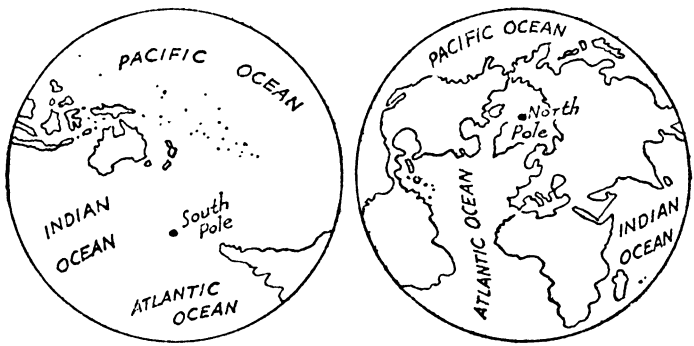
Peterborough Cathedral—Part of the West Front

and directions found to obtain between the places on its surface are consistent only with its possessing such a shape.

The earth is not, however, an exact sphere, but is very slightly flattened at the poles, so as to have the form known as an *oblate spheroid*. In this way the *polar diameter*, or diameter from pole to pole, is shorter than the diameter at right angles to this—the *equatorial diameter*. The most accurate measurements make the polar diameter almost 27 miles less than the equatorial, the equatorial diameter being found to be 7926·7 miles, and the polar 7900 miles. The earth is regarded as divided into two halves—the northern and the southern hemisphere—by the *equator*, an imaginary line going right round it midway between the poles. In order to indicate with precision the position of places on the earth additional circles are imagined to be traced upon the surface in such a manner that those of the one set all pass through both poles, while those of the other are drawn parallel to the equator. The former are called *meridians*, the latter *parallels of latitude*, and by reference to them we can state the latitude and longitude, and thus the exact position, of any place.

Many experiments by various methods have been made in order to determine the average density of the earth, and the total quantity of matter it contains. Amongst these methods may be mentioned: (1) that of measuring the deflection of a plumb-line due to a mountain's attraction, and thereby comparing the mass of the earth with that of the mountain; (2) that founded on the difference of oscillation period of a pendulum when placed at the summit of a mountain and when at the sea-level; (3) by the determination of the difference of gravity at the top and the bottom of a deep mine, by pendulum experiments; (4) Cavendish's experiment with the torsion balance, which attempts to compare the attractive force of two large lead balls upon two small lead balls with that exercised by the earth. From these and other experiments it has been calculated that the mean density of the earth is to that of water as about 5½ to 1.

The earth, in common with the other planets, moves round the sun, completing its revolution in about 365 days and 6 hours. The orbit of the earth is an ellipse, with the sun in one of its foci. Hence the earth is not equally distant from the sun throughout the year; it is over 3,000,000 miles nearer at one time than another, its least distance (*perihelion* distance), according to recent calculations, being about 91,340,000 miles; its greatest (*aphelion* distance), 94,450,000; and the mean distance, 92,897,000 miles. From this it may be calculated that the velocity of the earth in its orbit is about 18½ miles a second. About 3rd Jan. the earth is nearest the sun, and about 4th July farthest from it. This position of matters, which is subject to slow alteration in the course of ages, at present tends to moderate the seasonal variations in the northern hemisphere, and to intensify them in the southern. The passage of the earth round its orbit causes the sun to appear as if it described an annual circuit of the heavens; and hence it is that at one time of the year one group of stars is seen in the neighbourhood of the sun near sunrise or sunset, and at another time another group. This apparent path of the sun is the



Hemispheres showing distribution of land.

ecliptic, and corresponds with what would be the path of the earth as seen from the sun; and the groups of stars through which the sun successively passes form the *Zodiac*.

The earth's daily motion about its own axis takes place in twenty-three hours, fifty-six minutes, and four seconds of mean time. This diurnal revolution is the occasion of the alternation of day and night. As the axis on which the earth performs its diurnal rotation is inclined towards the plane of its path about the sun at an angle of 66½°, and the angle between the plane of the ecliptic and the plane of the earth's equator is therefore 23½°, the sun ascends in the heavens, as seen from our northern latitudes, from 21st March to 21st June (the summer *solstice*), to about 23½° above the celestial equator, and descends again towards the equator from 21st June to 23rd Sept.; it then sinks till 22nd Dec. (the winter *solstice*), when it is about 23½° below the equator, and returns again to the equator by 21st March. This arrangement is the cause of the seasons, and the inequality of day and night attending them. For all places removed from the equator, day and night are equal only twice in the year (at the *equinoxes*). At the summer solstice in the northern hemisphere the north pole of the earth is turned towards the sun, and the south pole away from it, and for places within 23½° of the former there is a period of longer or shorter duration during which the sun is continually above the horizon throughout the twenty-four hours of each day, while round the latter there is an equal extent of surface within which the sun for similar periods is below the horizon. (*See* DAY.) The reverse state of matters occurs at the winter solstice. The circles bounding these regions are called respectively the *arctic* and the *antarctic* circle, and the regions themselves the *polar* or *frigid zones*. Throughout a region extending to 23½° on each side of the equator the sun is directly overhead at any place twice in the year. The circles which bound this region are called the *tropics*, that in the northern hemisphere being the tropic of *Cancer*, that in the southern the tropic of *Capricorn*, while the region between is the *torrid zone*. The regions between the tropics and the polar circles are respectively the *north* and *south temperate zones*.

From the evidence furnished by volcanoes, hot springs, sinking of mines, &c., it is known that the earth has a high internal temperature. Taking the average of the various observed rates of increase this temperature seems to increase 1° F. for every 60 feet of descent. Assuming this to continue, the rocks at a depth of 2 miles would be as hot as boiling water, and at a depth of 50 miles the heat would be such as at the surface would melt every known solid. This being so, various theories as to the internal condition of the earth have been proposed: (1) that a thin envelope or crust surrounds a molten interior. It can be shown, however, that as tides must be produced in such a molten mass the cool outer crust would be unable to withstand the enormous force of these unless it were about 2000 miles thick. (2) That the interior is solid, with spaces here and there filled with liquid or gaseous material. This theory assumes that there are within the earth enormous cavities filled with molten rock, which escapes, when local pressure is removed, in the form of volcanic outbursts. (3) That the earth consists of a thin crust, a large solid nucleus, and a liquid film between the nucleus and the crust. (4) That the earth is solid to the centre, but any part may become liquid if local pressure is removed. On this theory it is supposed that if water should percolate to liquefied rocks, it would be converted into steam, and produce the various volcanic phenomena.

The question of the constitution of the earth's interior has in recent years been much investigated by means of seismographic records. These appear to indicate that there are three distinct divisions. The outer crust has a thickness of from 20 to 40 miles. It possesses a high power of resistance to all kinds of stress. Beneath it is a large shell possessing a density and elasticity resembling fine steel. This shell has a high rigidity against changing forces of shorter duration, like tidal action, but in its outer parts at least yields in time to unvarying long-continued stress. The third or innermost division of the earth is probably molten, as it can transmit compressional waves, but yielding immediately to distortional or twisting forces, is unable to transmit distortional waves. This innermost portion appears to be a sphere of radius approximately one-half that of the earth as a whole. The transition between the crust and intermediate shell is abrupt, but that between the latter and the central portion is more gradual.

The earth (like the other planets) is believed to have condensed and solidified from a gaseous or nebular condition, and to have once had a far higher temperature than now. If such were the case, the outer surface, losing heat by radiation, would be the

first part to cool quickly; while the interior, losing its heat by conduction, would not cool so rapidly, and, therefore, would naturally have a higher temperature than the portion at the surface. This is what all observations indicate the condition of the earth to be, and the shape of the earth also indicates that it must once have been in a fluid state. Calculations have been made of the time which has elapsed since solidification commenced, the estimates being in general of the order of hundreds of millions of years. *See* NEBULAR HYPOTHESIS.

Another feature that the earth as a whole presents is its magnetism. When a magnetic needle is balanced on a point, it remains at rest in one position only, pointing then nearly due north and south. This can be explained only on the supposition that the earth acts as a great magnet. It has, in fact, two poles—a north and a south magnetic pole—which are not very far from the geographical poles. The magnetic equator, where the vertical force is zero and the dipping needle takes a horizontal position, does not diverge greatly from the geographical equator. The earth acts upon all magnets as they act upon each other, and it is for this reason that they point north and south.

The surface of the earth contains over 196,000,000 sq. miles, of which about two-sevenths is dry land, the remaining five-sevenths being water. The land is arranged into masses of irregular shape and size, the greatest connected mass being in the eastern hemisphere. The chief masses receive the name of continents, detached masses of smaller size being islands. The surface of the land is variously diversified, exhibiting mountains, valleys, plains, plateaus, deserts, &c. The water area of the earth is divided into oceans, seas, bays, gulfs, &c., while rivers and lakes may be regarded as features of the land surface. The great phenomena of the oceans are currents and tides. The population of the whole earth is estimated at from 1600 to 1700 millions. The earth is attended by the moon as a subordinate or secondary planet. *See also* such articles as CLIMATE, CURRENTS, OCEAN, EARTHQUAKE, and SEASONS.—BIBLIOGRAPHY: A. von Humboldt, *Cosmos*; E. Reclus, *The Earth and its Inhabitants*; T. G. Bonney, *The Story of our Planet*; T. M. Reade, *The Evolution of Earth Structure*; *Theory of Geomorphic Changes*; A. T. Swaine, *The Earth: its Genesis and Evolution, considered in the Light of the most Recent Scientific Research.*

EARTHENWARE, a name applied to the commoner sorts of potterware. The older kinds of earthenware, such as Majolica, Delft-ware, Faïence, and Palissy-ware, are not only glazed, but are besides elaborately coloured and enamelled and ornamented with raised figures of various kinds. *See* POTTERY AND PORCELAIN.

EARTH-HOUSES, a name generally given throughout Scotland to underground buildings, also known as 'Picts' houses' or 'Picts' dwellings.' The earth-house in its simplest form consists of a single irregular-shaped chamber, formed of unhewn stones, the side walls gradually converging towards the top until they can be roofed by stones of 4 or 5 feet in width, all covered in by a mound of earth rising slightly above the level of the adjacent ground. In the more advanced form of these structures two or three chambers are found. Earth-houses are frequent in the north-east of Scotland, occasionally thirty or forty being found in the same locality. Querns, bones, deers' horns, earthen vessels, cups and implements of bone, stone celts, bronze swords, and the like, are occasionally found in connection with them. Very similar structures, known as beehive-houses, occur also in Ireland and Cornwall.

EARTH-NUT, the *Conopodium denudatum*, an umbelliferous plant common in woods and fields in Britain. The leaves are ternately divided, and the small white flowers are in terminal umbels. The tuber or nut is about 4 or 6 inches below the surface, at the termination of a long slender root. It is brown, the size of a chestnut, of a sweetish farinaceous nature, resembling in taste the common chestnut. Swine are very fond of the nuts, and fatten rapidly where they are abundant. The name is frequently applied to *Carum Bulbocastănum*, which has a similar tuber. *See* GROUND-NUT.

EARTHQUAKE, a shaking of the earth's surface, propagated from place to place by a wave motion. It may vary in intensity from the slightest perceptible tremor to a violent shock which bursts open chasms and changes the appearance of the ground. Earthquakes originate in the crust of the earth, generally at only a very few miles' depth, and probably never lower than about 30 miles. The point of origin is called the centre or seismic focus, and the place on the surface vertically over it the epicentre. It is rather difficult to tell the depth of the focus. Mallet estimated this by projecting backward the direction of travel of the wave at different points, as judged from the inclinations of the rents in buildings, &c., assumed to be at right angles to the line of propagation. The accuracy of this method has

been improved by substituting evidence of direction as given by seismographs. The focus of an earthquake is often submarine, and subsequent to the shock transmitted through the solid earth a great sea-wave may invade the land and produce far more disastrous effects.

Causes.—In some cases an earthquake may be caused by a fall of rock in some subterranean cavity. This gives only a minor and local shock. The vast majority of earthquakes are certainly *tectonic*, originating from the snapping of strata under great strain, or the further slipping of portions of the earth's crust along previously existing fault planes. Such dislocations probably arise sometimes from the variations of weight supported by the earth's crust in neighbouring regions, due to the transport by rivers of material, which they erode at one place and deposit at another. A further cause is the contraction undergone by the earth in its secular cooling. There are also earthquakes of *volcanic* origin, accompanying eruptions, but these are not usually of any great violence, nor do they involve any large area.

The coasts of the Pacific Ocean—American, Asiatic, and East Indian—are much visited by earthquakes, in especial the Japanese Islands. The other band of greatest frequency has a direction outlined by the Azores, Alps, Mediterranean, and the Caucasus and Himalaya Mountains. It may be noted that all the regions specially affected are distinguished by steep gradients of the earth's surface.

Seismograph.—In recent years much information has been obtained by the investigation of earthquakes by various kinds of seismograph. One single instrument at a particular station, e.g. a Milne seismograph, will enable the distance of the epicentre to be calculated. From the results of three stations, the precise locality can practically always be told. With additional or particular forms of instruments, this may even be possible by means of the records at one station. Earthquake waves are found to consist of distinctly defined types. The first to arrive are the preliminary tremors or first-phase waves, then the second-phase waves, next the third-phase or large waves, and lastly the concluding waves, consisting largely of 'echoes' or reflected vibrations. The speed of the preliminary tremors is found to be only about 2 miles per second for very short distances, but for a quadrant of the earth's surface they travel at an average of about 7 miles per second, a speed which is only slightly exceeded for still greater distances. The second-phase waves travel with a little under two-thirds of these velocities. These two classes of wave have been proved to travel through the earth, approximately along chords, but with the path slightly bent, convex towards the earth's centre. The first-phase waves are longitudinal, or waves of compression; the second-phase are transverse, or waves of distortion. The greater speed for greater distances is due to the track being more through the earth's interior and less through its outer portions, as the interior transmits wave-motion much more rapidly than the crust. The rigidity at some depth from the surface has been shown to be of the same order of magnitude as the rigidity of steel. The third-phase waves are of much longer vibration period and wide amplitude, and have been compared to a ground-swell on the sea. Their time of passage from the epicentre to any place is proportional to the distance measured round the earth's surface, and it is clear that they travel on the surface, and not through the interior. Their speed is nearly 2 miles per second. The difference in time between the arrival of the preliminary tremors at any station and the arrival of the second-phase waves, or between the second-phase and third-phase waves, enables the distance of the epicentre to be easily found, as these differences, of course, become greater with increasing distance.

The number of earthquakes has been found to be enormously greater than was at one time supposed; in fact, small tremors are occurring daily in one part or another of the earth. Among the most remarkable earthquakes of modern times were those which destroyed Lima in 1746 and Lisbon in 1755; more recently destructive earthquakes visited Calabria in 1857, Peru and Ecuador in 1868, the Island of Ischia in 1884, Japan in 1896, North India and Calabria in 1905, San Francisco in 1906, Messina and Reggio in 1908, and the provinces of Kansu and Shensi in North-West China in 1920. Yokohama was completely and Tokio partially destroyed and 98,000 people killed by the Japanese earthquake in Sept., 1923. In Feb., 1931, an earthquake in the Hawke's Bay area of New Zealand devastated the towns of Hastings and Napier and did damage amounting to £10,000,000. *See* SEISMOGRAPH.—BIBLIOGRAPHY: J. Milne, *Earthquakes and other Earth-Movements*; C. Davison, *A Study of Recent Earthquakes*; C. G. Knott, *The Physics of Earthquake Phenomena*.

EARTHS, a term applied in geology to certain loosely aggregated siliceous

and aluminous materials, the detritus of pre-existing rocks. In chemistry the term earth is given to certain metallic oxides, such as the 'alkaline earths' lime, baryta, and strontia; also to alumina and a series known as the 'rare earths.' The earths were regarded as simple bodies until Sir H. Davy proved them to be compounds of oxygen with metals.

EARTH-SHINE, in astronomy, a name given to the faint light visible on the part of the moon not directly illuminated by the sun, due to the illumination of that portion by the sunlight which the earth reflects on her. It is most conspicuous when the illuminated part of the disc is small, as soon after new moon. This phenomenon is popularly described as 'the old moon in the new moon's arms.'

EARTH-TONGUE. *See* GEOGLOSSUM.

EARTHWORKS (in fortification) are military works formed chiefly of earth and designed either as permanent or temporary defences. They are cheaper, more easily repaired, and expose their defenders to less risk from broken stone than stone-works. *See* ENTRENCHMENTS.

EARTHWORM, the name applied to segmented worms (Annelids) that burrow in the soil, and belong to the ord. Oligochæta, a subdivision of the bristle-worms (Chætopoda). They have a long, cylindrical body, divided by transverse furrows into numerous rings. The mouth is destitute of jaws, and they have no eyes, tentacles, or other head appendages. They are hermaphrodite. The commonest British forms are chiefly species of Lumbricus and Allolobophora. They feed on earth and various kinds of animal and vegetable matter, and move by the contractions of successive parts of the body aided by a double row of bristles. They are of great service to the agriculturist by loosening the soil and increasing its depth. This is chiefly the result of their mode of nourishment, since they deposit the soil they have swallowed, after digestion, in heaps called *worm castings* which bring up rich fine soil to the surface, gradually covering the upper layer sometimes to the extent of several inches.

EAR-TRUMPET, an artificial instrument for aiding the collection of the vibrations or waves of sound, and carrying them in an intensified form to the internal parts of the ear. They are generally made of tin, vulcanite, or gutta-percha and are of various forms. A small kind known as ear-cornets or acoustic auricles, attached to the ear by a spring, is sometimes used in slight cases of deafness.

EARWIG (*Forficŭla*), a common orthopterous insect whose name is derived from its supposed habit of insinuating itself into the ears of persons. This is practically impossible, yet the notion is widely spread, as appears from the names given to the earwig in different languages, as in Fr. *perceoreille* (pierce-ear), in Ger. *ohrenhöhler* (ear-borer). The earwig is about three-quarters of an inch in length, having the wings folded under very short and truncate elytra or wing-cases, and the extremity of the abdomen armed with a horny forceps.

EASDALE, a small island on the west coast of Scotland, 10 miles s.w. of Oban, and adjoining Seil Island. It has slate quarries. Area, 1½ sq. miles.

EASEMENT, in law, a right or privilege which one proprietor may have to use the land of another in connection with the needs of his own land, as the use of a way, a watercourse, &c. The right to an easement may be acquired either by grant or by uninterrupted enjoyment for a period of years.

EAST, one of the four cardinal points, being the point in the heavens where the sun is seen to rise at the equinox, or the corresponding point on the earth; that point of the horizon lying on the right hand when one's face is turned towards the north pole. By *the East*, in an indefinite sense, is often meant Syria, Arabia, Persia, India, and the eastern part of the world generally.

EASTBOURNE, a county borough and flourishing watering-place of England, county of Sussex, on the English Channel, near Beachy Head; also a parliamentary division of Sussex. The town is handsomely built, having fine parades and well-planted walks and drives. Pop. (1931), 57,435.

EAST CAPE, the most easterly point of Asia, projecting into Behring Strait nearly opposite Cape Prince of Wales in Alaska.

EASTER, the festival commemorating the resurrection of Christ, observed in the Roman Catholic, the Greek, Anglican, Lutheran, and other branches of the Christian Church. By the first Christians it was considered to continue the feast of the *passover*, at which the paschal lamb, a type of Christ, was sacrificed. Hence its name in Greek (*pascha*), French (*pâques*), and other Romance languages is taken from the Hebrew *pesach*, passover. The English name, according to the Venerable Bede, comes from the Anglo-Saxon *Eostre* (from Teutonic *Austrô*), a goddess of light or spring, whose festival was celebrated in April

There was long a dispute in the Christian Church as to the proper time for holding Easter, the Christians of the East celebrating it on the same day as that on which the Jewish passover fell, that is, the 14th of Nisan (hence they were called *quarto decimani*), while the majority of the Church celebrated it on the Sunday next after this day. The controversy was decided by the Council of Nice (Nicæa) in 325, which settled that it was to be reckoned as at present, namely, that Easter is the first Sunday after the full moon which happens upon or next after the 21st of March; and if the full moon happens on a Sunday, Easter-day is the Sunday after, but, properly speaking, for the 'full moon' in the above the 'fourteenth day of the moon' should be substituted.—Cf. Sir J. G. Frazer, *The Golden Bough*.

EASTER DUES, or **OFFERINGS,** in the Church of England, certain dues paid to the parochial clergy by the parishioners at Easter as a compensation for the tithe for personal labour.

EASTER EGGS. The egg was anciently a symbol of the mother goddess and of birth: the sun emerged from the cosmic egg. The Saxon goddess Easter was a life-giver. On Easter Day, the day of Christ's resurrection, eggs (Pasche eggs) were dyed in symbolic colours, and boiled hard to be rolled or used in egg-breaking contests. The Jews have eggs at the Passover Feast.

EASTER ISLAND, or **RAPA NUI** (discovered by the Dutch Admiral Roggeven on Easter, 6th April, 1722), an island, 12 miles long, in the South Pacific Ocean, long. 109° 17′ w., lat. 27° 6′ s., and utilized for grazing sheep and cattle. It now belongs to Chile, from which it is 2000 miles distant. Pop. 250 in 1916. The Routledge Expedition reported, in 1919, that the inhabitants are of mixed Polynesian and Melanesian origin. Their ancient bird-cult shows very close resemblances to that of the Solomon Islands. Numerous gigantic stone images of a soft 'volcanic ash' were being worshipped when the island was first visited by Europeans in the eighteenth century. Some still lie partly constructed in a crater quarry. These images date back a few centuries, and resemble those made until recently in wood on this island and elsewhere in Oceania, and bear symbols used on these and in tattooing. Local legends of the earliest settlements from distant islands and of local tribal wars still survive. The present inhabitants are undoubtedly descendants of the image-makers and worshippers. Cf. K. Routledge, *The Mystery of Easter Island.*

EASTERN BENGAL AND ASSAM, a former province of India, under a Lieutenant-Governor, formed in 1905 by disjoining from Bengal the three divisions of Chittagong, Dacca, and Rajshahi (with the exception of Darjeeling) and uniting Assam with them, as also the state of Cooch Behar. On 1st April, 1912, however, Assam was separated from Eastern Bengal and a new Presidency of Bengal was constituted.

EASTERN CHURCHES, a collective term for the Greek, Armenian, Coptic, Abyssinian, Syrian, and other kindred Churches, as distinguished from the Latin, or Western Church.

EASTERN QUESTION, THE, an international political problem which occupied the attention of European statesmen during the last two centuries, and even since 1453, when the Turks established their empire and gained sway over the Balkans. It deals with the relations of the Balkan nationalities, Turkey, and the Great Powers to each other. Russia, Germany, Austria, Greece, France, Italy, and Great Britain were all interested in the Near East and in the Eastern Question ever since the Treaty of Kutshuk-Kainardji in 1774. The Levantine commerce and the Mediterranean ports were, and still are, of vital importance not only to Russia, but also to the Balkan States and to the neighbouring European powers. The occupation of Egypt by Great Britain, the Russo-Turkish War of 1878, the proclamation of Bulgaria's independence, the annexation of Bosnia and Herzegovina by Austria in 1908, all contributed to the complication of the Eastern Question. This complication was further increased by Italy's occupation of Tripoli in 1911, by the Balkan Wars (1912–3), and by the construction of the Baghdad Railway with the aid of German capital. It is no exaggeration to say that the Eastern Question was one of the causes which led to the outbreak of the European War of 1914. The Peace Treaties of Versailles, Sèvres, Lausanne, and St. Germain did not settle the Eastern Question, and the peace in the Near East is still a problem which occupies the attention of European diplomatists.—BIBLIOGRAPHY: W. A. Phillips, *Modern Europe*; R. W. Seton Watson, *The Rise of Nationality in the Balkans.*

EASTERN RUMELIA. *See* BULGARIA; RUMELIA.

EASTER TERM, one of the four regular terms of the courts of common

law in England, beginning on the 19th April and continuing till the middle or end of May.—In Oxford University, a term beginning 13th April, ending 27th May; in Cambridge, beginning 18th April and ending 24th June.

EAST GRIQUALAND. *See* GRIQUALAND, EAST.

EAST HAM, a borough of Essex, England, 6 miles east of London. It is an industrial centre containing large docks and numerous factories. Pop. (1931), 142,460.

EAST INDIA COMPANY, a great English company, originally simply a trading association, which played an important part in the history of Hindustan. It was formed in 1599 in London, with a subscribed capital of about £30,000, for the purpose of trade with the East Indies. A charter was granted to it by Queen Elizabeth on 31st December, 1600, for fifteen years renewable for a similar period. In this charter the Company is styled, "The Governor and Company of the Merchants of London trading into the East Indies."

The first voyages resulted in large profits. In 1609 the charter was renewed by James I, and made perpetual, reserving power to the Crown to recall it at three years' notice. Additional power was granted to the Company of seizing and confiscating ships and goods of contraband traders, either in the British dominions or in any of the places where they were authorized to trade. Among the motives which had induced the Company to press for this renewal of their charter was the necessity they had experienced from the jealousy of the Dutch and Portuguese to send out vessels fitted not only for trade, but for defence and indeed attack. Accordingly Captain Best, who commanded the eighth expedition, attacked four Portuguese war galleons, convoying 200 sail of merchantmen, off Surat, and gained a complete victory, which so impressed the Great Mogul that he immediately made a treaty with Captain Best, giving the English full liberty to trade in his dominions. This treaty was concluded on 6th Feb., 1613. It was followed at once by a resolution of the Company to trade on a joint-stock. £429,000 was raised as capital, and apportioned in fitting out four voyages for 1613, 1614, 1615, 1617.

In 1617 and 1618 the Company was so enlarged as to include 954 proprietors, while a new joint-stock of £1,600,000 was subscribed. In 1619 a treaty was made with the Dutch, by which the two companies were to work in harmony for twenty years; but in 1623 the Dutch massacred the leading members of the English factory at Amboyna. In the feeble reigns of James and Charles I, however, the outrage remained unredressed, and the English Company, ill supported by the Crown, was often reduced to great straits. Their trade, impeded by the Dutch, became unprofitable, and, to add to their difficulties, Charles I in 1635 gave a licence to a rival company. At length, under Cromwell, the Company received a new charter. A territorial footing had been acquired in Madras in 1640, to which settlement was given the control of all the factories in Bengal and the Coromandel coast, the Supreme Council in India still remaining at Surat.

A new charter, granted by Charles II in 1660, enlarged the powers of the Company, giving it political and judicial authority in the factories and colonies established by it, with the right to appoint governors. On the Revolution of 1688 the Company was involved in new difficulties, and in 1692 the Commons presented an address to the Crown praying for their dissolution. At this time, by an accidental failure to pay a tax upon their stock, the Company formally forfeited their charter, and were compelled to accept its renewal with the important proviso of a reservation to the Crown of the right to alter or modify its conditions. The maximum stock to be held by any individual was fixed at £10,000, every £1,000 of which was to give a vote, while the right of membership was thrown open to all British subjects. The Scottish Parliament also sanctioned a company, but a war with Spain and the bitter opposition of the English Parliament made difficulties under which this company succumbed.

Meantime the misconduct of the English company had so strengthened its enemies that, in spite of all its opposition, a resolution in favour of the formation of a new company passed the House of Commons on 4th May, 1698, and this company was actually constituted by Act 9 William III cap. xliv. This Act provided for the extinction of the old company, but an amalgamation was eventually arranged in 1708. The possessions of the old company at the time of amalgamation, upon which the valuation of £330,000 was placed in 1700, included a large number of places in India, a footing having been by this time acquired in each of the three presidencies, besides possessions in Persia, Cochin-China, and Sumatra. The dividends of the Company rose rapidly after the amalgamation, and finally settled

at 8 per cent; and it procured without difficulty, at various periods, a prolongation of its exclusive privileges until 1780, still with three years' notice.

In the meantime the French possessions had, as well as the English, been growing in power and importance in the East, and on the outbreak of the war of the Austrian Succession in 1741 commenced those struggles (Clive being the first great English leader) by which a mercantile company was led on to establish British supremacy over nearly the whole of India. In 1766 the right of the Company to acquire territorial possessions formed a subject of parliamentary inquiry; and the question of the political rights of the Company being thus opened up, the ministry began to act on their view of it by sending out a Crown plenipotentiary to India. A regulating Act was passed in 1773 remodelling the powers of the Company, and placing it completely under the



Silver Rupee of East India Company, 1675

control of Parliament, providing for the establishment by the Crown of courts of judicature in India. The charter, which expired in 1780, was renewed till 1791. The Renewal Act provided that the Company, which was already bound to submit to the Government all dispatches received from India, should submit for approval all dispatches proposed to be transmitted thither.

In 1784 another Act established a board, afterwards known as the Board of Control, to superintend, direct, and control all acts, operations, and concerns relating to the civil and military government or revenues of India. The board was to consist of a principal Secretary of State, the Chancellor of the Exchequer, and four Privy Councillors nominated by the Crown. The directors of the Company were bound to submit all their papers except those referring to commercial matters to this board, and obey its instructions. From this time the political power of the Company was little more than nominal. While the right of nominating the servants of the Company was still left to the directors, the absolute right of recall was vested in the Crown. A subsequent Declaratory Bill regulated the power of the Board of Control to send out troops at the expense of the Company.

In 1813 the charter was renewed on condition that the right of exclusive trade should be restricted to China, while the India trade should be thrown open to all British subjects. A Church establishment for India was also provided by this Act. The appointment of governors-general, governors, and commanders-in-chief was no longer to be valid without the direct sanction of the Crown. The renewal of the Company's charter in 1834 took place amid continued opposition to their mercantile, and even to their legislative privileges. It continued them in all their possessions except the Island of St. Helena, put an end to the exclusive right of trade with China, and enacted that the Company should with all convenient speed close their commercial business, and make sale of all their property not retained for Government purposes; all their other property was to be held in trust for the Crown, which was to take over their debts and guarantee their dividend out of the revenues of India. The stock was valued at £6,000,000, which was to bear interest at 10 per cent. and be redeemable after 30th April, 1874, on payment of £12,000,000. The Company was now fairly in liquidation, and on the outbreak of the mutiny of 1857 it was felt indispensable to vest the government of India directly in the Crown, and this was accordingly done in 1858. Henceforth the Company existed only for the purpose of receiving payment of its capital, and of the dividends due upon capital until its repayment.—BIBLIOGRAPHY: J. Bruce, *Annals of the East India Company*; Sir W. W. Hunter, *History of British India*; W. Cunningham, *Growth of English Industry and Trade in Modern Times*; J. Macpherson, *The History and Management of the East India Company*; W. Foster and F. C. Danvers, *Letters received by the East India Company from its Servants in the East* (6 vols.).

EAST INDIES, the name loosely applied to all India, the Indo-Chinese peninsula, and a portion of the Eastern Archipelago, but excluding the Philippine Islands, New Guinea, and Australia.

EASTLAKE, Sir Charles Lock, English painter, president of the Royal Academy, born at Plymouth 17th Nov., 1793, died at Pisa 23rd Dec., 1865. He studied at the

Royal Academy, London, and at Paris. In 1817 he visited Italy and Greece, and painted besides other pictures his *Pilgrims arriving in Sight of Rome.* In 1830 he was elected member of the Royal Academy, and in 1850 became its president, receiving at the same time the honour of knighthood. From 1843 to 1847 he was keeper of the National Gallery, of which he was afterwards director for about ten years. Sir Charles is also known as a writer on art by his *Materials for a History of Oil-painting.* Among his most noteworthy pictures are: *Lord Byron's Dream* (in the Tate Gallery), *Greek Fugitives, Escape of the Carrara Family, Christ blessing Little Children, Christ lamenting over Jerusalem.*

EASTLEIGH, urban district of Hampshire. It is 5¼ miles from Southampton and is an important junction on the S. Rly. The main industry is the manufacture of railway stock. Pop. (1931), 18,333.

EAST LONDON, a seaport on the east coast of Cape Province, at the mouth of the Buffalo River, now an important outlet. Pop. (1921), 34,673 (20,374 white); white pop. (1931), 27,809.

EAST LOTHIAN. *See* HADDINGTON.

EAST MAIN, a considerable river of Canada, having a westward course to James Bay, the southern extension of Hudson Bay, and forming the boundary between Quebec province and Ungava territory.

EASTMAN, George, American inventor. Born at Waterville, New York, July 12, 1854, he was educated at Rochester. In 1880 he perfected a process for making sensitive gelatine dry plates. In 1884 he patented a photographic roll film and in 1888 a Kodak camera. On these and other inventions Eastman built up an enormous photographic business at Rochester. His gifts for charitable purposes are estimated at £15,000,000. Rochester received many of these, but they also include a dental clinic in London. He shot himself on March 14, 1932.

EASTON, a city of Pennsylvania, United States, at the junction of the Delaware and Lehigh Rivers, 75 miles S.W. of New York. It contains iron-foundries, tanneries, and breweries. Pop. 34,468.

EAST RIVER, a strait in New York State, separating New York from Brooklyn and connecting Long Island Sound with New York Bay, 15 miles long. The Brooklyn Bridge, and the Williamsburg, Queensboro, and Manhattan Bridges now cross the river.

EAST ST. LOUIS, a town of the United States, in Illinois, on the east bank of the Mississippi, opposite St. Louis, and connected with it by a great steel arch bridge and another bridge, carrying numerous lines of railway. Pop. 74,347.

EASTWOOD, a town of England, in Notts, on the Derbyshire border, with coal-mines, 8 miles W.N.W. of Nottingham. Pop. (1931), 5,360.

EAU (ō), a French word signifying *water*, and used in English with some other words for several spirituous waters, particularly perfumes, as *eau de Cologne,* and *eau de Luce.*

Eau de Cologne is a fragrant water, made originally and in most perfection in Cologne by a manufacturer named Farina, by whose successors the only genuine water is said still to be manufactured. It consists of spirits of wine flavoured by different essential oils blended so as to yield a fine fragrant scent. It was invented in Northern Italy by one of the Farina family, who afterwards settled in Cologne.

Eau Créole, a highly esteemed liqueur made in Martinique by distilling the flowers of the mammee apple with spirit of wine.

Eau de Luce ('water of Luce'), so called from the name of its inventor, is made by dissolving white soap in spirit of wine, and adding oil of amber and sal ammoniac. It is a milky fluid, antispasmodic and stimulant.

Eau de Vie ('water of life'), a term used by the French for the coarser kinds of brandy, *cognac* being the name of the best.

EAU CLAIRE (ō klār), a city of Wisconsin, United States, at the junction of the Eau Claire and Chippewa Rivers, a great lumbering centre. In 1910 Eau Claire adopted the commission form of government, being the first city in the state to do so. Pop. 26,287.

EAUX-BONNES (ō-bon), a watering-place, France, department of Basses Pyrénées, about 25 miles south of Pau. The hot sulphur springs are said to have great efficacy in affections of the chest. Pop. 622. —Near it is **Eaux Chaudes** also with warm springs.

E'BAL, a mountain of Western Palestine about half-way between Jerusalem and Nazareth, on the north side of a narrow valley, on the south side of which and directly opposite stands Mt. Gerizim with Nablous almost between. Here the Israelites set up an altar on their entrance into the Holy Land and had the law solemnly read to them by Joshua (*Jos.* viii 30–35). At the east end of the valley are Jacob's Well and Joseph's Tomb.

EBBSFLEET, a hamlet in the Isle of Thanet, county Kent, memorable as the place where the first Anglo-Saxon invaders landed.

EBBW-VALE, a town of England, in Monmouthshire, with ironworks, steelworks, and collieries. Pop. (1931), 31,695.

EBENA'CEÆ, a nat. ord. of gamopetalous Dicotyledons, consisting of trees and shrubs, of which the wood is very hard, and frequently of very dark colour in the centre, as ebony. The leaves are alternate, and generally coriaceous and shining; calyx gamosepalous and persistent, with three or six equal divisions; corolla with imbricated divisions. The fruit is a globular berry containing a small number of compressed seeds. The principal genus is Diospyros, which yields ebony and iron-wood.

EBERS (ā'bĕrz), **Georg Moritz,** German Egyptologist and novelist, born 1st March, 1837, at Berlin, died in 1898. He studied at Göttingen, and afterwards at Berlin, where he devoted himself to Egyptology. In 1870 he was made professor at the University of Leipzig, but he had to resign in 1889. In 1869 and 1870 he travelled extensively in Egypt and Nubia. Two years later he again visited Egypt, where he discovered the medical papyrus, known as the *Papyrus Ebers.* His most important works have been translated into English, such as *Egypt, Descriptive, Historical, and Picturesque*; and the novels *An Egyptian Princess, Uarda, Homo Sum, The Emperor, The Sisters,* all dealing with old Egyptian life; *The Burgomaster's Wife,* and *Only a Word.*

EBERSWALDE (ā'berz-vâl-de), a town in Prussia, in the province of Brandenburg, on the Finow Canal, 28 miles north-east of Berlin. It has a school of forestry, pisciicultural establishment, botanic gardens, well-frequented mineral springs, and industrial works of various kinds. Pop. 29,571.

EBERT, Fritz, first President of the new German Republic, born at Heidelberg in 1870, the son of a tailor. Having received an elementary education in his youth, he first worked in his father's shop, and was then apprenticed to a saddler. He spent his spare time in reading and acquiring knowledge, entered journalism, and in 1892 became editor of the *Bremer Bürgerzeitung.* In 1908 he was elected to the Reichstag, and in 1916 became president of the Socialist group of this Assembly. He appealed for peace in the Reichstag in Sept., 1918, and having thus become rather prominent, he succeeded Prince Max of Baden as Chancellor of the Empire. The office was suppressed a few days later, and Ebert became Provisional President of Germany. He crushed the efforts made by the Spartacus group to prevent the elections for the National Assembly, and altogether showed tact and energy in those critical days. The National Assembly met at Weimar, and elected Ebert as first President of the Reich on 11th Feb., 1919. He died in 1925.

E'BIONITES (Heb. *ebyonim,* poor), a sect of the first century, so called from their leader, Ebion. Irenæus described them as Jewish Christians. They held several dogmas in common with the Nazarenes, united the ceremonies of the Mosaic institution with the precepts of the gospel, and observed both the Jewish Sabbath and Christian Sunday. They denied the divinity of Christ and rejected many parts of the New Testament.

EBLIS, or **IBLIS,** in Mahommedan mythology, the chief of the evil spirits; also the name given to the prince of darkness, or Satan.

EB'OLI, a city of Campania, Southern Italy, a few miles from the Gulf of Salerno. Pop. 12,741.

EB'ONY, the popular name of various plants of different genera, agreeing in having wood of a dark colour. The best-known ebony is derived from plants of the genus Diospyros, nat. ord. Ebenaceæ. The most valuable is the heart-wood of *D. Ebĕnum,* which grows in great abundance in the flat parts of Ceylon, and is of such size that logs of its heart-wood 2 feet in diameter and from 10 to 15 feet long are easily procured. Other varieties of valuable ebony are obtained from *D. melanoxylon* of Coromandel, *D. tesseleria* of Mauritius, and other species. Ebony is hard, heavy, and durable, and admits of a fine polish or gloss. The most usual colour is black, red, or green. The best is jet black, free from veins, very heavy, astringent, and of an acrid pungent taste. On burning coals it yields an agreeable perfume, and when green it readily takes fire from its abundance of fat. It is wrought into toys, and used for mosaic and inlaid work.

EBONY LORE. In ancient times ebony was a sacred wood. The Indians carved from it images of gods and drinking-cups. It was first used by the ancient Egyptians, who called it *heben,* and imported it from 'God-land' (Punt). The Hebrew

name is *hobnim*, the Greek *ebenos*, the Hindi *ābanūsa*. *Ezekiel* (xxvii, 15) connects ebony with Tyre. The ebony displayed in Rome by Pompey in his triumph over Mithridates came, according to Solinus, from India. The Chinese call it *Wu-men* ('black-streaked wood'), and anciently imported it from India and Indo-China.

E'BRO (Lat. *Ibĕrus*), one of the largest rivers in Spain, which has its source in the province of Santander, about 25 miles S. of the Bay of Biscay, and after a south-easterly course of about 470 miles enters the Mediterranean. Its navigation is much interrupted by rapids and shoals, to avoid which a canal about 100 miles long has been constructed nearly parallel to its course. Saragossa is the principal town on the river.

ÉCARTÉ (ā-kär'tā), a card-game for two players, is played with thirty-two cards, the smaller ones, from two to six inclusive, not being used. The remaining cards rank as follows; king (highest), queen, knave, ace, ten, &c. In the English mode of playing, the players cut for the deal, which is decided by the lowest card. The dealer gives five cards to either player, three and two at a time, and turns up the eleventh card for trump. If he turns up a king he scores one; and if a king occurs in the hand of either player, the holder may score one by announcing it before the first trick. The non-dealer leads; trumps take all other suits, but the players must follow suit if they can. Three tricks count one point, five tricks two points; five points make game. Before play begins, the non-dealer may claim to discard (écarter) any of the cards in his hand, and to replace them by fresh ones from the pack. This claim the dealer may or may not allow. Should he allow it, he can himself discard as many cards as he pleases. Sometimes only one discard is allowed, sometimes more.—Cf. Cavendish, *The Laws of Écarté adopted by the Turf Club*.

ECBAT'ANA, the chief city or ancient metropolis of Media, the summer residence of the Median and Persian and afterwards of the Parthian kings. It was a place of great splendour at an early period. Its site can no longer be fixed with certainty, though many explorers agree in identifying it with the modern Hamadan.

ECCE HOMO (ek'sē; Lat., 'Behold the man!'), a name often given to crucifixes and pictures which represent Christ bound and crowned with thorns. The most celebrated of these paintings are by Sodoma, Correggio (in the National Gallery), Titian, Tintoretto, Guido Reni, and Murillo. The expression is derived from the words spoken by Pilate when he showed Christ to the multitude before he was led forth to Crucifixion (*John* xix, 5).

ECCEN'TRIC, a term in mechanics applied to contrivances for converting circular into reciprocating (backwards and forwards) rectilinear motion, consisting of circular discs attached to a revolving shaft, not centrally, i.e. eccentrically.

ECCHYMOSIS is extravasation of blood into the tissues underlying the skin. It is most frequently produced as the result of a bruise from injury, but may be due to some pathological condition.

ECCLEFECHAN (ek-l-fech'an), a Scottish village in Dumfriesshire, near the L.M.S. Railway main line, noteworthy as the birth-place and burial-place of Thomas Carlyle. Pop. 680.

ECCLES, a borough of England, in Lancashire, 4 miles from Manchester, of which it may be considered a suburb. The town, engaged in textile industries, is famous for its cakes. Since 1918 it returns one member to Parliament. Pop. (1931), 44,415.

ECCLESIAS'TES (-tēz), the title by which the *Septuagint* translators rendered the Hebrew *Koheleth* ('the gatherer of the people'), a symbolic name explained by the design of the book and the dramatic position occupied by Solomon in it, one of the canonical books of the Old Testament. The book consists of 12 chapters, being a series of discourses on the vanity of earthly things, and the tone, which is sceptical, is such as is found in Omar Khayyám. According to Jewish tradition, it was written by Solomon; but the best modern criticism has decided that its style and language, no less than its thought, belong to a much later date.

ECCLESIASTICAL COMMISSIONERS, in England, a body corporate, constituted in 1836, with extensive powers in regard to the organization of the Church, the distribution of episcopal duties, and the formation of parishes. It consists of all the bishops of England and Wales, five cabinet ministers, four judges, and twelve others. Their decisions are ratified by orders in council, and acquire the force of Acts of Parliament. The Commissioners deal with an annual income of about 2 million pounds.

ECCLESIASTICAL COURTS, courts in which the canon law is administered

and which deal with ecclesiastical cases, affecting benefices and the like. In England they are the *Archdeacon's Court, the Consistory Courts, the Court of Arches, the Court of Peculiars, the Prerogative Courts of the two archbishops, the Faculty Court,* and *the Privy Council,* which is the court of appeal, though its jurisdiction may by Order in Council be transferred to the new Court of Appeal. No separate ecclesiastical courts existed in England before the Norman Conquest, but by a charter of William I a distinction was made between courts civil and courts ecclesiastical. In Scotland the ecclesiastical courts are the *Kirk-session, Presbytery, Synod, General Assembly* (which is the supreme tribunal as regards doctrine and discipline), and the *Teind Court,* consisting of the judges of the Court of Session, which has jurisdiction in all matters affecting the teinds of a parish. In the Isle of Man ecclesiastical courts still have, as formerly in England, jurisdiction in probate and matrimonial cases.

ECCLESIASTICAL LAW may, in the broad sense of the term, be taken to include the regulations existing in any Church or sect, however small, for the formation of its own polity and for the control of its members. It is, however, more generally applied to those legal bonds which exist between Established Churches and the State.

The Roman Catholic Church claims to be the one and only true Church, regards her laws as being of universal application, and herself as an equal with the State; nevertheless she has, in non-Catholic countries, no higher legal standing than any small and obscure dissenting congregation, and is in this respect a 'free' Church.

Protestant ecclesiastical law claims no such sovereign power, and in no way interferes with the State law. In England the Convocations of York and Canterbury have no authority to change the law, their power being limited to the making of recommendations. All changes in Church law are made by Parliament. Laymen can be, and often are, officials of the ecclesiastical courts. The civil law is subject to the canon law, above which is the common law, with, yet higher, statute law. Over all is the nominal supremacy of the Crown. Ecclesiastical law deals with such affairs and property of the Church of England as ecclesiastical parishes, churches, and matters matrimonial; but only so far as these are not controlled by common or statute law. It has long ceased to have any practical control of the laity. In Ireland, ecclesiastical law disappeared with the disestablishment of the Church.

ECCLESIAS'TICUS, a book placed by Protestants and Jews among the apocryphal scriptures. The author calls himself Jesus the son of Sirach. Originally written in Hebrew, it was translated into Greek by the author's grandson in the second century B.C. In 1896 fragments of four MSS. in the Hebrew original were discovered in the *Geniza,* or hiding-place for worn out copies of biblical books, in the synagogue at Cairo. Another fragment was discovered in Palestine by Mrs. Agnes Lewis.—*Cf.* Schechter and Taylor, *The Wisdom of Ben Sira: Portions of the Book Ecclesiasticus.*

ÉCHELLES, LES (lā-zā-shāl; 'the Ladders'), a village, France, department of Savoie, 12 miles south-west of Chambéry, in a valley from which egress at one end was formerly by means of ladders, but now by a tunnel. Pop. 798.

ECHELON (esh'e-lon), a formation of successive and parallel units facing in the same direction, each on a flank and to the rear of the unit in front of it.

ECHENEIS, the type genus of a small family (Echeneididæ) of aberrant spiny-finned fishes, in which the first dorsal fin is modified into a transversely ridged suctorial disc. *See* REMORA.

ECHEVERIA (ech-e-vē'ri-a), a genus of succulent plants, ord. Crassulaceæ (house-leek), chiefly natives of Mexico, but now cultivated in European and other gardens and greenhouses, some for their flowers, others for their foliage.

ECHIDNA (ē-kid'na), a genus of Australian toothless mammals, in



Echidna

size and general appearance resembling a large hedgehog, excepting that the spines are longer and the muzzle is protracted and slender, with a

small aperture at the extremity for the protraction of a long flexible tongue. The habits of the Echidna are nocturnal; it burrows, having short strong legs with five toes, and feeds on insects, which it catches by protruding its long sticky tongue. It is nearly allied to the Ornithorhynchus, the two forming a peculiar class of animals, having in their structure some peculiarities at once of mammals, birds and reptiles.

In 1884 it was found that, as Geoffrey St. Hilaire had suspected, the Echidna, the closely related Proechidna of New Guinea, and the Ornithorhynchus constitute the lowest sub-class of mammals, the Prototheria or Monotremata, which present many reptilian characters. They possess a cloaca into which the intestine and urinogenital ducts open and are oviparous. During the breeding season a temporary pouch is formed, and into this the milk-glands open, but there are no teats. The egg when laid is put into the pouch by the mother, and is there hatched in a very immature state. It feeds by licking up the milk in the pouch. Later on, the mother digs a burrow, where she leaves the young at night, returning during the day to suckle it. One species (*E. hystrix*), from its appearance is popularly known as the *porcupine ant-eater*.

ECHINOCACTUS (e-kī'-), a genus of cactaceous plants inhabiting Mexico and South America, and remarkable for their peculiar forms, being globular, oblong, or cylindrical, and without leaves, fluted and ribbed, with stiff spines clustered on woolly cushions. Some of them are very bulky. The flowers are large and showy. *See* CACTUS.

ECHINOCOCCUS, the very large compound cyst which forms the bladder-worm stage in the life-history of a small tapeworm (*Tænia echinococcus*) living in the intestine of the dog. The cysts are found in various abdominal organs of herbivorous animals, and sometimes infest human beings, especially in Iceland.

ECHINODERMATA (e-kī-nō-dėr'-ma-ta), a phylum, or sub-kingdom of invertebrate animals characterized by having a tough integument in which lime is deposited in scattered plates (sea-cucumber), flexibly articulated plates (star-fishes), or so as to form a rigid test or shell like that of the sea-urchin; and by the radial arrangement of many of the parts of the adult. Movable spines are commonly present. There is a system of tubes into which seawater is admitted (ambulacral system), and commonly tube-feet, that are put into use by being distended with fluid. Some of them, as the encrinites or sea-lilies, are permanently fixed by a stalk when adult. Their development is accompanied by metamorphosis, and the embryo shows a distinctly bilateral aspect, though the radiate arrangement prevails in the adult. By some they are classed with the Scolecida in the sub-kingdom Annuloida. The phylum is divided into nine classes: Asteroidea (star-fishes); Ophiuroidea (brittle-stars), Echinoidea (sea-urchins), Holothuroidea (sea-cucumbers), Crinoidea (sea-lilies, feather-stars, the latter free-moving), Thecoidea or Edrioasteroidea (extinct, stalkless but fixed), Carpoidea (extinct, stalked), Cystoidea (extinct, stalked), Blastoidea (extinct, stalked). All are marine.

ECHINOMYS, or SPINY RAT, a genus of South American rodent mammals distinguished by the presence of spines among the coarse fur.



Echinomys

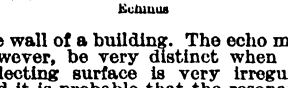
The long tail is covered by scales and hair intermixed, the ears are large, and all the extremities possess five digits.

ECHINUS (e-kī'nus), **SEA-URCHIN,** or **SEA-EGG,** a genus of marine animals the type of an order (Echinoidea) of the phylum Echinodermata (*see* above). In this type the body is spheroidal and invested in a test or shell composed of regularly arranged plates closely united together. It is covered with movable spines articulated by ball-and-socket joints. The mouth is situated in the centre of the under surface, and there is a complicated masticatory apparatus (Aristotle's lantern) consisting of five chisel-ended teeth supported by an elaborate framework. The anus is similarly placed on the upper side, and is surrounded by a circlet of ter plates (apical disc), one of which bean a furrowed tubercle (madreporite) perforated by small holes through which water enters the water-vascular system. Locomotion is effected by meridional rows of tube-feet, aided by the spines. *E. esculentus* and some other species are edible. *See* SEA-URCHIN.

ECHINUS (e-kī'nus), in architecture, the *ovolo* or quarter-round convex moulding, seen in capitals of the

Doric order. It is especially frequently found carved with the egg-and-dart ornament.

ECHO (ek'ō), the repetition of a sound caused by the reflection of sound-waves from some surface, as



Echinus

the wall of a building. The echo may, however, be very distinct when the reflecting surface is very irregular, and it is probable that the resonance of the obstacles and the masses of air which they enclose contribute in producing the echo. The waves of sound on meeting the surface are turned back in their course according to the same laws that hold for reflection of light. In order that the echo may return to the place from which the sound proceeds, the reflection must be direct, and not at an angle to the line of transmission, otherwise the echo may be heard by others but not by the transmitter of the sound. This may be effected either by a reflecting surface at right angles to the line of transmission, or by several reflecting surfaces which in the end bring the sound back to the point of issue. Sound travels about 1125 feet in a second; consequently, an observer standing at half that distance from the reflecting object would hear the echo a second later than the sound. Such an echo would repeat as many words and syllables as could be heard in a second. As the distance decreases, the echo repeats fewer syllables till it becomes monosyllabic. The most practised ear cannot distinguish in a second more than from nine to twelve successive sounds, so that a distance of not less than 60 feet is needed to enable an average ear to distinguish between the echo and the original sounds. At a near distance the echo only clouds the original sounds, and this often interferes with the hearing in churches and other large buildings. Woods, rocks, and mountains produce natural echoes in every variety, for which particular localities have become famous.

ECHO, in Greek mythology, a mountain nymph (one of the Oreads). Legend relates that by her talking she detained Hera, when the latter sought to surprise Zeus among the mountain nymphs. To punish her the goddess deprived her of speech, unless first spoken to. She subsequently fell in love with Narcissus, and because he did not reciprocate her affection she pined away until nothing was left but her voice.

ECHUCA (e-chŏ'ka), an Australian town, colony of Victoria, on the Murray, over which is an iron railway and roadway bridge, connecting it with Moama in New South Wales; trade (partly by the river) in timber and wool. Pop. 5,000.

ECIJA (ā-thē-hà), an ancient town of Southern Spain, province of Seville, on the Genil, with manufactures of textile fabrics and a good trade. It is one of the hottest places in Spain. Pop. 30,000.

ECK, Johann Maier von, the celebrated opponent of Luther, born in 1486, died in 1543. Having obtained a reputation for learning and skill in disputation, he was made doctor of theology, canon of Eichstädt, and prochancellor of the University of Ingolstadt. He went to Rome in 1520, and returned with a Papal bull against Luther, in attempting to publish which he met with violent popular opposition. In 1530, while at the Diet of Augsburg, he made the remarkable admission that he could confute the Augsburg Confession by the fathers but not by the Scriptures. Eck was present also at the Diets of Worms (1540) and Ratisbon (1541).

ECKENER, Hugo. German aviator. Born Aug. 10, 1868, he was a pupil of Count Zeppelin. He piloted the Graf Zeppelin across the Atlantic with 57 people on board in Oct. 1928; in 1929 he flew round the world, and in July, 1931, to the North Pole. He has made flights to South America and other places to demonstrate the possibility of the airship as a regular means of transport.

ECK'ERMANN, Johann Peter, German writer, born in 1792, died in 1854. In 1813 he served in the army against the French, and was afterwards appointed to a small governmental post. He finally settled in Weimar, where he became private secretary to Goethe. After Goethe's death he published his *Conversations with Goethe,* a book which has been translated into all European languages.

ECKMÜHL (ek'mül), a village of Bavaria, circle of Lower Bavaria, on the Gross Laber, 13 miles S.S.E. of Ratisbon, the scene of a sanguinary battle between the French and Austrians on 22nd April, 1809, in which the latter were defeated.

ECLAMP'SIA, a medical term applied to convulsions that seem to be of an epileptic character, but differ from true epilepsy as being due to some special poison. The use of the term is now practically restricted to puerperal eclampsia, convulsions occurring in pregnant women, generally those suffering from kidney disease.

ECLEC'TICS (Gr. *eklektikos*, select) is a name given to all those philosophers who do not follow one system entirely, but select what they think the best parts of all systems. The system is called *eclecticism*. In ancient philosophy Cicero was the most conspicuous representative of eclecticism, and in modern times the eclectic method found a notable supporter in the French philosopher Victor Cousin.

ECLIPSE (ek-lips'; Gr. *ekleipsis*, a failing, *ekleipō*, I fail), an interception or obscuration of the light of the sun, moon, or other heavenly body by the intervention of another and non-luminous body. A star or planet may be hidden by the moon; in this case the phenomenon is called an occultation.

An Eclipse of the Moon is an obscuration of the light of the moon occasioned by an interposition of the earth between the sun and the moon; consequently, all eclipses of the moon happen at full moon. Further, the moon's direction from the earth must make only a very small angle with the axis of the earth's shadow, or line joining centres of sun and earth produced. But as the moon's orbit makes an angle of more than 5° with the plane of the ecliptic, it frequently happens that though the moon is in opposition it does not come within the shadow of the earth.

If the sun were a point of light, there would be a sharp outlined shadow or *umbra* only, but since the luminous surface is so large there is always a region in which the light of the sun is only partially cut off by the earth, which region is known as the penumbra.

Hence during a lunar eclipse the moon first enters the penumbra, then is totally or partially immersed in the umbra, then emerges through the penumbra again.

An Eclipse of the Sun is an obscuration of the whole or part of the face of the sun, occasioned by an interposition of the moon between the earth and the sun; thus all eclipses of the sun happen at the time of new moon.

The dark or central part of the moon's shadow, where the sun's rays are wholly intercepted, is here the *umbra*, and the light part, where they are only partially intercepted, is the *penumbra*; and it is evident that if a spectator be situated on that part of the earth where the umbra falls, there will be a total eclipse of the sun at that place; in the penumbra there will be a partial eclipse, and beyond the penumbra there will be no eclipse.

As the moon is not always at the same distance from the earth, and as the moon is a comparatively small body, if an eclipse should happen when the moon is so far from the earth that her shadow falls short of the earth, a spectator situated on the earth in a direct line with the centres of the sun and moon would see a ring of light round the dark body of the moon.

Such an eclipse is called *annular*; when this happens, there can be no total eclipse anywhere. An eclipse can never be annular longer than 12 minutes 24 seconds, nor total longer than 7 minutes 58 seconds. The longest possible entire duration of an eclipse of the sun is a little over 4 hours.

An eclipse of the sun begins on the western side of his disc and ends on the eastern; and an eclipse of the moon begins on the eastern side of her disc and ends on the western. The largest possible number of eclipses in a year is seven, four of the sun and three of the moon, or five of the sun and two of the moon. The smallest is two, both of the sun. But a solar eclipse affects only a limited area of the earth, while a lunar eclipse is visible from more than a terrestrial hemisphere, as the earth rotates during its progress. Therefore at any given place eclipses of the moon are more frequently visible than those of the sun. — BIBLIOGRAPHY: R. Buchanan, *The Theory of Eclipses*; W. T. Lynn, *Remarkable Eclipses*.

ECLIP'TIC, the sun's path, the great circle of the celestial sphere, in which the sun appears to describe his annual course from west to east—really corresponding to the path which the earth describes. (*See* EARTH.) The Greeks observed that eclipses of the sun and moon took place near this circle; whence they called it the *ecliptic*. The ecliptic has been divided into twelve equal parts, each of which contains 30°, and which are occupied by the twelve celestial signs, viz.:

- ♈ Aires (the Ram), 21st March.
- ♉ Taurus (the Bull), 20th April.
- ♊ Gemini (the Twins), 21st May.
- ♋ Cancer (the Crab), 21st June.
- ♌ Leo (the Lion), 23rd July.
- ♍ Virgo (the Virgin), 23rd Aug.
- ♎ Libra (the Balance), 23rd Sept.
- ♏ Scorpio (the Scorpion), 23rd Oct.
- ♐ Sagittarius (the Archer), 22nd Nov.
- ♑ Capricornus (the Goat), 22nd Dec.
- ♒ Aquarius (the Water-carrier), 20th Jan.
- ♓ Pisces (the Fishes), 19th Feb.

These are also called signs of the *zodiac*, the zodiac being a belt of the heavens extending 9° on each side of the ecliptic. The days of the month annexed show when the sun, in its annual revolution, enters each of the signs of the zodiac. From the First Point of Aries, or the place of the sun at the vernal equinox, the degrees of the ecliptic are counted from west to east. The plane of the ecliptic is that by which the position of the planets and the latitude and longitude of the stars are reckoned. The axis of the earth is not fixed in direction in space, but performs a slow conical motion about the pole of the ecliptic in about 26,000 years. In consequence of this the points at which the equator intersects the ecliptic, viz. the First Point of Aries and First Point of Libra, recede westwards upon the ecliptic at the rate of about 50 seconds a year. The signs of the zodiac, therefore, do not now coincide, as they did some 2000 years ago, with the constellations of the same names, and the First Point of Aries has now regressed through the greater part of the constellation Pisces. The angle at which the ecliptic and equator are mutually inclined is also variable, and has been diminishing for about 4000 years at the rate of about 50 seconds in a century. Laplace gave a theory to show that this variation has certain fixed limits, and that after a certain time the angle will begin to increase again. *See* PRECESSION and NUTATION.

ECLOGUE (ek'log), a term usually applied to what Theocritus called *idyls*—short, highly finished poems, principally of a descriptive or pastoral kind, and in which the loves of shepherds and shepherdesses are described. Eclogues flourished among the ancients (*Bucolics* of Virgil), and, under the name of pastorals, were fashionable in the sixteenth century, Spenser's *Shepherd's Calender* being a good example. They were revived in the eighteenth century by Pope.

ÉCOLE DES BEAUX ARTS ('School of Fine Arts'), the French Government school of fine arts at Paris, founded by Mazarin in 1648, and provided with an extensive staff of teachers. The competitions for the *grands prix de Rome* take place at this school. All artists between the ages of fifteen and twenty-five, whether pupils of this school or not, may compete, after passing two preliminary examinations. The successful competitors receive an annual allowance from the State for three or four years, two of which must be passed at Rome. The Palais des Beaux Arts, the home of the École, was begun in 1820 and finished in 1863.

ÉCOLE NORMALE SUPÉRIEURE ('Superior Normal School'), a school at Paris for the training of those teachers who have the charge of the secondary education in France, founded by decree of the Convention in 1794, reorganized by Napoleon in 1808, and again in 1830 by the Government of Louis-Philippe. By the decree of 1903 the school forms part of the University of Paris. It maintains a hundred students and has a course of three years' duration.

ÉCOLE POLYTECHNIQUE ('Polytechnic School'), a school in Paris established with the purpose of giving instruction in matters connected with the various branches of the public service, such as mines, roads, and bridges, engineering, the army and the navy, and Government manufactures. It was founded in 1794, and is under the direction of the Minister of War. Candidates are admitted only by competitive examination, and have to pay for their board 1000 francs a year. The pupils who pass satisfactory examinations at the end of their course are admitted to that branch of public service which they select.

ECOLOGY, or **ŒCOLOGY**, the study of the relations of plants to their surroundings, a branch of plant geography.—BIBLIOGRAPHY: Horwood, *British Wild-flowers*; Tansley, *Types of British Vegetation*; Warming, *Œcology*.

ECONOMICS is the name applied, in substitution for the older one of political economy, to the scientific study of men in relation to the production, exchange, distribution, and consumption of wealth. The origin of both names lies in the analogy between provision for the needs of a household and for those of a State. To the former the term 'economy' was originally applied, as in Xenophon's treatise on the subject. But it was soon adopted to describe that branch of the art of government which dealt with public revenue and expenditure, and a matter intimately connected therewith, the enrichment of the community as a whole.

This conception of economics inspired all economic writings until late in the eighteenth century, a typical example being Thomas Mun's *England's Treasure by Foreign Trade* (1664), containing an exposition of the mercantile system which sought to increase natural wealth by regulation of the balance of trade.

The treatment of economics as a science had its origin in the writings of the Physiocrats, a group of French philosophers of whom Quesnay (1694–1774) was the most prominent, and

with whom Turgot (1727–81), the great minister of Louis XVI, held many doctrines in common. The Physiocrats argued that the wealth of the community was raised to the maximum, not by State regulation, but by entire freedom in the economic sphere.

But the chief importance of the Physiocrats lay in their paving the way for Adam Smith (1723–90), who in 1776 published *The Wealth of Nations*, a book which has exercised profound and widespread influence on thought and action, and is still a leading authority on the subject. Adam Smith definitely retained the conception of economics as part of the art of government. "Political economy," he says, "proposes two distinct objects: first, to provide a plentiful revenue or subsistence for the people . . . and secondly, to supply the State or Commonweal with a revenue sufficient for the public service. It proposes to enrich both the people and the sovereign." But the book is also largely occupied with an investigation of the production, distribution, and exchange of wealth when free from all regulation and restriction, together with a powerful indictment of such regulation.

This doctrine of non-interference by the State came to be known as the *laisser-faire* doctrine, from a phrase used by Gournay, one of the Physiocrats. Mainly through Adam Smith's influence, it became the orthodox view of the State's relation to trade and industry. This meant that the aims of economics, in its older sense, were best achieved without State action at all; and, consequently, economics came to mean simply the study of what are in fact men's activities in relation to wealth. This conception is clearly expressed in such writers as Ricardo (1772–1823), whose *Principles of Political Economy and Taxation* enunciates the theory of rent which has formed the basis of all subsequent reasoning on the subject, and states a theory of wages which gave colour to Karl Marx's doctrine of the exploitation of wage-earners by capitalists. It is also evident in the work of Nassau Senior (1790–1864), in the important *Principles of Political Economy* of John Stuart Mill (1806–73), and is most fully expressed by J. E. Cairnes (1823–75).

This conception has formed the basis of all modern economics, despite important differences in the method of treating material. The modern view of the matter is well stated by Dr. Alfred Marshall in his *Principles of Economics*, a most important contribution to the subject, which has exercised much influence. Economics he defines as "a study of mankind in the ordinary business of life; it examines that part of individual and social action which is most closely connected with the attainment and with the rise of material requisites of well-being." The separation between economics and the investigation of social phenomena in general is not so rigidly maintained to-day as in the past. It is realized that men's activities in relation to wealth are affected by other than purely economic considerations, and that political, moral, religious, and æsthetic forces must be taken into account. At the same time, the science deals only with what is, and not with what ought to be done; and is therefore distinct from *Ethics*, which is concerned with moral judgments.

Of late years, interest in the application of ethical considerations to economic problems has increased considerably, using the conclusions of economic science as its material, mainly in connection with problems of distribution, especially wages. One of the most important of modern political movements, Socialism, makes a just distribution of wealth the keynote of its doctrines. In so far as man's conduct is studied in economics, the science is concerned with psychological considerations; but it is distinct from *psychology*, taking the principles thereof as data rather than establishing them as conclusions.

The traditional arrangement of the subject matter of economics into the production, exchange, and distribution of wealth is still maintained; but in recent years consumption, the end of almost all man's productive activity, has received much attention, notably from W. S. Jevons (1835–82) and Marshall. Important conceptions in this connection are those of the *diminishing utility* to an individual or group of individuals of each successive increment of any commodity received beyond a certain point; and of *consumer's surplus*, measured by the difference between the price a person pays for a thing and what he would pay rather than go without it. Any rigid distinction between the different branches of economics is, however, impossible. For example, all processes of exchange may be considered as part either of distribution or of production.

The central problem of economics is really that of how the exchange value of commodities and services is determined; since in this determination all the forces regulating production, distribution, and consumption are brought to a focus, and their action and interaction can be investigated.

The study of value covers that of all forces affecting either the demand for or the supply of a commodity, including its cost of production. On the side of production, technical processes are not studied in detail, though some knowledge of them is indispensable; but matters common to all production are dealt with, such as the so-called *laws of increasing and diminishing* return, which are statements of the relation between the amounts of labour, land, and capital used in production, and the amount of product. Other questions considered are transport, markets of all kinds, banking, currency, finance, and trusts and combinations.

The study of distribution includes the methods by which wages, interest and profits, and rent are determined; and since each of these is payment for a service (of labour, capital, and land respectively) it is really an aspect of the study of value. Distribution also covers such subjects as trade unionism, co-operation, and labour disputes. Economics also deals with public finance (including taxation), treating of the effects of different methods of collecting and expending the State revenue. In considering the above-mentioned subjects, the method of economics is strictly that of a science, in that it aims partly at a descriptive analysis of material, and partly at a statement of cause and effect.

The laws of economics are, like other scientific laws, statements of tendencies. They are not laws such as the commands or prohibitions of the State, though they are often loosely referred to in this way. That economics should be able to generalize and to predict about the action of men is due to its dealing not with individuals, but with large groups, so that individual peculiarities can be neglected and the general characteristics of the group ascertained. It is in this connection that considerable controversy has arisen.

The older writers on economics were mainly deductive in method, i.e. they took a few general principles, such as that every man follows his own interest and knows where that interest lies, and made certain assumptions, such as the existence of free competition; and on this basis worked out a group of principles which were sometimes quite unrelated to actual facts. This method is undoubtedly a most powerful one, and of great value provided that the original assumptions are kept clearly in mind, and variations from them in a particular case allowed for in applying conclusions. But the unreality of some of its results produced a reaction, of which an early instance is the famous *Essay on the Principle of Population* by T. R. Malthus, published in 1798. This book inaugurated the rise of a school of economists who treated their subject from an inductive and historical point of view. The historians, who have been especially prominent in Germany, and of whom representatives are Roscher (1817–94), de Laveleye (1822–92), and Cliffe Leslie (1825–82), hold that economics should in the main be descriptive, and not attempt to formulate laws.

The inductive school, of whom J. S. Mill is an important member, base their work upon more extensive investigation than the older writers, and constantly test their conclusions by reference to facts. Another important reaction against the early economists arose from the identification of the latter with the doctrine of *laisser-faire*. Alexander Hamilton (1757–1804) and Friedrich List (1789–1846) argued in favour of an extension of State activity, especially for the purpose of protecting industry against foreign competition, and may be considered the fathers of modern protectionist doctrine.

In most modern treatment of economics, the deductive and inductive methods are employed side by side. The study of economic history has developed as a separate branch, but economists recognize that it provides them with much valuable material. Important recent developments in method are the increased use of statistics, made possible by their more widespread and careful compilation, and the application of mathematical methods to economic data. It is recognized that, with due care, many conceptions which are with difficulty expressed in words can be treated on mathematical lines to yield results of great service. In this work the researches of Italian writers, such as Pantaleoni and Pareto, are of conspicuous importance.—BIBLIOGRAPHY: A. C. Pigou, *Wealth and Welfare*; *Preferential and Protective Import Duties*; E. Cannan, *Wealth*; J. N. Keynes, *Scope and Method of Political Economy*; G. Cassel, *Nature and Necessity of Interest*; W. Smart, *Distribution of Income*; C. R. Fay, *Co-operation*; A. Andreades, *History of the Bank of England*; H. Levy, *Monopoly and Competition*; C. F. Bastable, *Public Finance*.

ÉCRASEUR is a wire loop or chain for amputating a growth suitably situated for such an instrument. The chain is passed round the base or pedicle of the growth, and gradually tightened by a screw till the growth falls off. Its application in surgery is limited.

ECTOCARPACEÆ, a family of Brown Algæ, section Phæosporeæ. The typical genus is Ectocarpus, comprising small, branched, filamentous plants of salt or brackish water. According to the species, growth of the filaments may be apical, intercalary, or common to all cells, whereas among the more advanced members of the Brown Algæ either apical or intercalary growth is characteristic of entire families. The gametes show every gradation from complete similarity (isogamy) to a condition like that of Cutleria.

ECUADOR (ek-wá-dôr') (*Republica Del Ecuador*), a republic of South America, situated under the equator, between Peru and Colombia. It is of triangular shape, its base resting on the Pacific. Boundaries with Peru were fixed in 1904, and with Colombia in 1916, but disputes are common, and there are at least six *official* maps of the country showing six different sets of boundaries, the areas ranging from 275,936 sq. miles to 337,304 sq. miles. The country is divided into fifteen provinces, one territory—'El Oriente'—and the Archipelago of Galapagos, officially called 'Colon.'

Physical features. It falls, as regards the surface, into three sections: the comparatively narrow and low-lying coast regions, the mountain region, and the extensive plains on the east. The mountain region is formed by a double range of snow-clad mountains—several of them active volcanoes—which enclose a longitudinal valley or tableland, with a breadth of 20 to 40 miles, and varying in elevation from 8500 to 13,900 feet. The most elevated of these mountains are, in the western range, Chimborazo, Pichincha, and Cotacachi, Chimborazo being 20,576 feet high. In the eastern range are Cayambe, Antisana, and Cotopaxi (19,613 feet). The cultivated land and the population of Ecuador lie chiefly in this elevated region, which extends along between the summits of the Cordillera, and may be considered as divided by transverse ridges or dikes into the valleys of Quito, Hambato, and Cuenca.

Towns. The chief towns here are Quito, the capital, with a pop. of 104,000 (1932). Riobamba, and Cuenca, all situated at a height of 9000 feet or more above the sea. The chief ports of Ecuador: Guayaquil and Esmeraldas.

Rivers. The most considerable rivers, the Tigre, Napo, Pastaza, &c., belong to the basin of the Amazon; and some of them, notably the Napo, are navigable for long distances. On the western slope of the Andes the chief rivers are the Esmeraldas and the Guayaquil.

Animals and birds. Ecuador is comparatively poor in Mammalia; although various kinds of deer as well as tapirs and peccaries are found in the forests. Parrots and hummingbirds are also numerous, but perhaps the most remarkable of the birds in Ecuador is the condor, which dwells on the slopes of the Andes. Reptiles, including serpents, are numerous.

The forests yield cinchona bark, caoutchouc, sarsaparilla, and vegetable ivory.

Climate. The climate on the plains, both in the east and the west, is moist, hot, and unhealthy. In the higher regions the climate is rough and cold, but in great part the elevated valleys, as that of Quito, enjoy a delightful climate.

Products. Here the chief productions are potatoes, barley, wheat, and European fruits. In the lower regions are grown all the food-products of tropical climates, cocoa, coffee, and sugar.

Commerce. The foreign commerce is not large, the exports and imports in 1932 were 49,297,809 and 25,165,009 sucrés respectively (£1 = 24·5 sucrés). In 1932 the imports from Ecuador to the United Kingdom amounted to £128,877 and the exports to Ecuador to £203,095, of which £4,184 were re-exports. Cocoa forms three-fourths (or more) of the whole export; the remainder is made up of tagua or ivory-nuts, rubber, straw hats, coffee, and gold. A little gold is mined, and Panama hats are made.

The State recognizes no religion, but grants freedom of worship to all. A system of education was organized in 1897 and improved in 1912. There are three universities: the Central University, at Quito; the Guayas University, in Guayaquil; and the Azuay University, in Cuenca. There are schools for higher education and primary schools, also 4 training colleges for teachers.

Constitution. The executive government is vested in a President elected for four years, who is assisted by a Council of State. The Congress is the legislative body, and consists of two Houses, one formed of Senators, two for each province, the other of Deputies, one for every 30,000 inhabitants. (*See* end of this article.) The Congress has extensive privileges, and cannot be dissolved by the President. The seat of government is Quito. In 1932 both the revenue and expenditure amounted to nearly 49,115,440 sucrés. The debt amounts to £4,676,000. The monetary standard is gold, the gold *condor* of 25 *sucrés* being equivalent to a sovereign. The metric system of weights and measures

is the legal one. Railways and telegraphs have made little progress.

History. Ecuador at the time of the conquest of Peru by the Spaniards formed part of the great empire of the Incas. As the Presidency of Quito it was long included in the Vice-Royalty of Peru. From 1710 it became part of the Presidency of New Granada (or Santa Fé de Bogotá). In the revolutionary war against Spain, Ecuador, along with the neighbouring territories, secured its independence (1822), and was ultimately created a separate Republic in 1831. After the European War various revolutionary movements culminated in a military *coup d'état* in 1925 and a junta of seven men was appointed by the Military Board. This was dissolved in 1926 and a provisional President appointed. The present Constitution of the Republic was promulgated on 26th March, 1929. A new president is elected directly by the people every four years. The political situation has improved immensely, and there is no doubt that, given a period of stable government, Ecuador will progress. Of the present population, the aboriginal red race form more than half; the rest are negroes, mulattoes, mestizoes, a degenerate breed of mixed negro and Indian blood, and Spanish Creoles or whites. Pop. (estimated 1931) 2,500,000.—BIBLIOGRAPHY: F. Garcia-Calderon, *Latin America : its Rise and Progress*; C. R. Enock, *Ecuador*; T. H. Stabler, *Travels in Ecuador*.

ECUMENICAL COUNCIL, a general ecclesiastical council regarded as representing the whole Christian world or the universal Church; specially applied to the general councils of the early Christian Church, beginning with that of Nicæa in 325, and later to those of the Roman Catholic Church, of which the most recent was the Vatican Council at Rome in 1870.

EC'ZEMA is a skin eruption marked by the appearance of papules or vesicles and accompanied by irritation of the affected part, frequently very severe. The characteristic watery discharge of the disease is produced by the bursting of the vesicles. There is difference of opinion among dermatologists as to whether or not it is primarily caused by germs. Various predisposing causes, like digestive disturbances, anæmia, and nervous disorders are important factors in determining the course of the disease.

ED'AM, a town of North Holland, near the Zuider Zee, 13 miles N.N.E. of Amsterdam, noted for its cheese markets; but 'Edam cheese' is mostly made elsewhere. Pop. 7,960.

EDDA (meaning 'great-grandmother'), the name given to two ancient collections of Icelandic literature, the one consisting of mythological poems, the other being mainly in prose. The first of these collections, called the *Elder* or *Poetic Edda*, was compiled in the thirteenth century, and discovered in 1643 by Brynjulf Sveinsson, an Icelandic bishop. For a long time an earlier date was given, the compiler being erroneously believed to have been Sæmund Sigfusson, a learned Icelandic clergyman, who lived from about 1056 to 1133. It consists of thirty-three pieces, written in alliterative verse, and comprising epic tales of the Scandinavian gods and goddesses, and narratives dealing with the Scandinavian heroes. These poems are now assigned to a period extending from the ninth to the eleventh century. The *Prose Edda*, or *Younger Edda*, presents a kind of prose synopsis of the Northern mythology; a treatise on the Scaldic poetry and versification, with rules and examples; and lastly a poem (with a commentary) in honour of Haco of Norway (died 1263). In its earliest forms this collection is ascribed to Snorri Sturluson, who was born in Iceland in 1178, and was assassinated there in 1241 on his return from Norway, where he had been scald or court poet.—Cf. S. Bugge, *Home of the Eddic Poems*.

EDDINGTON, Sir Arthur Stanley, English astronomer. Born at Kendal, 28th Dec., 1882, he was educated at Owens College, Manchester, and Trinity College, Cambridge, where he was senior wrangler (1904). He became chief assistant at the Royal Observatory, Greenwich, and was made Plumian Professor of Astronomy at Cambridge in 1913. Eddington, who was knighted in 1930, has written much on astronomy and kindred subjects.

EDDY, Mary Baker, founder of Christian Science (q.v.), born at Bow, New Hampshire, United States, 16th July, 1821, died 3rd Dec., 1910. She was married three times, to Mr. Glover, Mr. Patterson, and Mr. Asa Gilbert Eddy, all of whom she survived. She began to teach her system of psychotherapeutics in 1866, and founded the first Christian Science Church in Boston in 1879. In 1881 she established the Metaphysical College at Massachusetts. Her works, besides *Science and Health with Key to the Scriptures*, include: *Unity of God, No and Yes, Pulpit and Press, The First Church of Christ, Christian Science versus Pantheism*.—Cf. G.

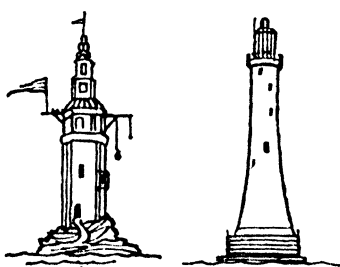
Milmine, *Life of M. B. G. Eddy and the History of Christian Science.*

EDDYSTONE LIGHTHOUSE, a lighthouse in the English Channel, erected to mark a group of rocks lying



Mary Baker Eddy

in the fair-way from the Start to the Lizard. The rocks are covered only at the flood. The first lighthouse was of wood, and built by Henry Winstanley in 1696. It was carried away in the storm of 1703. Another lighthouse, also of wood, was built in 1709 by Rudyerd, but was burned down in 1755. It was succeeded by one built by Smeaton between 1757 and 1759, a circular tower 85 feet high; but, as the foundations on which it stood became much weakened, a new structure, designed by Sir



In 1703 To-Day

Eddystone Lighthouse

J. N. Douglass, was built between 1879 and 1882 on the neighbouring reef. Its light is visible 17½ miles.

EDELWEISS (ā-dèl-vīs; Ger., 'noble white'), *Leontopodium alpinum*, a composite plant inhabiting the Alps, and often growing in the most inaccessible places. Its flower-heads are surrounded by a spreading foliaceous woolly involucre, and its foliage is also of the same woolly character. It is not difficult to cultivate, but is apt to lose its peculiar woolly appearance.

E'DEN (Heb. *eden*, delight), the original abode of the first human pair. It is said to have had a garden in the eastern part of it, and we are told that a river went out of Eden to water this garden, and from thence it was parted into four heads, which were called respectively Pison, Gihon,



Edelweiss

Hiddekel, and Euphrates (Phrat), but this does not enable us to identify the locality. It was not the whole of Eden that was assigned to man for his first habitation, but the part towards the east, to which the translators of the Authorized Version have given the name of the Garden of Eden, and which Milton, in *Paradise Lost*, calls Paradise, that word (originally Persian) having in its Greek form (*paradeisos*) been applied to the Garden of Eden by the translators of the *Septuagint*.

EDEN, a river in England, in Westmorland and Cumberland, falling into the Solway Firth after a course of

65 miles.—Also, a river in Fifeshire, Scotland.

EDENBRIDGE, market town of Kent. It is situated on the Eden near the Surrey border, on the Southern Rly., 26 miles from London. There is a trade in agricultural produce. Pop. 3,500.

EDENHALL, village of Cumberland. It stands on the River Eden, 4 miles from Penrith. It is famous for its hall, which, until sold about 1920, was the seat of the Musgrave family. It is now a school for girls. Its greatest treasure was a goblet of Venetian glass called the Luck of Eden Hall. Pop. 240.

EDENTA'TA (ē-), or **TOOTHLESS ANIMALS,** the name applied to a primitive order of mammals mostly native to the neotropical region, but also represented in South Africa and South Asia. The body is often covered by horny scales or bony plates, the digits are clawed, and the teeth either imperfect or absent altogether.

I. New World forms.—(1) *Ant-eaters.* Toothless, with long narrow snout, and protrusible tongue. Covered with dense fur. The great ant-eater (*Myrmecophăga jubata*) lives on the ground; the much smaller Tamandua and Cycloturus are arboreal. (2) *Sloths.* Toothed arboreal leaf-eaters, covered by coarse fur, and provided with very strong curved claws, by which they hang upside down from branches. The three-toed sloth (Bradypus) has three digits in the forelimb, the two-toed sloth (Cholæpus) only two. (3) *Armadillos.* Burrowing forms protected by a strong carapace of bony plates, and possessing numerous imperfect teeth. (4) *Extinct types.* The so-called ground sloths were of large size, Megatherium being nearly as large as an elephant, and Mylodon not much smaller. Glossodon, allied to the latter, survived into the human period. Glyptodon resembled a gigantic armadillo.

II. Old World forms.—(1) The *aard-vark* (Orycteropus) is a burrowing African form about the size of a pig, covered with coarse hair; long ears and snout; 20 imperfect grinding teeth. (2) *Scaly ant-eaters* or *pangolins* (Manis), native to South Africa and South Asia, are toothless forms not unlike the American ant-eaters in build, but the body is covered dorsally and laterally by large overlapping scales.

EDES'SA, the name of two ancient cities.—1. The ancient capital of Macedonia, and the burial-place of its kings, now *Vodhena.* It is probably the same as the still more ancient Aegæ. Philip II was murdered at Edessa in 336 B.C.—

2. An important city in the north of Mesopotamia, which, subsequent to the establishment of Christianity, became celebrated for its theological schools. In 1098, in the first Crusade, Edessa came into the hands of Baldwin, but ultimately became part of the Turkish Empire. It is thought to be the modern Urfa or Orfa.

EDFU, or **EDFOO'** (ancient **APOLLINOPOLIS**), a village in Upper Egypt, province of Aswân, on the left bank of the Nile, with manufactures of cottons and pottery. Its ancient magnificence is attested by several remains, especially a temple, founded by Ptolemy Philopator (181–145 B.C.), the largest in Egypt after those of Karnak and Luxor. Pop. 20,000.

ED'GAR (*the Peaceful*), one of the most distinguished of the Saxon Kings of England, was the son of King Edmund I. He succeeded to the throne in 959, and managed the civil and military affairs of his kingdom with great vigour and success. In ecclesiastical affairs he was guided by Dunstan, Archbishop of Canterbury, and he was a great patron of the monks. He died in 975, and was succeeded by his son Edward the Martyr.

EDGAR ATHELING, grandson of Edmund Ironside and son of Edward the Outlaw, was born in Hungary, where his father had been conveyed in infancy to escape the designs of Canute. After the battle of Hastings, Edgar (who had been brought to England in 1057) was proclaimed King of England by the Saxons, but made peace with William and accepted the earldom of Oxford. Having been engaged in some conspiracy against the king, he was forced to seek refuge in Scotland, where his sister Margaret became the wife of Malcolm Canmore.

Edgar subsequently was reconciled to William and was allowed to live at Rouen, where a pension was assigned to him. In 1097, with the sanction of William Rufus, he undertook an expedition to Scotland for the purpose of displacing the usurper Donald Bane, in favour of his nephew Edgar, son of Malcolm Canmore, and in this object he succeeded. He afterwards took part in Duke Robert's unsuccessful struggle with Henry I, but was allowed to spend the remainder of his life quietly in England.

EDGEHILL, a ridge in Warwickshire, England, 7 miles north-west of Banbury, where was fought a fierce but indecisive battle on 23rd Oct., 1642, between the Royalists under Charles I and the forces of the Parliament under the Earl of Essex.

EDGEWORTH, Maria, Irish novelist, born at Black Bourton, Oxfordshire, 1st Jan., 1767, died 22nd May, 1849, at Edgeworthstown. She was the daughter of Richard Lovell Edgeworth (1744–1817) of Edgeworthstown, County Longford, Ireland. Her first novel, *Castle Rackrent*, a tale of Irish life, published in 1800, immediately established her reputation. Her later works include: *Belinda, Moral Tales, Leonora, Popular Tales, Tales of Fashionable Life, Patronage, Harrington, Ormond*, and *Helen*, besides an *Essay on Irish Bulls*, and a work on *Practical Education*, largely based on Rousseau's *Émile*. Miss Edgeworth's characteristics are a simple and lucid style and considerable power of observation, but she was not a great creative artist.

EDGWARE, district of Middlesex. It is 8½ miles from London and is served by the L.N.E. Rly., a tube railway and trams and buses. The chief building is S. Margaret's Church, a modern structure with an old tower. Near is Canons Park, where the Duke of Chandos built a palatial residence; and here was the forge of William Powell, Handel's harmonious blacksmith, who is buried at the adjoining Whitchurch. Pop. 4,500.

EDICT, something proclaimed by authority; an order issued by a king or lawgiver. The first edicts were those issued by the prætor at Rome. Later the word was specially used for laws dealing with religious matters, as the Edict of Nantes.

ED'INBURGH, the metropolis of Scotland, and one of the finest as well as most ancient cities in the British Empire, lies within 2 miles of the south shore of the Firth of Forth.

Situation. It is picturesquely situated, being built on three eminences which run in a direction from east to west, and surrounded on all sides by lofty hills except on the north, where the ground slopes gently towards the Firth of Forth. The central ridge, which constituted the site of the ancient city, is terminated by the castle on the west, situated on a high rock, and by Holyrood House on the east, not far from which rise the lofty elevations of Salisbury Crags, Arthur's Seat (822 feet high), and the Calton Hill overlooking the city. The valley to the north, once the North Loch, but now drained and traversed by the L.N.E. Railway, leads to the New Town on the rising ground beyond, a spendid assemblage of streets, squares, and gardens. The houses here, all built of a beautiful white freestone found in the neighbourhood, are comparatively modern and remarkably handsome.

Principal streets. The principal streets of the New Town are Princes Street, George Street, and Queen Street. From Princes Street, which is lined by fine gardens adorned with Sir W. Scott's monument and other notable buildings, a magnificent view of the Old Town with its picturesque outline may be obtained. The principal street of the Old Town is that which occupies the crest of the ridge on which the latter is built, and which bears at different points the names of Canongate, High Street, Lawnmarket, and Castle Hill. This ancient and very remarkable street is upwards of one mile in length, rising gradually with a regular incline from a small plain at the east end of the town, on which stands the palace of Holyrood, and terminating in the huge rock on which the castle is built, 437 feet above sea-level.

Buildings. The houses are lofty and of antique appearance. Amongst the notable buildings are the ancient Parliament House, since the Union the seat of the supreme courts of Scotland; St. Giles' Church or Cathedral, an imposing edifice in the later Gothic style, dating from the fourteenth century and carefully restored between 1879 and 1883; the Tron Church; Victoria Hall (where the General Assembly of the Established Church meets), with a fine spire; and also John Knox's House, besides some of the old family houses of the Scottish nobility and other buildings of antiquarian interest. From this main street descend laterally in regular rows numerous lanes called *closes*, many of them extremely steep, and very few at their entrances more than 6 feet wide; those which are broader, and admit of the passage of carriages, are called *wynds*. In these and the adjacent streets the houses are frequently more than 120 feet in height, and divided into from six to ten stories, or *flats*, the communication between which is maintained by broad stone stairs, winding from the lowest part of the building to the top.

In the Old Town the most remarkable public building is the castle, an extensive mass, of which the oldest portion—and the oldest building in the city—is St. Margaret's Chapel, the private oratory of the Saxon princess Margaret, queen of Malcolm Canmore; another portion being a lofty range of old buildings, in a small apartment of which Queen Mary gave birth to James VI in 1566; while in an adjoining apartment are kept the ancient regalia of Scotland. Here is also the old Parliament Hall, restored during 1888 and 1889. In 1927 some old barracks were demolished and the magnificent Scottish National War

Memorial erected within the castle. An old piece of ordnance built of staves of malleable iron, cask fashion, and known as *Mons Meg* stands conspicuous in an open area.

The palace of Holyrood, or Holyrood House as it is more generally called, stands, as already mentioned, at the lower or eastern extremity of the street leading to the castle. No part of the present palace is older than the time of James V (1528), while the greater portion of it dates only from the time of Charles II. In the north-west angle of the building are the apartments which were occupied by Queen Mary, nearly in the same state in which they were left by that unfortunate princess. Adjoining the palace are the ruins of the chapel belonging to the Abbey of Holyrood, founded in 1128 by David I. On the south side of the Old Town, and separated from it also by a hollow crossed by two bridges (the South Bridge and George IV Bridge), stands the remaining portion of the city, which, with the exception of a few unimportant streets, is mostly modern.

Besides the buildings already noticed, Edinburgh possesses a large number of important edifices and institutions, chief amongst which are the Royal Institution (accommodating the Royal Society and other bodies), a beautiful Grecian building; the National (Picture) Gallery, another fine building in the Greek style, the two buildings standing on a conspicuous site between East and West Princes Street Gardens; the National Portrait Gallery, a building due to private munificence and accommodating also the National Museum of Antiquities; the Museum of Science and Art; the Episcopal Cathedral of St. Mary's, one of the largest religious edifices of modern times; the university buildings, including those of the medical department, standing apart from the others; the infirmary buildings; the high school, register office, and others.

Educational Institutions. Amongst the more prominent educational institutions are the university, the high school, the academy, the United Free Church New College, the Edinburgh School of Medicine (connected with the Royal College of Physicians and the Royal College of Surgeons), Medical College for Women, College of Agriculture, the Edinburgh Veterinary College, Fettes College, the Heriot-Watt College, normal schools, technical, commercial, and other institutions, and endowed secondary schools.



Princes Street, Edinburgh, showing Sir Walter Scott's Monument, and the Castle in the background

Libraries. The Advocates' Library, the largest in Scotland, contains upwards of 550,000 printed volumes and 3,000 MSS.; the university library, 200,000; the library of Writers to the Signet, 100,000. There is also a rate-supported public library in a building erected at the expense of the late Andrew Carnegie.

Industries. Printing, book-binding, coach-building, type-founding, machine-making, the making of rubber goods, furniture-making, ale-brewing on a very large scale, and distilling are the principal industries.

Edinburgh is the headquarters of the book trade in Scotland, and the seat of the chief Government departments. It is a great resort of tourists and other travellers. On account of its picturesque and commanding situation and its literary fame, Edinburgh is often called the 'Modern Athens.'

Origin. The origin of Edinburgh is uncertain. Its name is by many thought to be derived from Eadwinsburgh, the Burgh of Edwin, a powerful Northumbrian king of the early seventh century, who absorbed the Lothians in his rule. The town was made a royal burgh in the time of David I; but it was not till the fifteenth century that it became the recognized capital of Scotland, and from that time it was the scene of many important events in Scottish history. The city is now governed by a council, which elects from its members a Lord Provost, a city treasurer, and seven baillies. It returns five members to Parliament, and within the municipal boundaries are included Portobello, Granton, Liberton, Duddingston, and since 1920 the port of Leith. Pop. (1931), 438,998.—BIBLIOGRAPHY: J. B. Gillies, *Edinburgh, Past and Present*; M. O. Oliphant, *Royal Edinburgh, Her Saints, Kings, Prophets, and Poets*; W. H. O. Smeaton, *Edinburgh and its Story*; H. E. Maxwell, *Edinburgh: a Historical Study*.

EDINBURGH, COUNTY OF, or MIDLOTHIAN, is bounded north by the Firth of Forth, along which it extends 11 or 12 miles; and by the counties of Linlithgow, Haddington, Berwick, Lanark, Peebles, Selkirk, and Roxburgh; area, 234,325 acres, over half of which is arable or under permanent pasture. The south-south-east and south-west parts of the county are diversified with hills, of which the two principal ranges are the Pentlands and Moorfoots, the former stretching across the county to within 4 miles of Edinburgh. The principal rivers are the North and South Esks and the Water of Leith, all running into the Forth.

The lowlands towards the Forth are the most fertile; the farms are of considerable size, and the most approved methods of agriculture are in use. The hilly parts are chiefly under pasturage and dairy farming. The chief crops are oats, barley, turnips, and potatoes. The manufactures are comparatively limited, but include ale, whisky, gunpowder, paper, and tiles. The fisheries are valuable. The chief towns are: Edinburgh, Dalkeith, and Musselburgh. Midlothian and Peebles return two members to Parliament. Pop. (1931) 526,277.

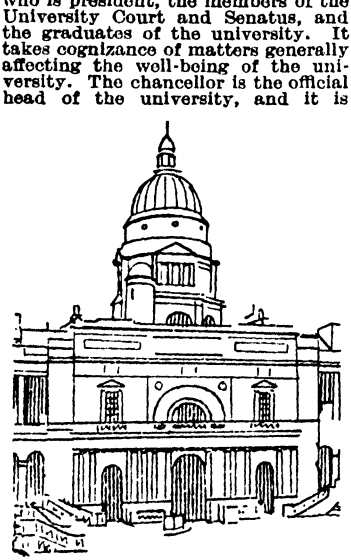
EDINBURGH, DUKE OF, H.R.H. Prince Alfred Ernest Albert, K.G., K.T., K.P., &c., Duke of Saxe-Coburg-Gotha, the second son of Queen Victoria, was born at Windsor Castle, 6th Aug., 1844, died in 1900. At the age of fourteen he joined the navy as naval cadet, and served on various foreign stations. In 1862 he declined the offer of the throne of Greece. On his majority he received £15,000 a year from Parliament, and was created Duke of Edinburgh, Earl of Kent, and Earl of Ulster. In 1867 he was appointed to the command of the frigate *Galatea*, in which he visited Australia, Japan, China, and India. In 1873 he received an additional anuity of £10,000, and next year he married the Grand-Duchess Marie, only daughter of the Emperor of Russia. In 1882 he was made a vice-admiral, and subsequently held important commands. In 1898 he succeeded his uncle as ruler of Saxe-Coburg-Gotha, and resigned £15,000 of his annuity and his other privileges as an English prince, but retained his rank of admiral. He had one son (who predeceased him) and four daughters. He was succeeded as Duke of Saxe-Coburg by his nephew, Leopold Charles, Duke of Albany.

EDINBURGH REVIEW, THE, a quarterly review established in 1802. It had an immediate and striking success, the brilliancy and vigour of its articles being much above the standard of the periodical literature of that time. In politics it was Whig, and did good service to the party. The *Review* was founded by a knot of young men living in Edinburgh, the more prominent of whom were Brougham, Jeffrey, Sydney Smith, and Francis Horner. It was edited from 1803 to 1829 by Jeffrey, under whom it was very successful. In reply to his criticisms Byron wrote his *English Bards and Scotch Reviewers*. Among the famous contributors to the *Review* were Lord Macaulay, Lord John Russell, and John Stuart Mill.

EDINBURGH UNIVERSITY, the latest of the Scottish universities, was founded in 1582 by a charter granted by James VI. The number of professors and other teachers is now over 240. The university is a corporation consisting of a chancellor, rector, principal, professors, registered graduates and alumni, and matriculated students.

Government. Its government is administered by the University Court, the Senatus Academicus, and the General Council, as in the other Scottish universities, in all of which new ordinances have been introduced

under the Universities (Scotland) Act of 1889. The University Court, which is the supreme governing body of the university, consists of the rector, who is president, the principal, the Lord Provost of Edinburgh, and eleven assessors. The Senatus superintends the teaching and discipline of the university, and consists of the principal and professors. The General Council consists of the chancellor, who is president, the members of the University Court and Senatus, and the graduates of the university. It takes cognizance of matters generally affecting the well-being of the university. The chancellor is the official head of the university, and it is



Edinburgh University

through him or his deputy, the vice-chancellor, that degrees are conferred. He is elected for life by the General Council. The principal is the resident head of the university and president of the Senatus, and is appointed for life (at Edinburgh by a body called the 'Curators,' elsewhere by the Crown). The lord rector is elected for three years by the matriculated students.

Faculties. There are six faculties in the university, viz. arts, science, divinity, law, medicine, and music. Some of the professors are appointed by the Crown, others by special electors, and a considerable number by the curators, who represent the university court and the town council. The number of students in 1919–20 was over 4,300. Candidates for degrees in the different faculties must now pass an entrance examination before attendance upon classes. Women are admitted to all courses and degrees, equally with men, except in the faculty of divinity.

Those desirous of taking the degree of Master of Arts (M.A.) must attend classes and pass examinations in at least seven subjects, selected from four departments, viz. language and literature, mental philosophy, science, history and law, the course of study extending over three academic years at least. There is a considerable restriction in choice of subjects, since four of them must be (*a*) Latin or Greek; (*b*) English or a Modern Language; (*c*) Logic or Moral Philosophy; (*d*) Mathematics or Natural Philosophy; and the whole subjects must include both of (*a*) or both of (*c*), or two out of the three—mathematics, natural philosophy, and chemistry.

Four medical degrees are conferred: Bachelor of Medicine (M.B.), Bachelor of Surgery (Ch.B.), Master of Surgery (Ch.M.), and Doctor of Medicine (M.D.). Before any of these degrees can be obtained the candidate must have been engaged in medical study for at least five years.

The degrees in law are Bachelor of the Law (B.L.), Bachelor of Laws (LL.B.), and Doctor of Laws (LL.D.), the last being purely honorary. In divinity the degrees are Bachelor and Doctor of Divinity (B.D. and D.D.), the latter being honorary. In science the degrees are likewise Bachelor and Doctor (B.Sc. and D.Sc.), both conferred in the three departments of pure science, engineering, and public health. There is also a B.Sc. in agriculture.

The degree of Doctor of Philosophy (D.Phil.) is conferred for proficiency in mental science, and that of Doctor of Letters (D.Litt.) for proficiency in literary, philological, and linguistic studies. The degrees of Bachelor and Doctor of Music (Mus.B. and Mus.D.) are also conferred. There is a joint board of examiners for the four Scottish universities, having the control and supervision of the preliminary examinations.

Laboratories, Library, Bursaries, etc. The university has splendid laboratories and museums. The foundation stone of a new science laboratory was laid by King George on 6th July, 1920. The library contains 200,000 volumes. There are bursaries, scholarships, and fellowships, amounting annually to about £12,500. Since 1918 the University of Edinburgh unites with the other Scottish universities in returning three members to Parliament. The constituency consists of the General Council.—BIBLIOGRAPHY: J. Kerr, *Scottish Education, School and University, from Early Times to* 1908: *University Calendar*;

Sir Alex. Grant, *The Story of the University of Edinburgh from Early Times to* 1908.

ED'ISON, Thomas Alva, an American inventor, born in Ohio in 1847, died 17th Oct., 1931. He became a newsboy on the Grand Trunk Railway, and afterwards, having obtained some type, issued a small sheet of his own known as the *Grand Trunk Herald*, printing it in a freight car. He then set himself to learn telegraph work, and in a short time became an expert operator. In 1863, while at Indianopolis, he invented an automatic telegraph repeater. This was the first of a long series of improvements and inventions. He opened an extensive establishment at Newark for the manufacture of electrical, printing, automatic, and other apparatus. In 1876, his health breaking down, he gave up manufacturing and devoted himself to investigation and invention. Amongst his numerous inventions are the quadruplex and sextuplex telegraph, the carbon telephone transmitter, the 'Edison system' of lighting, the electric fire-alarm, the 'Edison electric railway,' the phonograph, and the megaphone. His improvements in the cinematograph made it practicable, though he did not originate the idea of it.

ED'MONTON, an urban district and parliamentary borough in England, county of Middlesex, 6½ miles north of London, with an extensive trade in timber, carried on by the Lea River navigation. The 'Bell at Edmonton' has become famous by association with the adventures of Cowper's *John Gilpin*. The borough returns one member to Parliament. Pop. (1931), 77,652.

EDMONTON, a town of North-Western Canada, on the North Saskatchewan (here navigable). Since 1905 it is the capital of the province of Alberta, and has grown considerably in recent years. It is an important terminal for the Canadian Pacific and Canadian National Railways, and is the distributing centre of an immense area, including the Peace River district. Cattle are raised in the vicinity. Easily-mined coal is worked here. Pop. (1931), 79,197.

ED'MUND, St., King of the East Angles, began to reign in 855, died in 870. He was revered by his subjects for his justice and piety. In 870 his kingdom was invaded, and he himself slain, by the Danes. The Church made him a martyr, and a town (Bury St. Edmunds) grew up round the place where he was buried.

EDMUND I, King of England, an able and spirited prince, succeeded his brother Athelstan in 940. He conquered Cumbria, which he bestowed on Malcolm, King of Scotland, on condition of doing homage for it to himself. He was slain at a banquet 26th May, 946.

EDMUND II, surnamed *Ironside*, King of England, the eldest son of Ethelred II, was born in 989. He was chosen king in 1016, Canute having been already elected king by another party. He won several victories over Canute, but was defeated at Assandun in Essex, and forced to surrender the midland and northern counties to Canute. He died after a reign of only seven months.

EDOM, in the New Testament *Idumæa*, in ancient times a country lying to the south of Palestine. The Edomites are said in *Genesis* to be the descendants of Esau, who was also called Edom (a word signifying 'red'), and who dwelt in Mount Seir, the mountain range now called *Jebel Shera*, stretching between the Dead Sea and the Gulf of Akabah. Edom is frequently mentioned in the Assyrian inscriptions. The Edomites were subdued by King David, and after the separation of the ten tribes remained subject to the Kingdom of Judah until the reign of Jehoram, when they revolted and secured their independence for a time. They were again subdued about half a century later by Amaziah, and again, in the reign of Ahaz, recovered their independence, which they maintained till the time of the invasion of Judea by Nebuchadnezzar. They fell under the rule of the Persians, and afterwards their fortunes were merged in those of Arabia. The chief city in this region was Petra, which now presents remarkable ruins, as well as several rock-cut temples.

EDRED, King of England, son of Edward the Elder, succeeded to the throne on the murder of his brother, Edmund I, in May, 946. He quelled a rebellion of the Northumbrian Danes, and died in 955.

EDRIOPHTHAL'MATA, one of the great divisions of the Crustacea, including all those genera which have their eyes sessile, or embedded in the head, and not fixed on a peduncle or stalk as in the crabs, lobsters, &c. It is divided into two orders. (1) Amphipoda, laterally flattened, as in the marine sandhopper (Talitrus), and the fresh-water shrimp (Gammarus). (2) Isopoda, flattened from above downwards. Sea-slaters or wood-lice (Ligia and Idothea); fish parasites (Cymothoa); fresh-water wood-lice (Asellus); land wood-lice (Oniscus, Porcellio, Armadillidium, which can roll up).

EDRI'SI, Abu-Abdallah Mohammed, a famous Arabian geographer, a

descendant of the ancient princely family of the Edrisites, born about A.D. 1100, died about 1180. He studied at the Moorish university of Cordova, after which he travelled through various countries. At the request of King Roger II of Sicily he constructed a globe with a map of the earth, which represented all the geographical knowledge of the age. He accompanied this with a descriptive treatise completed about 1154, and still extant. The work was published at Rome in Arabic (1592), and in 1619 a Latin translation of it, under the title of *Geographia Nubiensis*, appeared in Paris.

EDUCATION is the name applied to the systematic instruction given by each succeeding generation to the young of the race to fit them for the work of life. The word itself is derived from the Latin verb *educare*, which means to rear, to nourish, to bring up, and also to educate. Long before the dawn of civilization men saw that the young had to be prepared for the battle of life; had to learn how to make and how to use the offensive and defensive weapons employed against their enemies; how to form or build shelters to protect themselves against the weather and against their foes; how to make traps or snares for the wild things on which they fed; how, in fact, to use their powers of mind and body in such a way as to secure for themselves the fullest and most satisfactory life possible under the circumstacnes in which they found themselves.

While education thus understood would be the story of man on the earth, an account of his more or less satisfactory, but always continuous, efforts to perfect the relations between his desires and his environment, it would have to embrace also an account of the conflict between the demands of communities and the rights of individuals. Education, however, as we understand it, is more limited in its scope. It is the instrument employed by the State for the training of its citizens.

Greeks. The Greeks were the first Europeans to treat education as a science. The results they obtained were good, and have to a certain extent determined the course taken by European education ever since. Plato defined the aim of the education of which he gives us an account in the *Republic*, to be the "development in the body and in the soul of all the perfection which it is possible for them to attain." This was the Greek ideal of what education should aim at; a high ideal indeed; but one that omits an element of immense importance which we find introduced in Milton's definition of the 'end of learning,' that is, the aim of education. Milton boldly declares this to be: "To repair the ruin of our first parents by regaining to know God aright, and out of that knowledge to love Him, as we may the nearest by possessing our souls of true virtue, which being united to the heavenly grace of faith makes up the highest perfection." Perfection is the end sought in both cases, and which seems the nobler it is unnecessary to say. This impression is deepened when he proceeds to declare that as "Our understanding cannot . . . arrive so clearly to the knowledge of God and things invisible, as by orderly conning over the visible and inferior creatures, the same method is necessarily to be followed in all discreet teaching."

Aristotle. By Aristotle the order of education was: first, education of the body, the just and proportionate development of its powers. The instrument employed for this purpose was gymnastics; not the gymnastics employed in training professional athletes, but more moderate exercises; for, as the philosopher insists, too strenuous bodily exertion is apt to spoil the child, because body and mind must not be hard worked at the same time. Music, according to him, had various aims: education proper, the training of the affections, and the occupation of leisure. Drawing was taught as a branch of music for the purpose of developing the child's sense of beauty, mathematics were taught to cultivate his intellect, and dialectic (logic and philosophy) to prepare the pupil for a scientific training.

Plato. To the idealistic philosopher Plato, the whole life of man, at least the whole of what we may call the active life, was educative. Education was State-controlled, and at the end of the first six years, spent by the child in the seclusion of family life, the State took charge. The aim of the education proposed by Plato was to develop in the child the cardinal virtues—honour to parents, love of fellow-citizens, courage, truthfulness, and self-control. From the seventh to the tenth year the training was mainly in gymnastics; from the tenth to the thirteenth the child learned to read and to write; from the thirteenth to the sixteenth his affections and his sense of the beautiful were cultivated through learning poetry and studying music; from the seventeenth to the twentieth year he applied himself mainly to athletics, so that he might be qualified to take his share in the defence of the State. At twenty men were called upon to choose their occupation; to turn their minds to the study of the sciences; and to shape by

practical military and other services to the State that character which it was the aim of education to form. From thirty to thirty-five Plato supposes the citizens of his ideal republic to devote themselves to the study of *Dialectics*, the method of purely intellectual knowledge, by which reason, using hypothesis, arrives at the first principles of things. From thirty-five to fifty the life of the citizen was to be given up to public service, that is, to the promotion in the position for which he was best fitted of the general well-being.

Greek Philosophers. The training set forth by the Greek philosophers was the training thought necessary to fit a man to be a ruler. As the Greek city states were slave states, and most of the manual work was performed by slaves, that necessary part of the training of the youth of the community is ignored. This fact has had, undoubtedly, an enormous influence on the ideas of education put forward since. The preliminary training demanded by the Greeks included, besides gymnastics, grammar and music. At a later time these were understood to incluue the seven arts: Grammar, Rhetoric, Dialectic (*Trivium*), and Arithmetic, Music, Geometry, and Astronomy (*Quadrivium*). To the Greeks, myths were the instruments of the earliest education, the aim of which was the development of a character in the citizen which would lead him to give his best and most loyal services to the State.

Greek and Roman Education. The aim of Greek education was the formation of the philosophic thinker, the man fitted by nature and training to guide and direct the energies of the man of action. Roman education, on the other hand, directed its efforts mainly to the moulding of the man of action himself. The Romans adopted the form rather than the spirit of Greek education. The aim of Roman education was to make a man who could do things; a practical man, a man full of energy, who was ever ready to sacrifice himself in the interests of the State; a man who knew the laws and who regulated his conduct by them; who reverenced his father and his country's gods; and found his chief pleasure in the complete overthrow and utter destruction of his country's foes. He could discourse eloquently and not unphilosophically; and he spared neither himself nor others in his effort to maintain the freedom of his country, and to bring destruction on the enemies of Rome. Roman education began in the home, and during the earlier years was largely directed by the mother. Later the preparation of the boy for life was taken over by the father; but it is probable that from very early times many, if not most, Roman boys were sent to school, where, under the *magister literarius* (elementary teacher), the *grammaticus* (advanced teacher), and the *rhetor* (professor), they acquired the knowledge and accomplishments it was needful for them to obtain.

Roman Schools. The Roman schools, elementary and secondary, seem to have been conducted in a verandah, and boys and girls seem to have been taught in the same school. The chief Roman writers on education are Cicero, Seneca, and Quintilian. Quintilian tells us that Cato also wrote a treatise on the subject, but that that work had been lost. The oratorical training of which Quintilian was the expositor seems to have been largely out of connection with real life; and, though he claims that the orator must be a widely cultured, wise, and honourable man, seems to have developed a tendency to the bombastic abuse of ornate and stilted speech. The practical effects, too, of the corruption of family education were far from satisfactory. Moral degradation followed, and humanity seems to have been rescued only by the introduction of a new ideal of life, which substituted for the pagan self-reliance, self-control, moderation, and proportion, self-denial, self-forgetfulness, and humility; which made the last, indeed, the chief virtue, and looked on pride and self-confidence as spiritual sins.

Christianity. The introduction of Christianity was followed by the inroads into the Roman Empire of barbarous tribes from the north and east. Before these attacks the Western Roman Empire collapsed, and with it to a greater or less extent the educational system of the time.

It must be remembered that between three and four hundred years elapsed between the downfall of the Western Roman Empire and the beginnings of the Holy Roman Empire under Charlemagne. Classical or pagan culture, as profane learning, was at a discount, and the aim of the monasticism which grew out of the introduction of Christianity was mystic absorption in the contemplation of God.

This interval was followed by the efforts of Charlemagne to revive Roman culture, and to establish schools throughout Western Europe. In this he was aided by Alcuin and other scholars from England, where in the comparative quiet that followed the conquest of Britain there had grown up a system of education. Throughout his dominions three

classes of schools were established by Charlemagne, the Palace School, the Bishop's School, and the Monastery School. These were intended to take the place of the splendid system of public schools that had grown up under the Roman Empire. The course of studies established in these mediæval schools, following the practice of Greece and Rome, was divided into two parts: the *Trivium*, including Grammar, Dialectic, Rhetoric; and the *Quadrivium*, which embraced Geometry, Arithmetic, Music, and Astronomy. Education in the palace or castle schools had a different aim. It sought to develop the bodily powers, and to awake in the pupils that respect for the weak which was shown in the worship of women, and that love of justice, and belief in its supremacy, which characterized the *chivalry* of the Middle Ages.

The scholastic education of this time laid special stress on formal logic and metaphysics. Latin was taught, was, indeed, the universal language of the period. Questions about the nature of the unseen and the spiritual occupied much of men's minds; while their time was taken up in discussing the character of universals, the true realities which lay behind the individual manifestations of experience. As a rule, the physical world was ignored, and human intelligence disregarded; but there were notable exceptions, among which the teachings of Bishop Grosseteste (died 1253) and of Roger Bacon (1214 to 1294) take a prominent place.

It was during the period of scholasticism that universities, in imitation of the trade guilds of the time, sprung up in different parts of Europe, particularly in Spain, Italy, France, and England. To the famous schools both in England and on the Continent scholars flocked from all parts, and their instruction presented little difficulty, as Latin, the language in which the instruction was given, was the common language of scholars in Western Europe. The establishment of universities in different countries was a sign rather than a cause or result of that intellectual and spiritual awakening which, after nearly a thousand years of almost complete stagnation, manifested itself among the peoples of Europe.

Renaissance. It is usual to date the Renaissance from 1453, the fall of Constantinople; but it must not be forgotten that owing to the clash between East and West, the struggle between Christianity and Mohammedanism (the Crusades, as these religious wars were called), there had from the end of the eleventh century been a considerable change of outlook among the nations of Western Europe. This was specially the case in Italy, where city states, not unlike those of Greece in their character, had sprung up, and where, as in Greece in the time of Pericles, there had been the great outburst of literary activity which is associated with the names of Boccaccio, Dante, and Petrarch. In Northern and Western Europe the intelligence stimulated by the new learning was directed towards the improvement of the method of study. All study was linguistic. Latin was the instrument of common intercourse; Greek and Hebrew were sacred as the tongues in which the Scriptures had been conveyed; it was no wonder, therefore, that the humanistic education was almost entirely confined to the study of languages. Sturm (1507 to 1589) drew up a scheme of studies which had long a great influence on the school courses of instruction throughout Europe.

Reformation. The action against authority which marked the Reformation period was specially noted for the reaction against the purely verbal education given to the young, whose education, as we learn from Locke, was calculated to teach them "not to believe, but to dispute," and to fit them "for the university, not for the world." On the Continent Rabelais (1483 to 1533) led this realistic movement, which was continued by Montaigne (1533 to 1592) in France, and under the influence of Bacon by Brinsley and Hoole in England, and Ratke and Comenius on the Continent. Up to this time the chief English writers on the subject of education had been Sir Thomas Elyot in his *Governour*, Roger Ascham in his *Scholemaster*, and Richard Mulcaster in his *Positions*.

16th Century. The intellectual activity which marked in England the closing decades of the sixteenth and the first part of the seventeenth century saw the issue of Milton's *Tractate*, one of the most famous books on education ever produced. The *Tractate* discusses only the kind of education that should be given to gentlemen's sons between the ages of twelve and twenty-one, so that it is strictly limited in its application, as it does not deal with the education of the people, nor with the education of women. The ideal which Milton put before him as the aim of "a complete and generous education" was "to fit a man to perform justly, skilfully, and magnanimously all the offices both private and public of peace and war." Milton in his *Tractate* discusses studies, exercise, and diet, showing that he clearly understood that education was con-

cerned with the body as well as the mind and spirit.

17th Century. Towards the close of the seventeenth century Locke, an English physician and philosopher, published (1693) his *Thoughts concerning Education*, a book which influenced immensely the character and direction of future educational studies. As he informs his readers in his letter to Edward Clarke, he counsels everyone "after having well examined and distinguished what fancy, custom, or reason advises in the case . . . to promote everywhere that way of training up youth . . . which is the easiest, shortest, and likeliest to produce virtuous, useful, and able men in their distinct callings." He begins his essay with the statement, "A sound mind in a sound body is a short but full description of a happy state in this world," and the suggestions he makes as to the physical, moral, and intellectual training of the young are for the most part sound. He decried a too severe discipline, maintaining that "If the mind be curbed and humbled too much in children, . . . they lose all their vigour and industry." On the other hand, he held that if you "Remove hope and fear, there is an end of all discipline"; and he held that, as far as possible, "Childish actions are to be left perfectly free and unrestrained." He applied the science of psychology to the study of child nature, and of the methods to be employed in training it; and so prepared the way for the modern methods of education. "Interest is the secret of Herbart," according to one of his devoted admirers. Locke seems to have anticipated this when he declares that "None of the things they are to learn should ever be made a burden to them, or imposed on them as a task."

Rousseau. Though his attitude towards the universe was utterly opposed to the attitude of Locke, Rousseau drew almost all that was practical in his scheme for the education of the young from the English writer. Rousseau's work, though largely inspired by Locke, was essentially of a revolutionary kind. It held that man is the great corrupter; that "Everything is good as it comes from the hands of the Creator; and that man's handling makes everything worse." In effect he said, leave the child as much as possible alone. An attempt constantly to direct him can only result in stupefying him. It is true we receive our education from nature, from men, and from things; but nature must be our guide in determining the use of the other two. As few restraints as possible must be imposed on the child, and the use of books should be prohibited. For the child there should be "no other book but the world," and "no other instruction but facts." The child's education he divides into four stages, infancy, childhood, boyhood, and youth. The first two stages last till the beginning of the thirteenth year, when the boy is supposed to be fit for instruction. From such instruction the teaching of words must disappear, and the teaching of things must take its place. The subjects most suitable for instruction were, Rousseau declared, measuring, drawing, geometry, speaking, and singing. Books, he declares, are useless, are, indeed, altogether harmful. The method he advocates is the method of self-teaching and the use of the senses, which Rousseau held would work to the profit of the intelligence. The child's knowledge should rest on his own observation, and not on belief in authority, and each child should be taught a manual trade.

At fifteen, according to Rousseau, real education begins; and it is the duty of the teacher to study the subject he has to act upon, in other words, to discover the nature of the pupil, which must in all cases determine the means and the method employed in his education. Two things must be taught. These are the true relations, racial and individual, that exist among men; and how to direct and control the emotions aroused by the environment so that the best results may arise. Here he finds occasion for the use of moral teaching and for instruction in religion. The facts of history must be placed before him; but he must be left to form his own judgment. He is now to be taught religion as a help to the regulation of the passions; but not the religion of any particular sect. His time is to be given up largely to reading and to the acquirement of taste; to the study of history and eloquence; and to attendance at the theatre.

The revolutionary doctrines preached by Rousseau in his *Émile* and in his other educational works had an immense effect on the Continent, and particularly on the work of one of his most ardent admirers, the Swiss farmer and schoolmaster Pestalozzi, an eccentric, dubbed by his schoolfellows "Harry Oddity of Foolstown." Thinking the education demanded for Émile by Rousseau vastly superior to that which he himself received, he very early became an ardent admirer of the system advocated by the French philosopher, and an eager reformer. *Émile* and the *Contrat Social* were condemned by the

magistrates of Zürich, and Pestalozzi and some of his fellow-students were imprisoned for the *Memorial* in which they defended these works. Later, Pestalozzi determined to be a farmer. He was married at the age of twenty-three, and started growing madder and vegetables on some poor land near Zürich. On the land he built for himself a house, the *Neuhof*.

Pestalozzi. In the winter of 1774 he hit upon the expedient of taking into his house some twenty poor children of the neighbourhood, whom he treated as his own. They worked with him in summer in the fields, and in winter in the house. Improved health for the children, increased intelligence and a manifest devotion to their benefactor were some of the results speedily displayed, and the experiment drew much attention to itself. Urged on by his love for the children, Pestalozzi took in a larger number, and in a very short time found himself bankrupt. In this period of seeming disaster Pestalozzi turned author. The books which he produced were greedily read on the Continent, and aroused the greatest interest. After some work at Stanz and at Burgdorf, Pestalozzi settled to work in the castle of Yverdun on Lake Neuchâtel, which became in the early years of the nineteenth century a place of pilgrimage for European students and lovers of education. Forced to leave Yverdun in 1815, he continued his work at Clindy till 1824.

Froebel. Friedrich Froebel spent the years 1807 to 1809 at Yverdun, and so fitted himself to carry on the work Pestalozzi had to some extent made popular. His name, however, is specially associated with the schools for very young children to which he gave the name of *Kindergarten*, that is, 'gardens of children,' places where young children, like young plants, were properly watched and tended. For the children in these schools their employment was to be play, play from which and by which they acquired clear notions regarding themselves and their environment. "Education," he asserted, "should lead and guide man to clearness concerning himself and in himself, to peace with nature, and to unity with God." He held that powers were developed by exercise; that failure to use any part of the body or mind led to the shrinkage of the part, and sometimes even to its complete loss. He held that if we wish to develop the body we must exercise the body, and that, similarly, if we wish to develop the intellect or the emotions they must be exercised. He insists that teachers must be careful to interfere as little as possible; must remember at all times that the aim of teaching is "to bring ever more and more out of man rather than to put more and more into him." He based his system on action; agreed with Montaigne that "children's games were their most serious occupations"; and with Locke that "All the plays and diversions of children should be directed towards good and useful habits." Froebel was not the founder of infant schools. These were first established on the Continent and in Britain with the object of helping mothers. In Britain their establishment is associated with the names of the educational enthusiasts James Buchanan and Samuel Wilderspin.

Herbart. Nearly ten years before Froebel's stay with Pestalozzi at Yverdun, Herbart, next to Kant and Hegel the most influential of German philosophers, visited the inspired educationist at Burgdorf, and found him employing methods based on the principles which he himself had worked out in his psychology. To both it was clear that there is a definite order in which subjects should be taught to the children, and that this order is determined, not merely by the relation of the subjects to each other, but by their power of satisfying the growing wants and capacities of the child. Pestalozzi had arrived intuitively at a method, and had practically applied it, which Herbart had scientifically worked out as applicable to the whole educational field. Three years later Herbart published pamphlets on Pestalozzi's best-known book, *How Gertrude teaches her Children*, and on *The A.B.C. of Sense-perception*, and in these showed what weight he attached to observation as an instrument of education. Two years later he published one of his most notable works on education, *The Æsthetic Revelation of the World*, and in 1806 *General Pedagogy*. In 1809 he was appointed professor of philosophy at Königsberg, where he remained till 1833, and where his services to the cause of education, both by his writings and by his establishment of normal schools and experimental schools, cannot be exaggerated. He warns teachers not to educate too much; to be careful not to destroy the individuality of the child, such individuality being that which characterizes individuals of the same class. He lays the greatest stress on the importance to the teacher of child study, maintaining that he will be unable to teach unless he knows the child as he is. For Herbart the aim of education is summed up in morality, "the highest aim of humanity and consequently of education," itself. "I have no conception," he writes, "of education without instruction, just as

I do not acknowledge any instruction that does not educate." "Instruction," he says elsewhere, "will form the circle of thought, and education the character; the last is nothing without the first."

A great deal, according to Herbart, depends upon the pupil himself, who "grasps rightly what is natural to him," and who must be saved from the tendency to one-sidedness in which following his bent would result, by the cultivation in him of many-sidedness. This cultivation involves the control of the pupil's mental activity, and the instrument for this control is interest, which causes the pupil's complete absorption in its object. For the attainment of this Herbart proposes certain formal steps of instruction. These steps are usually set forth as (1) Preparation, (2) Presentation, (3) Comparison, (4) Generalization, (5) Application.

19th Century. The nineteenth century was a period of continuously increasing interest in education, and of a generally growing belief in its utility. It was taken up by the Governments of the different countries, and ordered and regulated almost out of existence. Seven years before the death of Pestalozzi the first public grant for education was made by the British Parliament, and from that time up to the present the Government has continued to extend its power over the education of the country. For a long time the Government in Britain was satisfied to subsidize elementary education; but later it insisted on hard-and-fast lines of instruction. So thoroughly were these regulated in most countries that a French Minister of Education could boast he was able to say what work every child in France was engaged in at that particular moment.

Government. In Britain it was only bit by bit, and with very considerable reluctance, that the Government took upon itself the responsibility for the education of the country. In Scotland a national system of general education, constituted in 1560, remained in force until reconstructed by the *Education Act* of 1872. (*See* SCOTLAND.) Compulsory education was introduced into England in 1870, together with what was described as payment by results; and, for some time, the aim which the teacher had to keep before him was the production at the annual examination of the largest number of pupils who could satisfy the tests in Reading, Writing, and Arithmetic, or, as they were called, the 'three R's,' and so earn the Government grant. For between thirty and forty years this unnatural and mechanical system remained in force. From 1864 onwards Commission after Commission sought to reduce English secondary education to order. The most notable of these was The Bryce Commission of Enquiry into Secondary Education, 1894–5, whose recommendations have since been put into force by legislation. One of the results of the increasing interest in education throughout England was the founding, early in the latter half of last century, of great day schools, like the City of London, St. Paul's, and Merchant Taylors, in London and other large cities; and, after the passing of the Education Act of 1902, the establishment everywhere of Council Secondary Schools.

19th Century Works. Of the immense number of works on education issued during the last half of the nineteenth century, perhaps the best known are those of Herbert Spencer and of Professor Bain. The former seeks to explain education from the Darwinian standpoint, and the latter to determine from psychology the intellectual value of the various subjects taught in school, and the average age at which they should be taught to children. Of practical English educators during the nineteenth century, the most outstanding names are undoubtedly those of Arnold of Rugby, Thring of Uppingham, and Abbott of the City of London School.

Recent Times. In recent times the advances made in the theoretical and practical studies of the sciences of anthropology, physiology, and psychology have exercised an enormous influence on educational theories and practices. Careful observations of young children by scientific observers like Darwin, Dearborn, and Preyer have added greatly to our knowledge of child-nature; and helped to suggest new methods of studying it and developing it. The result has been the promulgation within the present century of a number of educational methods, some of which, in contrast to the older practices, must seem almost revolutionary. Among these must be remembered the 'Heuristic Method' of teaching science put forward by Professor H. E. Armstrong. The object of the method is to put the student as completely as may be in the position of an original investigator; and it has been classed by writers on education as being, like so many other modern methods, a 'play method.'

Montessori. Froebel, in his kindergarten, was one of the first to introduce successfully the play method in education, and the 'gifts' by which the plan was carried through were of

his own devising; but such cannot be said of Dr. Montessori, whose method of education engrosses so much attention at the present time. The Montessori apparatus was originally devised by Dr. Seguin for the instruction of mental defectives. Dr. Montessori used the apparatus first for the training of young children; but the cardinal feature of the Montessori system is the determined effort to make the child entirely responsible for his own education, and to interfere as little as possible with his development. The apparatus is so contrived that it can only be used in one way if the problem is to be solved; so the child is forced to attend to the differences in size and shape and carefully to compare the different pieces. In addition, the Montessori system attempts to cultivate the social virtues; teaches the children to live and to work and play with others, and so to learn to be well-mannered. The teacher in this system retires into the background, and the children are left to go their own way, to choose their own tasks, and to be their own critics. Great attention is also given to the physical development of the children.

Experimental Education. This has been attempted both in Germany—where the need for it was first put forward by Kant—and in England; but it is in the United States of America that the chief advances in this direction have been made. There the Binet attempt to measure the intelligence of the child, to fix in fact a metric scale of intelligence, has been elaborated, and the Binet-Simon system of tests devised, and later modified by L. M. Terman. There, too, schools have been established which have tried the working out of what may be described as the non-interference with the pupil principle. Among these may be mentioned the 'George Junior Republic' and the Gary Schools. The latter, we are told by their founder, were "not instituted to turn out good workers for the steel company, but for the educational value of the work they involved." To this must be added the 'Dalton Laboratory Plan', tried lately as an experiment by Miss Helen Parkhurst in a public secondary day school in Dalton. By this plan, the timetable is abolished, the child undertakes to get up a certain amount of work each month in each particular subject, and is left free to distribute his time as he chooses, so that he can devote more time to those subjects in which he is backward. The school is divided into departments (laboratories) each under a specialist who gives the help needed, but leaves the pupil to himself as much as possible.

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EDUCATION ACT, the name given to several Acts dealing with education in Great Britain. Among the principal Education Acts are: (1) that of 1870, which introduced compulsory education; (2) that of 1891, which reduced, or in some cases abolished, school fees; (3) that of 1902, which authorized the levying of an education rate; and (4) that of 1918, which raised the age for leaving school, and made education compulsory up to the age of eighteen by means of continuation schools. Pupils must attend these schools for 320 hours each year.

EDUCATION, BOARD OF, in England and Wales a body set up in 1899 to control education. It took over the duties formerly discharged by a committee of the Privy Council. Its president is a member of the Cabinet and it has a large staff of inspectors and other officials. The offices are in Whitehall, London.

For supervising education in Scotland there is a department under the Secretary of Scotland at 14 Queen Street, Edinburgh. Each of the self-governing parts of the British Empire has an education department. In most foreign countries education is controlled by a department of State.

EDWARD, known as *the Elder*, King of England, son of Alfred the Great, born about 870, died in 925. He succeeded his father in 901, and his reign was distinguished by successes over the Danes. He fortified many inland towns, acquired dominion over Northumbria and East Anglia, and subdued several of the Welsh tribes.

EDWARD, surnamed *the Martyr*, King of England, succeeded his father, Edgar, at the age of fifteen, in 975. His reign of four years was chiefly distinguished by ecclesiastical disputes. He was treacherously slain in 979 by a servant of his stepmother, at her residence, Corfe Castle. The pity caused by his innocence and mis-

fortune induced the people to regard him as a martyr.

EDWARD, King of England, surnamed *the Confessor*, was the son of Ethelred II, and was born at Islip, in Oxfordshire, about 1004. On the death of his maternal brother, Hardicanute the Dane, in 1041, he was called to the throne, and thus renewed the Saxon line. Edward was a weak and superstitious, but well-intentioned prince, who acquired the love of his subjects by his monkish sanctity and care in the administration of justice. His queen was the



Edward the Confessor

daughter of Godwin, Earl of Kent. He died in 1066, and was succeeded by Harold, the son of Godwin. Edward caused a body of laws to be compiled from those of Ethelbert, Ina, and Alfred, to which the nation was long fondly attached. He was canonized by Pope Alexander III in 1161.

EDWARD, Prince of Wales, surnamed *the Black Prince*, born 15th June, 1330, the eldest son of Edward III and Philippa of Hainault. In 1346 he commanded part of the forces at the battle of Crécy, and earned the praise of his warlike father. It was on this occasion that he adopted the motto *Ich dien* (I serve), used by all succeeding Princes of Wales. In 1355 he commanded the army which invaded France from Gascony, and distinguished himself the following year at the great battle of Poitiers. By the Peace of Brétigny the provinces of Poictou, Saintonge, Périgord, and Limousin were annexed to Guienne and formed into a sovereignty for the prince under the title of the Principality of Aquitaine. A campaign in Castile, on behalf of Pedro the Cruel, and the heavy taxes laid on Aquitaine to meet the expenses, caused a rebellion, and ultimately involved him in a war with the French king. His own health did not allow him to take the field, and having seen his generals defeated he withdrew into England, and after lingering some time died (1376), leaving an only son, afterwards Richard II.

EDWARD I (of the Norman line), King of England, son of Henry III, was born at Winchester in 1239, died 7th July, 1307. The contests between his father and the barons called him early into active life, and he finally quelled all resistance to the royal authority by the decisive defeat of Leicester at the battle of Evesham, in 1265. He then proceeded to Palestine, where he showed signal proofs of valour, although no conquest of any importance was achieved. His father's death in 1272 gave him the crown. On his return home he showed great vigour as well as a degree of severity in his administration. He commenced a war with Llewellyn, Prince of Wales, which ended in the annexation of that Principality to the English Crown in 1283. Edward's ambition was to gain possession of Scotland, but the death of Margaret, the Maid of Norway, who was to have been married to Edward's son, for a time frustrated the king's designs.

But on 26th Dec., 1292, John Baliol was induced to do homage for his crown to Edward at Newcastle. Baliol was forced by the indignation of the Scottish people into war with England. Edward entered Scotland in 1296, devastated it with fire and sword, and placed the administration of the country in the hands of officers of his own. Next summer a new rising took place under William Wallace. Wallace's successes recalled Edward to Scotland with an army of 100,000 men. Wallace was at length betrayed into his hands and executed as a traitor. All Edward's efforts, however, to reduce the country to obedience were unavailing, and with the flight of Robert Bruce, Earl of Carrick, to Scotland, the banner of Scottish independence was again unfurled. Edward assembled another army and marched against Bruce, but only lived to reach Burgh-on-Sands, a village near Carlisle, where he died. Edward I was wise in council and vigorous in action. During his reign

great progress was made in the establishment of law and order throughout the land.

EDWARD II, King of England, born at Carnarvon Castle in 1284, and the first English Prince of Wales, succeeded his father, Edward I, in 1307. He was of an agreeable figure and mild disposition, but indolent and fond of pleasure. After marching as far as Cumnock, in Ayrshire, with the army collected by his father, he returned, dismissed his troops, and abandoned himself entirely to amusements. His weakness for a clever but dissolute young Gascon, Piers Gaveston, on whom he heaped honours, without limit, roused the nobles to rebellion. Gaveston was captured in Scarborough Castle, and executed as a public enemy on 19th June, 1312.

Two years after this, Edward assembled an immense army to check the progress of Robert Bruce, but was completely defeated at Bannockburn. In 1322 he made another expedition against Scotland, but without achieving anything important. The king's fondness for another favourite, Hugh le Despenser, had made a number of malcontents, and Queen Isabella, making a visit to France, entered into a correspondence with the exiles there, and formed an association of all hostile to the king. Aided by a force from the Count of Hainault, she landed in Suffolk in 1326. Her army was completely successful. The Despensers, father and son, were captured and executed, and the king was taken prisoner and confined in Kenilworth, and ultimately in Berkeley Castle, where he was murdered 21st Sept., 1327.

EDWARD III, King of England, son of Edward II by Isabella of France, was born in 1312, died 21st June, 1377. On his father's deposition in 1327 he was proclaimed king under a council of regency, while his mother's lover, Mortimer, really possessed the principal power in the State. The pride and oppression of Mortimer led to a general confederacy against him, and to his seizure and execution (10th Oct., 1330). Edward now turned his attention to Scotland, and, having levied a well-appointed army, defeated the regent, Douglas, at Halidon Hill, in July, 1333. This victory produced the restoration of Edward Baliol, who was, however, again expelled, and again restored, until the ambition of the English king was diverted by the prospect of succeeding to the throne of France. Collecting an army and accompanied by the Black Prince, he crossed over to France. The memorable battle of Crécy followed, 25th Aug., 1346, which was succeeded by the siege of Calais. In the meantime David II, having recovered the throne of Scotland, invaded England with a large army, but was defeated and taken prisoner by a much inferior force under Lord Percy.

In 1348 a truce was concluded with France; but on the death of King Philip, in 1350, Edward again invaded France, plundering and devastating. Recalled home by a Scottish inroad, he retaliated by carrying fire and sword from Berwick to Edinburgh. In the meantime the Black Prince had penetrated from Guienne to the heart of France, fought the famous battle of Poitiers, and taken King John prisoner. A truce was then made, at the expiration of which (1359) Edward again crossed over to France and laid waste the provinces of Picardy and Champagne, but at length consented to a peace. This confirmed him in the possession of several provinces and districts of France which were entrusted to the Prince of Wales (the Black Prince), but gradually all the English possessions in France, with the exception of Bordeaux, Bayonne and Calais, were lost.

EDWARD IV, King of England, was born in 1442, died in April, 1483. His father, Richard, Duke of York, was grandson of Edmund, Earl of Cambridge and Duke of York, fourth son of Edward III, while the rival line of Lancaster descended from John of Gaunt, the third son. The York line had intermarried with the female descendants of Lionel, the second son, which gave it the preferable right to the Crown. Edward, on the defeat and death of his father at the battle of Wakefield, assumed his title and, having entered London after his splendid victory over the troops of Henry VI and Queen Margaret at Mortimer's Cross in Feb. 1461, was declared king by acclamation. The victory of Towton, soon after his accession, confirmed his title, and three years after this, on 4th May, 1464, the battle of Hexham completely overthrew the party of Henry VI.

The king now made an imprudent marriage with Elizabeth, widow of Sir John Grey, at the very time when he had dispatched the Earl of Warwick to negotiate a marriage for him with the sister of the French king. He thus alienated powerful friends, and Warwick, passing over to the Lancastrian cause, gathered a large army and compelled Edward to fly (in Sept. 1470). Henry's title was once more recognized by Parliament. But in 1471 Edward, at the head of a small force given him by the Duke of

Burgundy, landed at Ravenspur in Yorkshire, and his army, being quickly increased by partisans, marched swiftly on London and took the unfortunate Henry prisoner. Warwick now advanced with an army to Barnet, where a battle was fought, 4th April, 1471, which ended in the death of Warwick and a decisive victory for Edward. Shortly afterwards Edward also met and defeated a Lancastrian army, headed by Queen Margaret and her son Edward, at Tewkesbury. The prince was murdered, and the queen was thrown into the Tower, where Henry VI soon after died. Edward was preparing for an expedition against France when he died.

EDWARD V, King of England, the eldest son of Edward IV, was in his thirteenth year when he succeeded his father in 1483. His uncle, the Duke of Gloucester, soon made himself king as Richard III, and caused the young king and his brother to be sent to the Tower, where he had them smothered by ruffians.

EDWARD VI, King of England, son of Henry VIII by Jane Seymour, was born in 1537, died in July, 1553. At his father's death he was only nine years of age. His education was entrusted to men of the first character for learning, under whose training he made great progress, and grew up with a rooted zeal for the doctrines of the Reformation. His reign was, on the whole, tumultuous and unsettled. In Oct., 1551, the Protector Somerset, who had hitherto governed the kingdom with energy and ability, was deposed by the intrigues of Dudley, Duke of Northumberland, who became all-powerful. He induced the dying Edward to set aside the succession of his sisters, Mary and Elizabeth, and settle the crown upon Lady Jane Grey, to whom he had married his son Lord Guildford Dudley. Edward VI restored many of the grammar schools suppressed by Henry VIII, and these schools are still known as King Edward's schools.

EDWARD VII, King of Great Britain and Ireland and Emperor of India, eldest son of Queen Victoria and the Prince Consort, was born at Buckingham Palace on 9th Nov., 1841, died 6th May, 1919. In Dec., 1841, he was created Prince of Wales. He was educated under private tutors and at Edinburgh, Oxford and Cambridge; visited Canada and the United States in 1860; and underwent military training at the Curragh camp in 1861. Promoted to the rank of general in 1862, he visited Palestine and the East, and next year took his seat in the House of Lords. On 10th March, 1863, he was married in St. George's Chapel, Windsor Castle, to Princess Alexandra, eldest daughter of Christian IX of Denmark, and from this time onwards he discharged many public ceremonial functions.

Attacked by typhoid fever in the winter of 1871, his life was for a time despaired of, but he recovered early in 1872, his recovery being made the occasion of a thanksgiving service in St. Paul's Cathedral. During 1875 and 1876 he visited India. He was a member of the Poor Law Commission of 1893. He promoted the establishment of the Imperial Institute as a memorial of Queen Victoria's jubilee (1887), and he commemorated her diamond jubilee (1897) by founding the Prince of Wales's (now King's) Hospital Fund for the better financial support of the London hospitals.

On the death of Queen Victoria on 22nd Jan., 1901, he succeeded to the throne, and was crowned on 9th Aug., 1902. King Edward did much to promote friendly relations with foreign powers, especially with France and the United States. It was through his personal influence that the Entente Cordiale with France was brought about. To him and Queen Alexandra were born: Albert Victor Christian Edward, Duke of Clarence and Avondale, born 1864, died 1892; George Frederick Ernest Albert, who succeeded his father as George V, born 1865, married 1893, to Princess Victoria Mary of Teck; Princess Louise, now Princess Royal, born 1867, married 1889, to the Duke of Fife, who died 29th Jan., 1912; Princess Victoria, born 1868; and Princess Maud, born 1869, married 1896, to Prince Charles of Denmark, now King of Norway as Haakon VII.

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EDWARD, Thomas, a Scottish naturalist, born 1814, died 1886. The son of poor parents, he was apprenticed to a shoemaker, and worked at his trade till nearly the end of his life, but succeeded in acquiring much knowledge of natural history and some fame as a naturalist. An interesting biography of Edward (*Life of a Scottish Naturalist*), written by Samuel Smiles, appeared in 1876, and a pension of £50 a year was shortly afterwards conferred on him by Queen Victoria.

EDWARDS, Alfred George, Welsh prelate, born Nov. 2, 1848, he went to Jesus College, Oxford, and was

ordained. In 1873 he was chosen headmaster of Llandovery College; in 1882 Vicar of Carmarthen; and in 1889 Bishop of St. Asaph. He took a leading part in the campaign against the disestablishment of the Church in Wales, and when it was effected was chosen the first archbishop under the new conditions.

EDWARDS, Amelia Blandford, English novelist and Egyptologist, born in London in 1831, died in 1892. She gave early evidence of great literary ability by her contributions to periodicals, and attracted attention by her novel *My Brother's Wife* (1855). Among her best-known novels are; *Hand and Glove* (1859), *Barbara's History* (1864), *Half a Million of Money* (1865), *Debenham's Vow* (1870), and *Lord Brackenbury* (1880). Miss Edwards also wrote ballads and books of travel, and in 1882 founded the Egypt Exploration Fund and devoted herself to Egyptology, leaving funds to found a chair of Egyptology in University College, London.

EDWARDS, Bryan, English writer, born in Wiltshire in 1743, died in 1800. He inherited a large fortune from an uncle in Jamaica, where he long resided. His *History, Civil and Commercial, of the British Colonies in the West Indies* appeared in 1793.

EDWARDS, John Passmore, British philanthropist and journalist, born at Blackwater, Cornwall, in March, 1823, died on 22nd April, 1911. Trained as a journalist, he became representative of the paper *The Sentinel*, and was opposed to the Corn Laws. In 1862 he bought *The Building News*, and in 1876 the London *Echo*, of which he was director for twenty years. Although somewhat unpopular on account of his opposition to the Boer War, he is remembered as a public benefactor, having founded numerous Passmore Edwards institutions, public libraries, and settlements, and contributed largely to hospitals. He was a delegate to the peace congresses at Brussels, Paris, and Frankfort (1848–50), and twice refused a knighthood.

EDWARDS, Jonathan, American theologian and metaphysician, born 5th Oct., 1703, died 22nd March, 1758. He entered Yale College in 1716, and studied till 1722, when he received a licence as preacher. In 1723 he was elected a tutor in Yale College, but resigned in 1726 to be ordained as minister at Northampton (Mass.). After more than twenty-three years of zealous service here, he was dismissed by the congregation owing to the severity with which he sought to exercise church discipline. He then went as a missionary among the Indians at Stockbridge, in Massachusetts. Here he composed his famous work on the *Freedom of the Will*, which appeared in 1754. In 1757 he was chosen president of the college at Princeton, New Jersey, but died shortly afterwards.

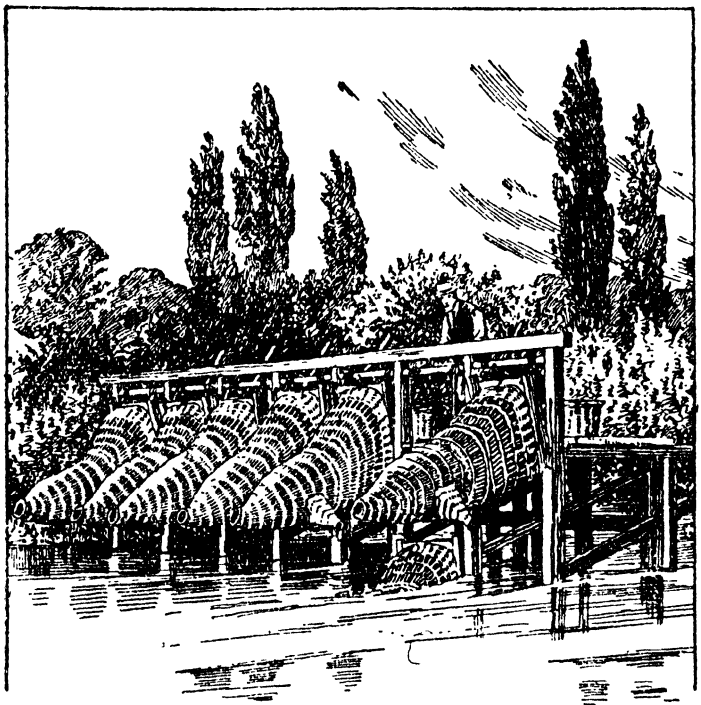
EDWIN, King of Northumbria. A son of Ella, King of Deira, he was born about 585 and became king in succession to his father. Driven out by the King of Bernicia, in 617 he returned, killed his foe in battle, and united Bernicia and Deira into the Kingdom of Northumbria. He married Ethelburga, daughter of the King of Kent, and in 627, under her influence and that of Paulinus, became a convert to Christianity. He was killed in battle at Hatfield Chase, Yorkshire, Oct. 12, 633, when fighting an army led by Penda, King of Mercia. Edinburgh was founded by and named after him.

EDWY, King of England, son of Edmund I, succeeded his uncle Edred in 955. Taking part with the secular clergy against the monks, he incurred the confirmed enmity of the latter. The Papal party, headed by Dunstan, was strong enough to excite a rebellion, by which Edwy was driven from the throne to make way for his brother Edgar. He died in 959, being probably not more than eighteen or nineteen years old.

EECLOO (āk-lō′), a town, Belgium, province of East Flanders, 11 miles north-west of Ghent, the seat of textile manufactures. Pop. 14,672.

EEL, the popular name of fishes belonging to the teleostean sub-order Apodes. The common eel (*Anguilla vulgaris*) is the type of a special family (Anguillidæ) and has a very wide distribution in the fresh waters of the globe. It is snake-shaped, devoid of ventral fins, and the minute scales are embedded in the slimy skin. When five to twelve years old it crosses the Atlantic to breed in an area near Bermuda, and then dies. Curious flattened larvæ (Leptocephalus) hatch out from the floating eggs, and undergo a metamorphosis to become young eels or elvers which, when a year old, ascend rivers in vast numbers as 'eel fare.' Eels are esteemed as an article of food, and even elvers are compressed into a sort of cake. In England river eels are caught in great numbers by means of eel-bucks or eel-pots, traps consisting of a kind of basket with a funnel-shaped entrance composed of willow rods converging towards a point, so that the eels can easily force their way in but cannot return. A stocking or tube of coarse cloth hanging from an aperture of a box down into the interior is also used.

In England a kind of trident called an **eel-spear** is used also for taking them. A fisherman wades to the shallows, and, as he strikes his spear in the mud in every direction around him, the eels reposing on the bottom are caught between the prongs. They are also taken by hooks and lines and in other ways. *See* CONGER-EEL; MURŒNA. Electric eels belong to another group. *See* ELECTRICAL FISHES.



Eel-bucks on the Thames

EEL GRASS, popular name of two diverse genera of aquatic herbs. *Zostera marina*, usually called eel grass in the U.S.A., grows on gently sloping shores in temperate regions. It serves as a non-conductor wrapped in burlap, in artificial refrigeration.

Valisneria spiralis, or water celery, grows in the warmer parts of both hemispheres. It is a short-stemmed plant, often cultivated in aquaria. Its thread-like flower-stalks, coiling spirally, draw the flowers under water to mature the fruit. The canvas-back duck and the terrapin eat it.

EEL PIE ISLAND, small island in the Thames opposite Twickenham. It is a popular resort for picnic and boating parties, and an angling centre.

EFFEN'DI, a Turkish title which signifies lord or master. It is particularly applied to the civil, as *aga* is to the military officers of the Sultan. Thus the Sultan's first physician is called *Hakim effendi*, and the priest in the seraglio *Imam effendi*.

EFFERVES'CENCE, the rapid escape of a gas from a liquid, producing a turbulent motion in it, and causing it to boil up. It is produced by the actual formation of a gas in the liquid, as in fermentation, or by the liberation of a gas which has been forced into it, as in aerated beverages.

EFFICIENCY, in mechanics and

engineering, the ratio of the useful energy given out by a machine to the energy supplied to it. Energy cannot be created or destroyed, but it may assume various forms and, within limits, can be changed from any one of these forms to any other. A machine or engine is an apparatus for converting energy in some given form into energy in another assigned form. In practice it is found impossible to convert the whole of the given energy into the form wanted, there being always a residue which is not of the right kind, and is, therefore, counted as useless. The smaller the residue the more efficient is the machine.

In the machines of elementary mechanics, such as the lever or the screw, the energy supplied is work done by the power or effort, and the energy wanted is work done on the load. If E is the effort, and W the load, then if there were no friction we would have $E = Wr$, where r is the velocity ratio, or ratio of the velocities of the points of application of load and effort. The relation found by experiment, however, is usually of the type $E = Wr + C$, where C is a constant. The efficiency is the fraction Wr/E or $1 - C/E$, so that it increases with the load. In *heat engines*, energy in the form of heat is converted into mechanical energy. Heat is taken in at the source, part of it is changed into mechanical energy, and the remainder is rejected to the condenser. According to the second law of thermodynamics, the efficiency of such an engine has a definite upper limit which it cannot exceed, this being the ratio of the difference of the temperatures of the source and the condenser to the temperature of the source, these temperatures being measured on the absolute scale, that is, from $-273°$ C. reckoned as the zero. The efficiency of a steam-engine is usually compared with that of an ideal engine working between the same temperatures and going through a definite periodic set of operations called the Rankine cycle. If the thermal efficiency of an actual engine is 27 per cent, and that of an ideal engine working on the Rankine cycle is 30 per cent, obviously the important figure is the ratio of 27 to 30, or 90 per cent.

The performance of a steam-engine depends, not only on its *thermal efficiency*, but also on its *boiler efficiency* and its *mechanical efficiency*. The boiler efficiency is the percentage of the heat obtainable from the fuel consumed which is actually used in the engine; in a good boiler it may be 75 per cent. The mechanical efficiency is the ratio of the work given out at the crankshaft to the work done on the piston; in other words, it is the ratio of brake horse-power to indicated horse-power. It may perhaps be 80 per cent. To arrive at the over-all efficiency, the various partial or component efficiencies must be multiplied together. In comparing one type of engine with another, what is important is obviously this over-all efficiency, or ratio of energy output to the theoretical energy value of the fuel employed.

Thus, to take the case of marine engines, the Diesel oil-engine is inferior to the turbine and to the reciprocator in point both of thermal and of mechanical efficiency. But when the efficiency of the boilers is taken into account, the Diesel comes out very decidedly ahead of the others. Taking coal at 10,000 British thermal units per pound, and Diesel oil at 18,000 British thermal units per pound, Mr. T. R. Wollaston has given the following figures for the number of British thermal units consumed per brake horse-power hour: steam-engine 19,000; steam turbine 21,000; gas-engine; 15,000; Diesel engine 9,000. Electrical plant in general reaches a high standard of efficiency. Some figures are: transmission lines 85 to 95 per cent; motors and generators at full load 70 to 80 per cent from 1 to 5 h.p., 80 to 90 per cent from 5 to 50 h.p., and 95 per cent for large sizes. Electrical transformers are the most efficient of all machines. Their efficiency ranges from about 90 per cent in small sizes, up to perhaps 98·5 per cent for large machines at full load. *See* ENERGY; INTERNAL-COMBUSTION ENGINES; STEAM-ENGINES; THERMODYNAMICS.

EFFIGY, figure or likeness. The term is used chiefly for the head of a sovereign or other person on a coin. It is also applied to the figures sculptured on tombs. Another effigy is the figure of a detested person made in order to be burned, *e.g.* Guy Fawkes.

EFFLORES'CENCE, the property which certain hydrated salts have of losing water when exposed to air. Thus washing-soda, Na_2CO_3, $10H_2O$, if left in air becomes opaque, loses its crystalline appearance, and finally falls to a powder by loss of water. The term is also applied in botany to the process of flowering.

EFFLUENTS, a general term applying to liquids, on being discharged, after undergoing some form of treatment. The term is more particularly applied to the purified liquid discharged into rivers and streams from sewage-works, the crude sewage having been freed of the grosser solids, and ren-

dered clear and innocuous to animal and vegetable life.

EFFODIEN'TIA, the name proposed for a new order of mammals to include pangolins and aard-varks. *See* EDENTATA.

EFFUSION, a pouring forth. The term is used in pathology for an escape of a fluid into the tissues or cavities of the body, as seen in wet pleurisy. Effusion also results from inflammation and occurs in dropsy.

ÉGALITÉ, Philippe. *See* ORLEANS, LOUIS PHILIPPE JOSEPH.

EGBERT, considered the first king of all England, was of the royal family of Wessex. He succeeded Brihtric in 802 as King of Wessex. He reduced the other kingdoms and rendered them dependent on him in 829, thus becoming their overlord. He died in 839.

EGEDE, Hans (ā'ge-dā), the apostle of Greenland, born in 1686 in Norway, died in 1758. In 1721 Egede set sail for Greenland with the intention of converting the natives to Christianity, and for fifteen years performed the most arduous duties as missionary, winning by his persevering kindness the confidence of the natives. In 1736 he returned to Copenhagen, where he was made a bishop and director of the Greenland Missions.

EGER (ā'gėr), now **CHEB,** a town of Bohemia, Czechoslovakia, on a rocky eminence above the Eger, 91 miles west of Prague; once an important fortress, now dismantled. It has manufactures of woollens, cottons, leather, and soap. Wallenstein was assassinated there (1634). Pop. 31,549.

EGE'RIA, a nymph who received divine honours among the Romans. Numa is said to have received from her the laws which he gave to the Romans.

EGERSUND (ā'gėr-sund), a seaport on the south-west coast of Norway, some distance south of Stavanger, and connected with it by railway, has a large pottery-work, fishing and shipping trade. Pop. 3,500.

EGERTON, Francis. *See* BRIDGEWATER, DUKE OF.

EGG (1) in the narrower sense, the female reproductive or germ-cell, which after impregnation or fertilization by a male germ-cell (spermatozoon or sperm) develops into an embryo. (*See* OVUM.) (2) The term is applied, more broadly, to a more complicated reproductive body that consists of an ovum together with supplementary parts. The egg of a bird, for example, includes the fertilized and developing ovum (yolk), nutritive white (albumen), and protective double egg membrane covered by a porous calcareous shell. The eggs of animals lower than the birds have usually only three parts, viz. the germinal spot or dot, the germinal vesicle, and the vitellus or yolk; the first being contained in the vesicle, and that again in the yolk.

The common domestic fowl, the turkey, the pea-hen and the common duck produce the eggs which are commonest in the market. The eggs of the green plover (*Vanellus cristatus*) are esteemed as a delicacy. The hard roes of fishes are the ovaries, containing innumerable eggs (over nine millions in the cod). The salted hard roes of the sturgeon are known as caviare. A hen's egg of good size weighs about 1,000 grains, of which the white constitutes 600, the yolk 300, and the shell 100. When the white of an egg is warmed it coagulates to a firm opaque mass. Eggs form an important article in British commerce; the number imported in 1931 amounted to 3,111,024,120, mainly from Russia, Denmark, Austria, France and Italy.

EGG, an island of Scotland. *See* EIGG.

EGGA, a town of N. Nigeria, on the right bank of the Niger, about 70 miles above the junction of the Binue. Pop. 10,000.

EGGAR, or EGGER, a name given to moths of the family Lasiocampidæ. *Lasiocampa trifolii,* a well-known British moth is called the grass-egger, and the *L. quercus* the oak-egger, from the food of their caterpillars.

EGG-BIRD, or SOOTY TERN (*Sterna fuliginosa*), a bird of considerable commercial importance in the West Indies, as its eggs, in common with those of two other species of tern, form an object of profitable adventure to the crews of numerous small vessels.

EGGLESTON, Edward, American novelist and miscellaneous writer, born in 1837, died in 1902. He entered the ministry of the Methodist Church, was engaged in pastoral work for some years, afterwards as pastor of an independent church founded by himself. He wrote and edited much, among his books being: *The Hoosier Schoolmaster* (1871), which first appeared in *Hearth and Home*; *The End of the World: A Love Story; Roxy,* a highly popular novel (1878); *The Hoosier Schoolboy*; *The Graysons; Household History of the United States; The Faith Doctor.* His novels are marked by abundance of incident,

skilful handling of dialect, and realistic portraiture.

EGGLESTONE, village of Yorkshire (N.R.). It stands on the Tees, a mile from Barnard Castle. The beautiful cruciform church was once part of Egglestone (or Eglistone) Abbey. Near is Rokeby Hall.

EGG-PLANT, or **BRINJAL** (*Solānum melongēna*), nat. ord. Solanaceæ, an herbaceous plant, from 1 foot to 18 inches high, with large white or purplish flowers. The fruit is about the size of a goose's egg, and generally



Eglantine

yellow, white, or violet, and when boiled or stewed is used as an article of food. It is cultivated in India, the United States, &c., and in European hothouses. There are several other species of egg-plants, as *S. indicum* and *S. sodomeum*.

EGHAM, an urban district of England, county of Surrey, on the Thames opposite Staines, 18¼ miles from London, with the Royal Holloway College for women, and the Holloway Sanatorium. Near it is Runnymede, where King John signed Magna Charta. Pop. (1931), 15,195.

EGIL SKALLAGRIM, an Icelandic bard or poet of the tenth century, who distinguished himself by his warlike exploits in predatory invasions of Scotland and Northumberland. Having fallen into the hands of a hostile Norwegian prince, he procured his freedom by the composition and recitation of a poem called *Egil's Ransom*, which is still extant.

EGINHARD, or **EINHARD,** friend and biographer of Charles the Great (Charlemagne), born in Maingau (East Franconia) about 770, died in 840. He was educated in the monastery at Fulda, and his capacity attracted the attention of Charles, who made him superintendent of public buildings, and of whom he became the constant companion. He also enjoyed the favour of his son Louis the Pious. His later years were passed at Mühlheim-on-the-Main, where he founded a monastery. His *Vita Caroli Magni* is a work of great value, and his letters are also important.

EG'LANTINE, one of the names of the sweet-brier (*Rosa rubiginosa*), a kind of wild rose. The name has sometimes been erroneously used for other species of the rose and for the honeysuckle.

EGLINTON, village of Ayrshire. It is 2 miles from Irvine and gives the title of earl to the family of Montgomerie. In 1508 Hugh Montgomerie was made Earl of Eglinton and the title has been since held by his descendants. Archibald, the 13th earl, was made Earl of Winton, and the present earl holds the double title. The earl's eldest son is called Lord Montgomerie. Eglinton Castle, the family seat, was built about 1800.

EG'MONT, Lamoral, Count, Prince of Gavre, was born in 1522, of an illustrious family of Holland. He adopted a military career, accompanied Charles V in his African expeditions, and distinguished himself under Philip II in the battles of St. Quentin (1557) and Gravelines (1558). Philip having gone to Spain, Egmont soon became involved in the political and religious disputes which arose between the Netherlands and their Spanish rulers. He tried to adjust the difficulties between both parties, and in 1565 went to Spain to arrange matters with Philip. He was well received, sent back with honour, but quite deceived as to the king's real intentions. In 1567 the Duke of Alva was sent with an army to the Netherlands to reduce the insurgents. One of his first measures was to seize Count Egmont and Count Horn. After a trial before a tribunal instituted by Alva himself they were

executed at Brussels 5th June, 1568. A well-known drama of Goethe's is founded on the story of Egmont.

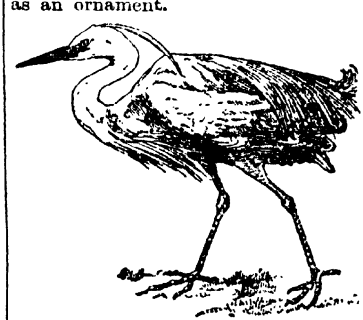
EGMONT, Earl of, Irish title held by the family of Perceval. It was given in 1733 to Sir John Perceval, Bart. (1683–1748), an M.P. and one of the founders of the colony of Georgia. John, the 2nd earl (1711–70) was First Lord of the Admiralty, 1761–66, and was the father of Spencer Perceval, the Prime Minister. Frederick, who was born in 1873, lived for years as a rancher in Canada, until he succeeded as 10th earl in 1929. He died from the effects of a motor accident on May 16, 1932, leaving an only son. The family seat is Avon Court, Ringwood; formerly it was Cowdray Park, Midhurst. Egmont is a village in Co. Cork, Irish Free State.

E'GOISM, as a philosophical doctrine, the view that the elements of all knowledge and the reality of the things known are dependent on the personal existence of the knower. This theory is also called Subjective Idealism or Solipsism. It maintains that his individual ego is the only being that a man can logically assert to exist. As an ethical theory (practical egoism) it is the opposite of altruism. It maintains that the governing principle of conduct for the individual is his own good on the whole, and that self-interest is the basis of morality. Egoism is to be distinguished from egotism, which denotes the practice of putting forward or dwelling upon oneself, of thinking, talking, or writing about oneself.

EGREMONT, town of Cheshire. A residential suburb of Liverpool and Birkenhead, it stands on the Mersey, 2 miles from Birkenhead, with which it is connected by railway. Steamers go regularly across the Mersey to Liverpool, and there is a promenade to New Brighton.

EGREMONT, a town of England, in Cumberland, in the valley of the Ehen, 3 miles from the sea, giving name to a parliamentary division. It has ruins of an ancient (twelfth century) castle associated with a legend that served Wordsworth as the subject of a poem. Iron-ore and limestone are worked. Pop. (1931), 6,015.

EG'RET, a name given to those species of white herons which have the feathers of the lower part of the back elongated and their webs disunited, reaching to the tail or beyond it at certain seasons of the year. Their forms are more graceful than those of common herons. The American egret (*Ardĭa egretta*) is about 37 inches long to the end of the tail; plumage soft and blended; head not crested; wings moderate; the tail short, of twelve weak feathers. The European egret (*A. alba*) is about 40 inches long, of a pure white plumage; the bill is black or dark brown, yellow at the base and about the nostrils, and the legs are almost black. The little egret (*A. garzetta*) is about 22 inches long from bill to end of tail, the plumage is white. The term egret is used in the feather trade for a bunch of the loose plumes, valued as an ornament.



Little Egret

EGYPT, a kingdom in North-East Africa, bounded by the Mediterranean Sea, Italian Libya, the Anglo-Egyptian Sudan, the Red Sea, and a line from Rafa to the head of the Gulf of 'Aqaba. In 1925 the boundary with Cyrenaica was adjusted. The total area, including the Libyan Desert and the Sinai Peninsula, is 383,000 sq. miles, but of this the settled area (the Nile Valley and Delta) is only 13,600 sq. miles. Upper Egypt, stretching from Halfa to Beni Suef, is an undulating plateau rising in the west to a height of 2000 feet, while Lower Egypt (the Delta lands) is a fertile plain. The peninsula of Sinai, bounded on the west by the Suez Canal (q.v.), is mountainous. There are numerous oases (Siwa, Bahariya, Farafra, Dakhla, Kharga, &c.) much used by caravans. The destinies of Egypt are ruled by the Nile (q.v.), the basin of which is extremely fertile. By means of canals and reservoir works (at Aswân, Nag' Hammâdi, Esna, Asyut, and Zifta) large areas are irrigated. The construction of a new barrage at Nag' Hammâdi was completed in 1930. The capacity of the Aswân reservoir will be further increased in 1933, by the raising of the dam level.

Crops. The total cultivable area in 1930 was estimated at 8,239,185 feddâns (1 feddan = 1·038 acre). In

1932 the principal crops and the areas devoted to them were:

Crop.	Area in Feddâns.
Maize ..	2,113,397
Cotton ..	1,682,938
Wheat ..	1,588,985
Beans ..	423,586
Millet ..	329,651
Barley ..	294,573
Lentils ..	82,081
Sugar-cane ..	65,298

Rice and onions are also grown. Sugar, cotton and rice are cultivated from March to October, and cereals from November to May.

Minerals. The chief mineral products are petroleum from the coasts and islands of the Red Sea (1931 output, 289,419 M. tons), phosphates from the Red Sea coasts and Upper Egypt, 257,011 M. tons), manganese ore from Sinai, 101,781 M. tons), ochre from Aswân, and gold and jewels from the deserts.

Manufactures. The chief manufactures are connected with cotton, but cigarette-making and sugar-refining are also important. There is a Government oil-refinery at Suez, and other industries are the making of railway rolling stock (Cairo), attar of roses (Faiyum), soap, and pottery. The natives weave rugs and make ornamental wares in their own homes. The value of exports in 1931 was £E28,073,630, and of imports £E31,528,167. The chief articles of export in 1930 were raw cotton (£E19,688,069), cereals, &c. (£E4,143,098), oils (£E883,699), animal food products (£E351,101), and tobacco (£E312,279). British exports to and imports from Egypt in 1932 were respectively £6,513,000 and £10,406,000.

Money and Measures. The monetary unit of Egypt is the gold Egyptian pound (£E) of 100 *piastres*, valued at £1 0*s.* 6½*d.* sterling. There are gold, silver, nickel, and bronze coins in circulation, and British sovereigns are legal tender (value, 97½ piastres). The chief measure of capacity is the *ardeb* (43·555 gallons), while the weights are the *roll* (·9905 lb.) and the *oke* (2·75 lb.). The unit of length is the *diraa* (22·8 inches), and the unit measure for land is the *feddân* (1·038 acres).

Ports and Population. The capital of Egypt is Cairo, ports are Alexandria, Port Said, Port Fuad, and Suez, and other important places are Tanta, Damanhur, Mansura, Damietta, Aswân, Faiyum, Beni Suef, Asyut, and Zagazig. The population of Egypt was in 1927, 14,217,864, of this number 12,929,260 are Moslems, 999,170 are Orthodox, and 66,080 are Protestants.

Education. The chief seats of Koranic learning are at Cairo (the Mosque and University of El Azhar), Tanta, Damietta, and Alexandria. The State University was founded in 1925. There are in Egypt large numbers of native Christians attached to Oriental Churches: of these the Copts are the most important. Education is well advanced, there are numerous elementary vernacular schools (*maktabs*), industrial and commercial schools, technical and special schools, and higher colleges (law, medicine, training of teachers, &c.).

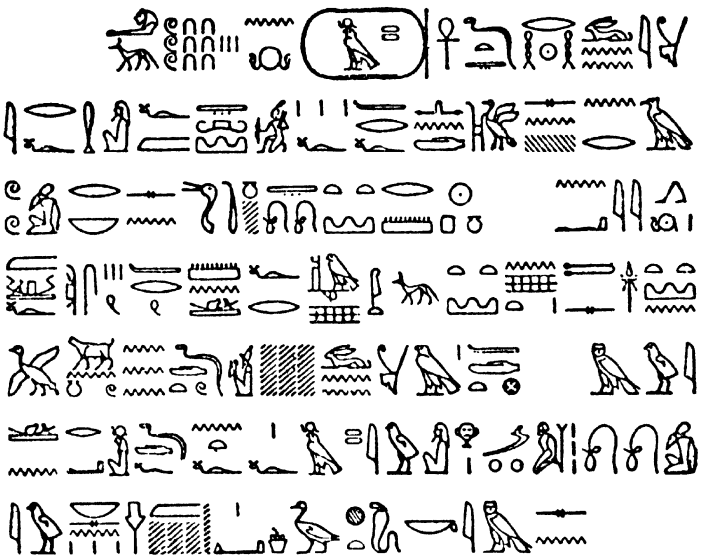
Defence. The army is under British control, and there is also a small British army of occupation. Cairo is the head-quarters of the Middle East Air Command.

Communications. In 1931 there were in Egypt 3,374 miles of State railways (1,165 miles are in Upper Egypt). There are also 874 miles of private railways.

Early Religion and Civilization. In its earliest phases the religion of ancient Egypt reflected the natural phenomena of the Nile Valley in their relation to the needs, experiences and achievements of mankind. The flood was an annual 'miracle of mercy,' and the early people tried to account for it. They concluded it was a gift of the gods. It ensured the food-supply; it brought health and relief from the oppressive heat endured when the sand-wind prevailed and the river was low. The new water was 'the water of life'; it fertilized the parched soil and caused barley and millet (which grew wild in the Delta) to spring up, trees to yield fruit, and curative herbs to appear on the river banks. In the prehistoric period the Nile was identified with Osiris, who, according to the traditions of the Delta people, once reigned as their king, and introduced the agricultural mode of life which made it possible for large and growing communities to dwell in the narrow valley.

In the Pyramid Texts (*c.* 2700 B.C.) Osiris is the controller of the Nile, the principle of life in the Nile, and the Nile itself. In one of his phases the god is the 'Green One'—the Green Nile. A Pyramid Text reads: "Horus comes! He beholds his father in thee, Green One, in thy name of Water of Greenness". The soul-substance (literally 'the seed') of Osiris was the vital principle in the green or new water. Osiris was the serpent-soul in the water, and the serpent (leviathan) of the ocean which 'encircled the netherworld.' The god is

addressed in a Pyramid Text: "Thou art great, thou art green in thy name of Great Green" (Mediterranean Sea). Osiris was slain by Set, and his life-blood was the Red Nile, which entered the soil and vegetation. Osiris was not regarded as the Green One because vegetation is green; the ancient Egyptians appear to have attributed the greenness of vegetation to the Green Nile, the soul-substance of



Part of the Hieroglyphic Legend of Heru-Behutet and the Winged Disk, cut on the Walls of the Temple of Edfû in Upper Egypt

Translation: In the three hundred and sixty-third year of Rā-Heru-Khuti, who liveth for ever and ever His Majesty was in TA-KENS, and his soldiers were with him; (the enemy) did not conspire (auu) against their lord, and the land (is called) UAUATET unto this day. And Rā set out on an expedition in his boat, and his followers were with him, and he arrived at UTHES-HERU, (which lay to) the west of this nome, and to the east of the canal PAKHENNU, which is called (. . . to this day). And Heru-Behutet was in the boat of Rā, and he said unto his father Rā-Heru-Khuti (i.e. Rā-Harmachis), "I see that the enemies are conspiring against their lord; let thy fiery serpent gain the mastery . . . over them.—Reproduced by permission from Vol. XXXII of *Books on Egypt and Chaldæa*, by Sir E. A. Wallis Budge

Osiris. The sap of shrubs and trees was 'Blood'—the blood of the god. Osiris continued to live after death. On earth he was in barley, fruit, &c., and in the fertilized soil. He was in the other world Judge and King of the Dead. In his underworld Paradise the souls of the dead grew corn and cultivated fruit-trees—the 'food of life'.

The Osirian cult had origin in the Delta of Lower Egypt. In Upper Egypt a solar cult exalted Horus, the falcon god, as chief deity. Their heaven was beyond the sky 'to the east'. In the Pyramid Texts there is clear evidence that the solar cult believed the souls of the dead went eastward, while the Osirian cult believed they went westward. Osiris was called 'First of the Westerners'. The 'Easterners' of the south (Upper Egypt) conquered the 'Westerners' of the north (Lower Egypt), and Egypt was united into a single kingdom by the traditional King Mena, with whom begins the dynastic history of Egypt.

This conquest appears to have been due to the introduction of copper weapons.

The idea that the Horites were invaders from Arabia or Mesopotamia has been abandoned. Copper was anciently found in the wadis of Upper Egypt and on the shores of the Red Sea. After boat-building and navigation were well advanced copper was mined in Sinai. According to Egyptian evidence, Edfu was the centre of the early copper industry and of the Horus cult. As Egyptian copper is naturally hard, it required no amalgam. Egypt, therefore, never had a

Bronze Age, nor had it a Neolithic Age. The copper artifacts were imitations of Palæolithic forms of the Solutrian type. After the conquest there occurred fusions of religious cults. Local pantheons reflected local politics. But although the sun-cult of Heliopolis exalted Ra (or Re) as



Painted inner wooden coffin of Pen-Amen-Neb-Nest-Taui, a prophet of the God Amen and the goddess Bast at Thebes

King of the Gods, the belief that all that existed originated in water persisted till the end. The water-mother was Hathor, who gave birth to Osiris. As the Nile was supposed to come from heaven, she was the sky-goddess; her animal was the primeval cow of a pre-dynastic cult, and she was the shell-spirit of water as well—the Egyptian Aphrodite. The shell, pearl, cow, sky, sun, moon, and stars were connected with Hathor as Nut. Ra, the sun-god, was, like Osiris, regarded as her son. Her attributes were in time absorbed by Isis.

At the dawn of the Dynastic Age the religious beliefs of the Egyptian peoples were already well developed, the agricultural mode of life was established in the Nile Valley and in the Delta area, the calendar had been introduced, while copper weapons and implements were in use. The subsequent history of the official religion has a political aspect. Local cults rose into prominence as a city-state or ruling family achieved political ascendancy. Memphite theology and the Memphite god Ptah (the god of artisans) assumed importance when the city of Memphis became the capital of the united kingdom. Heliopolis ('the city of the sun') was the northern centre of the solar cult, which, during the fourth and fifth dynasties (c. 2900–2625 B.C.), became influential enough to impose its theology on the court. The popular Osirian faith was absorbed. Pharaohs were 'Sons of Ra', the sun-god, and Ra supplanted the southern sun-god Horus. Before the Pyramid Age the Osirian and Horite cults had been blended, and Horus became the son of Osiris. Although the living Pharaoh, however, was the son of Ra, he was also a Horus; after death he became an Osiris. The culture-blending process introduced many complexities.

During the twelfth dynasty (2000–1788 B.C.) the name of the Theban god Amon entered into royal names. But the permanent political ascendancy of Amon of Thebes really followed upon the expulsion of the Hyksos military aristocracy about 1580 B.C. By this time the northern sun cult's influence had become sufficiently strong to have Ra blended with the Theban deity who was subsequently known as Amon-Ra. Before the close of the eighteenth dynasty (c. 1350 B.C.) a royal sun cult, promoted by Pharaoh Akhenaton (Amenhotep IV), exalted Aton, the sun-disc, as sole god of Egypt, and the rest of the world. The Amon-Ra cult regained its political ascendancy with the rise of the nineteenth dynasty.

In later times the chief gods of the reigning families were blended forms of Amon, Ra, Ptah, and Osiris. Not only the gods, but the rival Paradises, were blended. Osiris's underworld Paradise was transferred to the mythical other world beyond the horizon, and the sun-barque of the sun-god, which carried the soul of the Pharaoh, was supposed to touch at 'the port of Paradise'. It went westward and passed through the

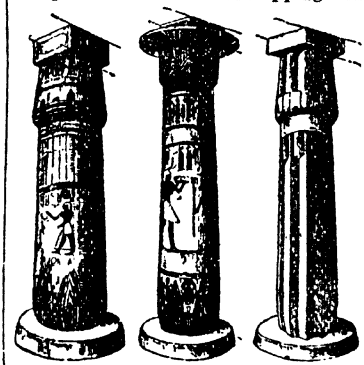
under-world and emerged again next morning at dawn in the east.

The contradictions in the Egyptian religious texts are believed to be mainly due to the blending of beliefs regarding the fate of man which were originally fundamentally different. Local deities were embraced in the official theology, but at their centres remained prominent and influential. But these, too, were in time so strongly influenced by the solar and Osirian faiths that they suffered in no small degree loss of identity except in name. The religious beliefs of Egypt as a whole were never completely systematized. There were no heresies because there were no orthodox beliefs. Any religious cult was tolerated, so long as it acknowledged the supremacy of the god or pantheon of the ruling family. In the later period the cult of Serapis (Asar Hapi), the bull form of Osiris, was popular.

Arts and Crafts.—Art developed in ancient Egypt under religious patronage. The earliest use made of Nubian gold was in manufacturing imitation luck-shells worn by the pre-dynastic peoples. Gold thus acquired a religious significance; at an early period it was associated with the sun-deity—the mother-goddess in her solar aspect was called 'Golden Hathor'. The hieroglyph for gold (*nub*) is a collar of beads. Exquisite gold ornaments in symbolic shapes were produced during the early dynasties. No finer gold ornaments have ever been produced anywhere than those of the twelfth dynasty (*c.* 2000 B.C.). These include chased gold pectoral ornaments and coronets and crowns inlaid with stones. When copper was first introduced it was used like gold.

After implements were made of copper, vases of alabaster, diorite, &c., were worked with increasing skill and taste. The hardest stone was hewn and dressed for building purposes. No people have ever shown greater skill than the Egyptians in their stone-work. The sculptors set themselves, when constructing temples, to imitate in stone the lashed palm-sticks, reeds, and papyrus stems used in the earliest shrines to stiffen the mud walls. Massive temple pillars were decorated with lotus petals, rose petals, &c. The early artists, who carved ivory, began to work in stone after copper implements were invented, and produced low reliefs in temples and tomb-chapels. Statuary in limestone, wood, and copper in the early dynastic period was vigorous and realistic. The sculptors were using the hardest material by the time of the Pyramid Age (*c.* 2700 B.C.). A great tomb-statue of Pharaoh-Khafra, in diorite, preserved in the Cairo Museum, is one of the triumphs of Egyptian sculpture. The Empire-period sculpture reached a high level of excellence. It was to provide 'soul-bodies' for dead Pharaohs that these great works of art were produced.

A great advance in the manufacture of pottery was achieved during the Pyramid Age, when the potter's wheel was invented. To Egypt the ancient world owed this notable contrivance. It was introduced in time into Babylonia, Iran, India, China, Crete, Greece, and Western Europe. Shipbuilding is another Egyptian industry which promoted progress. Cretan and Phœnician vessels were of Egyptian design. In all histories of shipping and navigation the ancient Egyptians are credited with being the pioneers of maritime enterprise. The custom of mummification arose in Egypt, and promoted the study of anatomy. Surgery had its origin in mummification, as astronomy had in astrology, and chemistry had in alchemy. Connected with each temple were architects, artists and sculptors, metal-workers and dyers. Ships were constructed to obtain wood for temples and to import pearls, precious stones, herbs, incense-bearing shrubs and trees, &c., for religious purposes. In the history of early civilization the Egyptian priests play a prominent part as patrons of the arts and crafts.



Types of Columns from Egyptian Temples

History.—In the hot, dry sands of Upper Egypt, which preserve the dead from decay, have been found the bodies of large numbers of pre-dynastic Egyptians. They were of the type known as the 'Mediterranean race'. The contents of their stomachs have yielded husks of barley and millet and fragments of mammalian and fish bones. Circumcision was

EGYPTIAN POTTERY-MAKING
From a wall-painting in the tombs of Beni-Hassan

practised, and some men shaved. These people used malachite as an eyelid paint. When they discovered that copper could be extracted from malachite, it was used at first like gold, as has been stated. The production of copper implements and weapons was followed by the conquest of Lower Egypt by the copper-using Upper Egyptians. After the latter moved north, they found that the bodies of their dead decayed, and the practice of mummification was introduced. Before 3000 B.C. the broad-headed, long-bearded Armenoid type began to filter into Lower Egypt. The blending of Armenoids and Arabians in Syria produced 'the hybrid race of Semites'. In Egypt the ethnic fusion was most marked at the commercial capital, Memphis, and especially during the time of the pyramid builders (*c.* 2900–2750 B.C.).

The spread of 'copper culture,' and the importation into Egypt of timber from Lebanon, apparently brought the ancient races into close contact. Withal, shipbuilding and the art of navigation had advanced by leaps and bounds. Before the Pyramid Age there were sea-traders on the Mediterranean, and the Egyptians imported copper from Sinai across the Red Sea. The legendary Pharaoh who united Upper and Lower Egypt was Mena or Menes. From his time (*c.* 3400 B.C.) till the close of the sixth dynasty (*c.* 2475 B.C.) the capital was Memphis. This period is known as that of the 'Old Kingdom'. Among its outstanding monarchs were Khufu, Khafra, and Menkure of the fourth dynasty, the builders of the largest pyramids. Herodotus refers to them as *Cheops*, *Chephren*, and *Mykerinos*. The 'Middle Kingdom' begins with the rise of Thebes in Upper Egypt as the centre of political power. During this period the nobility became so influential that the Pharaohs had to recognize their rights and privileges.

In the period of the famous twelfth dynasty (*c.* 2000–1788 B.C.) the Theban monarchs established a uniform control of Egypt.

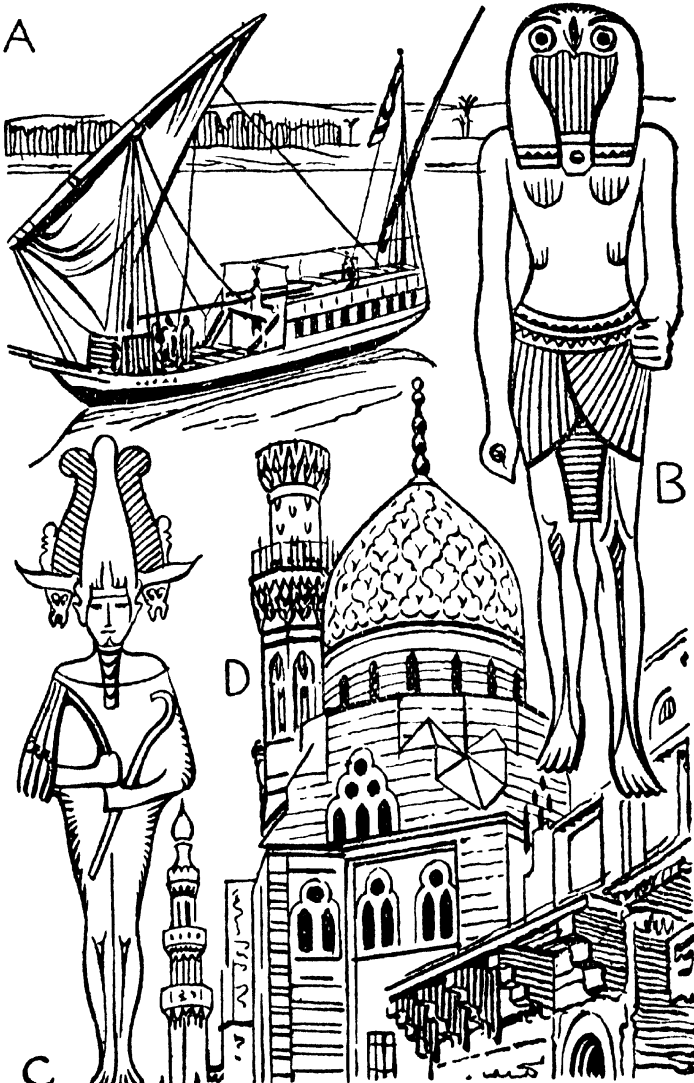
The later kings of this dynasty were unable, however, to withstand the inroads of Asiatics, and the Middle Kingdom came to an end with the Hyksos invasion. Of the Hyksos, the so-called 'Shepherd Kings,' little is known. They were civilized Asiatics, and during their overlordship of Egypt, which embraced the thirteenth till the seventeenth dynasties (*c.* 1800–1575 B.C.), the horse and chariot were introduced into Egypt. A Theban royal house rose into prominence during the latter part of their sway, and the Hyksos were finally expelled by Pharaoh Aahmes, who founded the eighteenth dynasty. The Empire period was then inaugurated. Egypt's greatest emperor, Thothmes III (1515–1461 B.C.), extended his conquests to the borders of Asia Minor, and received tribute from the Hittites, and even from Cyprus and Crete. During the reign of Akhenaton, the Hittites and their allies, the Amorites, seized



Nefert, a royal princess of the Old Kingdom period

the Egyptian sphere of influence in Syria and Northern Palestine.

In the nineteenth dynasty (1350–1205 B.C.) much of the lost territory was recovered. Rameses II (1325–1258 B.C.) fought his Waterloo at Kadesh, but found it necessary about 1300 B.C. to conclude a treaty of peace with the Hittites, the Assyrian Power at the time becoming very powerful and aggressive. Rameses III of the twentieth dynasty was the last great Pharaoh of the Empire period. He successfully resisted the threatened



A—Modern Nile Boat
C—Copper Statuette of Osiris (British Museum)

B—Copper Statue of RÁ (British Museum)
D—Mosque of Ibrahim Agha in Cairo

invasions of naval and military peoples from Greece and Anatolia in 1200 B.C. It is believed that the Trojan War (1194–1184 B.C.) was waged by the same confederacy which had attempted to invade the Delta region. No fewer than nine Pharaohs named Rameses ruled in Egypt after Rameses III. Most of these were priest-kings. A Libyan dynasty held sway for about two centuries (950–750 B.C.). One of its Pharaoh-Sheshhonks was the 'Shishak' who was an ally of Solomon; after the death of that monarch he invaded Palestine. The Ethiopians of Nubia (Sudan) subsequently overran Egypt. One of its Pharaohs, Shabaka, was the ally of King Hosea of Israel against Assyria; he was defeated at Raphia by Sargon in 720 B.C. The last Ethiopian Pharaoh, Taharka, was in 662 B.C. overcome by the invading army of the Assyrian Emperor, Ashurbanipal.

The northern royal family of Sais then came into power, and the twenty-sixth dynasty, which lasted for about 130 years (662–525 B.C.), was inaugurated by Psamtik I. Pharaoh-Necho, referred to in the Bible, was the second ruler. It was during Necho's reign that his Phœnician mariners circumnavigated Africa. Egyptian culture was at the time spreading far and wide along sea and land routes. Trade was flourishing. The greatest world-power at the time, however, was Persia, and in 525 B.C. Egypt was conquered by Cambyses and became a Persian province, with short interruptions of weak native dynasties (the twenty-eighth to thirtieth), until in 332 B.C. Alexander the Great seized it and founded Alexandria. The Ptolemaic dynasty afterwards held away for about three centuries. During this period learning and the arts flourished. Alexandria was not only a commercial town, but a centre of culture and the capital of Egypt. Osiris was worshipped there in the form of Serapis. During the latter part of the dynasty the native Egyptians were using Greek and Græcized names, and the whole country was more or less Hellenized. The fifteenth Ptolemy was the younger brother of the famous Cleopatra, the seventh of her name. He vanished, and was succeeded by Cleopatra's son, Cæsarion—Ptolemy XVI—whose father was Julius Cæsar. Both Cleopatra and her son perished when Egypt became a Roman province in 30 B.C. A daughter of Cleopatra and Antony became the wife of Juba, King of Morocco.

The Romans drew vast quantities of gold from the mines of Nubia (*nub* means 'gold') and made Egypt their 'granary.' Egyptian religious beliefs and customs were perpetuated by the Roman emperors. Tiberius and Vespasian restored ancient Nilotic temples. The worship of Isis spread to Rome. Hadrian had to give a decision in a dispute between Memphis and Heliopolis regarding the sacred bull. But Egyptian native learning was decaying, and the knowledge of hieroglyphic writing was dying out. Christianity was introduced during the Roman period, and the Coptic Church established. In A.D. 642 the Romans finally abandoned Egypt, which, till 868, became a province of the successive Mohammedan caliphates of Medina, of Damascus, and Baghdad. The Turkish soldiery dominated Egypt for a period. The Shia heretics afterwards became powerful, and the Christians were well treated.

In 1250 the Mamelukes (descendants of slaves) came into power. Their pomp-loving sultans and emirs lived in great splendour. They came under Turkish sway early in the sixteenth century, but when Napoleon conquered Egypt in the eighteenth century they were again semi-independent. The British drove the French out of Egypt. Mehemet Ali, an Albanian officer in a Turko-Albanian force, had himself declared Sultan of Egypt, but when he overran Syria and threatened to march to Constantinople, Russia intervened. Britain and France afterwards prevailed on Mehemet Ali to rule Egypt as the viceroy of the Sultan of Turkey. His successor and grandson, Abbas I, built the first railway in Egypt. The next viceroy, Said Pasha, son of Mehemet Ali, granted to a French company the right to construct the Suez Canal. Egypt became bankrupt under his successor, Ismail Pasha, the first Khedive (Prince), during whose reign the Suez Canal was opened. He was deposed when the British and French took over the control of Egyptian finance. During the term of his successor, Tewfik Pasha, the Arabi Pasha rebellion took place. The military occupation of Egypt by British troops was followed by peace and good government. But trouble broke out in the Sudan. Mohammed Ahmed declared himself the Mahdi (Messiah) of the Mohammedans, and conquered a great part of the Sudan.

In Nov., 1883, General Hicks ('Hicks Pasha') led an army of 10,000 Egyptians against the false prophet, but while marching across the driest part of the Sudan, misled by spies who acted as guides, his thirst-stricken army was entirely destroyed by the Mahdi's force. This victory gave the false prophet great prestige. In Jan., 1884, General Gordon was sent to

THE GREAT PYRAMIDS OF GIZA AND THE SPHINX

Built by Cheops (Khufu) and Cephren (Khafra) as their future tombs, in order to secure immortality by the preservation of the mummy

Khartoum as Governor-General of the Sudan, but was completely isolated there. Khartoum was captured and the gallant general slain on 26th Jan., 1885, before a relieving force could reach him. The Mahdi died in June, 1885, and was succeeded by Abdullah the Khalifa. After a period of reorganization and preparation in Egypt, the reconquest of the Sudan was begun. Lord (then Sir Herbert) Kitchener was Sirdar, or Commander-in-Chief of the Egyptian army, and his expeditionary force was strengthened by British regiments. In April, 1898, the Khalifa's army was defeated on the banks of the Atbara, and on 2nd Sept. Kitchener won a great victory near Omdurman. The Khalifa escaped, but was rounded up by Sir Reginald Wingate's force, and slain with his emirs at Ummc Dubraykat on 24th Nov., 1899. Thereafter the Sudan came under the control of a British-Egyptian *condominium*, which appointed a Governor-General.

At the time of the outbreak of the European War, in 1914, the Khedive of Egypt was in Constantinople and sided with the Central Powers. He was consequently deposed by Britain, and Prince Hussein Kamil (uncle of the deposed Khedive) was declared Sultan of Egypt; the suzerainty of Turkey terminated at the same time. Hussein Kamil died in 1917, and was succeeded by Ahmed Fuad Pasha.

Under the Peace Treaty, Egypt was recognized as an independent kingdom, and in 1922 the British Protectorate came to an end, though the army remained under British control and certain other stipulations were made in order to safeguard British interests. The new Constitution was promulgated in 1923, and declares Egypt to be a Sovereign State, its monarchy hereditary, and its Government representative. The Parliament consists of a Senate and of a Chamber of Deputies, and the liberty of the individual and of religious belief is guaranteed. Ahmed Fuad Pasha became king in 1922.

There has always been a strong anti-British feeling in Egypt, and from time to time this has given rise to unpleasant situations. Zaghlul Pasha, who became Prime Minister in 1924, made no attempt to suppress this hostility to Britain, and in Nov., 1924, Sir Lee Stack, Governor-General of the Sudan and Sirdar, was shot at and fatally wounded in the streets of Cairo. This murder projected a crisis: Egypt was fined £500,000, all Egyptian troops were ordered from the Sudan, the British Government took prompt measures to ensure the safety of British interests, and reservations regarding the Gezira Irrigation Scheme (q.v.) were withdrawn. Viscount Allenby, the British High Commissioner, acted promptly, and soon had the situation well in hand. At the same time Britain informed the Powers that she would brook no interference in Egyptian affairs. In 1928 Parliament was suspended for three years, but the Constitution was restored in 1929. An agreement was made between Great Britain and Egypt in 1929 regarding the rights of the latter and the Sudan in the waters of the Nile, and the regulation of irrigation works. The following year Arthur Henderson, who was Foreign Secretary in the Labour Government, tried to settle differences between Britain and Egypt, but without material success.—BIBLIOGRAPHY: J. H. Breasted, *Development of Religion and Thought in Ancient Egypt*; Sir E. A. W. Budge, *Gods of the Egyptians*; G. Elliot Smith, *The Ancient Egyptians*; Flinders Petrie, *A History of Egypt*; Sir A. Colvin, *The Making of Modern Egypt*; Sir V. Chirol, *The Egyptian Problem*; Baedeker's *Egypt*.

EGYPTIAN VULTURE (*Neophron percnopterus*), a bird that frequents both shores of the Mediterranean, but rarely passes farther north, though it has been found in the British islands. It is one of the smaller vultures, about the size of a raven. The general colour is white, the quill feathers of the wing being dark brown. It frequents the streets of Eastern towns, where it is protected as a scavenger.

EHRENBERG (ā'-rĕn-berĸ), **Christian Gottfried**, a German scientist, born in 1795, died in 1876. After studying theology, medicine, and natural history, he joined in 1820 an expedition to Palestine, Egypt, and Abyssinia, returning to Berlin in 1825. In 1829 he accompanied Humboldt to the Ural and Altai ranges and to Central Siberia. His great work on Infusoria appeared in 1838, and was at once recognized as the highest authority on the subject. It was followed in 1854 by his *Microgeology*.

EHRENBREITSTEIN (ā'rĕn-brit-stīn), a dismantled Prussian fortress formerly of great strength and situated opposite the confluence of the Moselle with the Rhine, on a precipitous rock 387 feet above the river, and inaccessible on three sides. It is connected with Coblentz on the opposite shore by a bridge of boats. The fortifications could accommodate a garrison of 14,000 men, and possessed room for stores to last an army of 60,000 for a year.

EHRLICH, Paul, German physician, born in Silesia in 1854, died in 1915. Educated at Breslau, Strasburg,

and Leipzig, he became *privatdozent* at the University of Berlin in 1889, and in 1896 was appointed director of the Royal Institute for Serum Research at Steglitz, which was transferred to Frankfurt in 1899, and became the Royal Institute for Experimental Therapeutics. His studies in the histology of blood are very important, but his claim to fame is based upon his discovery of *salvarsan* (606) and of *neosalvarsan* (614), arsenic compounds which are very efficacious in the treatment of syphilis. He delivered the Croonian lectures in 1900 and the Harben lectures in 1907, received honorary degrees from the universities of Oxford and Chicago, and in 1908 shared the Nobel prize for medicine with Metchnikoff of the Institut Pasteur in Paris. His works include: *Beitrage zu Histologie und Klinik des Blutes, Anæmie, Abhandlungen über Salvarsan*, &c.



Eider Duck, female

EIBENSTOCK (I'ben-stok), a town in the south-east of Saxony, with important manufactures of lace. Pop. 9,528.

EICHHORN (*Ih'*horn), **Johann Gottfried,** German Orientalist, historian, &c., born in 1752, died in 1827. He became professor of Oriental languages at Jena, and then at Göttingen. Amongst his works are: *The Hebrew Prophets, History of Literature, History of the Last Three Centuries, Introductions to the Old and New Testaments and to the Apocrypha.*

EICHSTÄTT (*Ih'*stet), an old town, Bavaria, in a deep valley of the Altmühl, 67 miles N.N.W. of Munich. Pop. 8,029.

EIDER (I'dèr), a river of Schleswig-Holstein, rises 8 miles S. of Kiel, and after a winding course falls into the North Sea at Tönning; length, 117 miles. By means of a canal it long gave communication between the North Sea and Baltic, but the Kiel canal has superseded this route.

EIDER DUCK (*Somateria mollissima*), a species of duck found from 45° north to the highest latitudes yet visited, both in Europe and America. Its favourite haunts are solitary rocky shores and islands. In Greenland and Iceland they occur in great numbers, and also breed on the western islands of Scotland. The eider duck is about twice the size of the common duck, being about 2 feet 3 inches in length, 3 feet in breadth of wing, and from 6 to 7 lb. in weight. The male is black, head and back white, with a black crown. The female is reddish drab spotted with black, and with two white bands on the wings. They feed largely on shell-fish and crustaceans. Their nests are usually formed of drift grass or dry sea-weed, lined with a large quantity of down, which the female plucks from her own breast. In this soft bed she lays five eggs, which she covers over with a layer of down. If this, with the eggs, is removed, the bird repeats the process.

One female generally furnishes about ¼ lb. of down, but the quantity is reduced by cleaning. This down, from its superior warmth, lightness, and elasticity, is in great demand for beds and coverlets; and the districts in Norway and Iceland where these birds abound are guarded with the greatest vigilance as a most valuable property. As found in commerce this down is in balls of the size of a man's fist, and weighing from 3 to 4 lb. It is so fine and elastic that 5 lb. of the best quality is sufficient for a whole bed. The down from dead birds is little esteemed, having lost its elasticity. The king eider duck (*Somateria spectabilis*) is another species resembling the preceding and inhabiting the same coasts.—Cf. J. G. Millais, *British Diving Ducks.*

EIFFEL (ā-fel) **Alexandre Gustave,** French engineer, born in 1832; attended, from 1852 to 1855, the École Centrale des Arts et Manufactures at Paris, and devoted himself chiefly to the designing of large structures in iron, especially bridges and viaducts, the great bridge over the Douro being one of his works. His name is best known, however, from the lofty iron tower erected by him in connection with the Paris Exhibition of 1889, rising to the height of 985 feet on the Champ de Mars. He was condemned in 1893 to two years' imprisonment and a fine of 20,000 francs for misappropriation of funds belonging to the Panama Canal Company, but the judgment was set aside on technical grounds. In 1913 he published a work entitled *Resistance of the Air.* He died in 1923.

EIFFEL TOWER, a structure named after the originator, one of

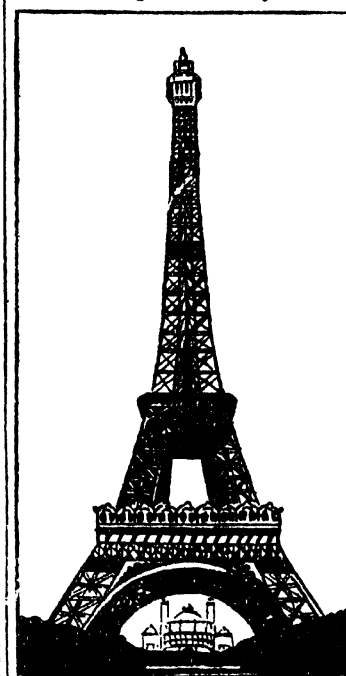
the sights of Paris. It surpasses the Washington Obelisk, (555 feet), by 430 feet. (The loftiest structure in existence, the Empire State Building, New York, is 1248 feet.) It cost about £260,000, and was erected partly at the cost of the State, partly by funds provided by Eiffel himself, who formed a company for the purpose. The company derived its profits from the fee which visitors had to pay, but the tower became the property of the State in 1909.

The top may be reached by stairs and lifts. The first stage or platform is at the height of 189 feet, and forms a quadrilateral 213 feet square, fitted up as a restaurant. The next platform is at the height of about 380 feet, and is 98 feet square. The third platform is at the height of 906 feet, and is large enough to accommodate a good number of persons, affording a magnificent view. The lantern higher up is supplied with powerful electric searchlights, and on the very summit is a small area utilized chiefly for scientific observations. The tower has been utilized in experiments connected with the fall of bodies, vibration of the pendulum, and pressure of the air. In recent years the tower has become an important wireless telegraphy station.

EIGG (eg), an island on the west coast of Scotland, county of Inverness, about 10 miles from the mainland, and 5 miles long by about 3 broad. It has bold, rocky shores, and terminates to the south in a lofty promontory called the Scuir of Eigg, with a peak of columnar pitchstone porphyry 1339 feet above the sea, and on one side perpendicular as a wall. It is the scene of the massacre, towards the end of the sixteenth century, of 200 Macdonalds by the Macleods of Skye, who suffocated them in a cave where they had taken refuge. Pop. 197.

EIGHT-HOUR DAY. The eight-hour day was proposed in England as early as 1833, and in 1869 the Trade Union Congress of Birmingham formulated the demand that this ideal working day should be adopted throughout the United Kingdom. The Trade Unions and the Socialists sought to secure the establishment of the eight-hour day through legislation, and it gradually came into force not only in coal-mining, but in various trades and industries. The agitation in favour of an eight-hour day became very strong in Europe towards the end of the nineteenth and at the beginning of the twentieth centuries, and in England it was granted to miners in 1908, and to railway employees in 1919. Since the European War the movement has made great headway, and it now forms part of the programme of the Labour parties in almost all European countries.—BIBLIOGRAPHY; Hedfield and Gibbins, *A Shorter Working Day*; Robertson, *The Eight Hour Question*.

EIGHTY CLUB, The, a club formed in 1879 by a number of prominent English Liberals with a view to the promotion of the success of Liberalism at the general election of 1880, whence its name. The members lecture on political subjects and



Eiffel Tower

address Liberal associations throughout the country. Women were first admitted to membership in 1920.

EIKON BASILIKĒ (ī'kon ba-sil'i-kē; Gr., 'the royal image'), the name of a book published shortly after the execution of Charles I in Jan., 1649, and supposed by some to have been written by the king himself. At the Restoration Gauden, afterwards Bishop of Worcester, laid claim to the authorship, and a memorandum in the copy of the Earl of Anglesea, Lord Privy Seal under Charles II, affirms his claim with the authority

of Charles II and the Duke of York. The Royalist Clarendon, author of the *History of the Rebellion*, accepted this statement, but others refused to credit Gauden with the authorship. Within a year of its publication, 48,000 copies of the book were sold, and the republicans put forward Milton to answer it, his *Eikonoklastes* (that is 'image-breaker') appearing the same year, by order of Parliament. The *Eikon Basilikè* professes to be a sort of private journal of the king, written in an affectedly dignified strain, and containing numerous assertions of love for his misguided and ungrateful people.—Cf. Almack, *Bibliography of the King's Book, or Eikon Basilikè*.

EILDON HILLS (ēl'don), a picturesque hill-mass with three summits, south of Melrose Roxburghshire, Scotland, reaching a height of 1385 feet, fabled to have been cleft in three by Michael Scott.

EILEITHYIA (ī-lī-thī'ya), the Greek name of the ancient Egyptian city Nekheb (the modern El-Kab), on the Nile, some distance above Esneh. Important remains have been obtained from rock-tombs in the neighbourhood, and there are several ruined temples.

EILENBURG (ī-lèn-burh), a town, Prussian Saxony, 26 miles N.N.E. of Merseburg, on an island of the Mulde. It has manufactures of calico. Pop. 18,172.

EIMBECK (im'bek), or **EINBECK**, a town of Prussia, province of Hanover, 50 miles south of Hanover, once famous for its beer (*Eimbecker Bier*, whence *Bock*). Pop. 9,600.

EINSIEDELN (in'zē-dèln), a village and district, Switzerland, in the canton and 9 miles north by east of Schwyz, 2,908 feet above the sea, celebrated for its Benedictine abbey. An image of the Virgin, alleged to possess miraculous powers, annually attracts immense numbers of pilgrims. Pop. 8,500.

EINSTEIN, Albert (1879–), physicist, was born at Ulm, Würtemberg, Germany, of German-Jewish parents. He was educated at the Gymnasium in Munich, and, on leaving school in his sixteenth year, accompanied his parents to Milan. Six months later, he enrolled at the Technical High School in Zurich, where he studied from 1896 to 1900. He held a post in the Swiss Patent Office from 1902 to 1909, then various professorships in Zurich till 1914, when he received a call to the Prussian Academy of Science, Berlin, and became Director of the Kaiser Wilhelm Physical Institute.

He has become famous as the author of the Theory of Relativity (q.v.). The 'special theory,' which deals chiefly with electrodynamics and optics, was published in 1905, and the 'general theory' or theory of gravitation, about ten years later. His name became popularly known in 1919, after observations made during the solar eclipse of that year had verified his prediction of the bending of rays of light coming from a star and passing close to the sun. He has made other valuable contributions to Theoretical Physics. In 1921 he received the Nobel prize, and in 1925 the Copley medal of the Royal Society. In 1933 he accepted a life appointment as head of the School of Mathematics in the Institute for Advanced Study, Princeton, United States.

EISENACH (ī'zèn-ăh), a town of Germany, in the Free State of Thuringia, near the mountains of Thuringia, at the junction of the Nesse and Hörsel. It is an attractive town, and contains a palace erected in 1742. It has manufactures of pottery, leather, woollen yarn, &c. Sebastian Bach was born there in 1685. Near it lies the Wartburg, where Luther was kept for safety during 1521 and 1522. Pop. 43,385.

EISENBERG (ī'zèn-berh), a town in Thuringia, Germany, former duchy of Saxe-Altenburg, with a palace and various manufactures. Pop. 11,220.

EISLEBEN (īs'lā-bèn), a town, Prussian Saxony, 25 miles north-west of Merseburg, celebrated as the place where Luther was born and where he died. There are many memorials of Luther, and also a bronze statue of the reformer erected in 1883. Copper is extensively worked in the neighbourhood. Pop. 23,694.

EISNER, Kurt, Bavarian revolutionary leader, born in 1867 at Berlin, of a Jewish family. He studied at the University of Marburg, and early acquired a vast erudition. Entering journalism, he contributed to the *Frankfurter Zeitung*, where he published an article attacking the Kaiser. For this he was condemned to nine months' imprisonment. He then wrote for the Socialist press and eventually became editor-in-chief of the *Vorwärts*. In 1907 he published a work entitled *The Fall of the Empire* which attracted much attention, and in 1910 he attacked Prussian ascendancy in the *Munich Post*.

Eisner took an active part in the Revolution of 1918, and was appointed Prime Minister of Bavaria. A revolutionary and a Socialist, he was, however, opposed to Bolshevism, which he did not hesitate to criticize violently. But his policy of separation, his aim of liberating the South German

States, and his constant attacks upon the Kaiser and the whole military caste of Germany, brought him many enemies. Whilst on his way from his house to the Foreign Office he was shot at and killed by Count Arco Valley on 21st Feb., 1919.

EISTEDDFOD (I-steth'vŏd; W. *eisteddf*, to sit, and *bod*, to be; pl. *eisteddfodau*), an ancient assembly of Welsh bards for the purpose of musical and poetical contests, the judges being originally appointed by commissions from the native princes, and after the conquest from the English kings. There are two kinds of eisteddfodau, the national or general, and the provincial gatherings which take place in many parts of Wales. The last commission was issued by Queen Elizabeth in 1568, but the eisteddfod fell into abeyance during the seventeenth century. In 1798 the ancient custom was revived by the Gwynnedigion Society, and on a more elaborate scale by the Cambrian Society, which grew out of the Gwynnedigion. Eisteddfodau are now held annually in North and South Wales alternately, and are attended by many thousands of people. The festivals of 1919 and 1920 were held at Corwen and at Barry, Glamorgan, respectively.—Cf. Rhys and Brynmor Jones, *The Welsh People*.

EJECT'MENT, in law, an action wherein the title to lands and tenements may be tried and the possession recovered. It is commenced by a writ addressed to the tenant in possession and all entitled to defend the possession, bearing that the plaintiff lays claim to the property in question, and calling upon all interested to appear within a certain time to defend their rights. In its older form the action was remarkable for the curious fictions on which procedure was based The names of John Doe, an imaginary plaintiff, and of Richard Roe, an imaginary defendant, were familiar in cases of this kind in the English courts until 1852, when the Common Law Procedure Act abolished these fictitious suitors.

EJECTOR, in mechanical engineering, an appliance for ejecting gases, vapours, or liquids from closed spaces by the use of another gas, vapour, or liquid at a higher pressure. For instance, the air may be extracted from a condenser by an ejector. A jet of steam is directed along a short specially-shaped pipe leading from the condenser to the outside atmosphere. The velocity of the steam when it leaves the jet in the pipe is very high, and it blows out into the atmosphere in spite of the atmospheric pressure against it. In blowing out into the atmosphere it sucks the air in the condenser along with it, and after it has been in operation some time practically the whole of the air is sucked out of the condenser. The appliance works on the principle of momentum. The active jet mixes with the material to be ejected and imparts a common momentum to the mixture, which is sufficient to enable it to pass outside the vessel from which the ejection is taking place. The same principle is used in the mercury air-pump (*see* AIR-PUMP).—BIBLIOGRAPHY: W. E. Dalby, *Steam Power; Modern Mechanical Engineering* (The Gresham Publishing Company).

ELÆGNA'CEÆ, the oleaster family of plants, a small nat. ord. of apetalous dicotyledons scattered over the northern regions. The only British member is the sea-buckthorn (*Hippophaë rhamnoides*).

ELA'IN, the oily principle of fat obtained by submitting fat to the action of boiling alcohol, allowing the stearin to crystallize, and then evaporating the alcoholic solution. It is not unlike vegetable oil in its appearance and its properties, and forms soaps with alkalies.

E'LAM, the ancient name of a country on the eastern border of Babylonia. Its civilization dates back beyond 3000 B.C. Before 2000 B.C. it was strong enough to subdue part of Babylonia. Its power was finally broken by the last Assyrian monarchs. The capital was Susa, which became prominent again after the rise of Cyrus. Its splendour during the Persian period is reflected in the *Book of Esther*, in which it is referred to as 'Shushan.'

E'LAND, *Oreas* (*Orias*) *canna*, a species of antelope inhabiting Africa, the largest of all its kind, being about the size of an ox. Its flesh, especially that of the thighs, which are dried and used in this state, is highly prized. It is now almost extinct south of the Limpopo, but it is plentiful in the Kalahari. The colour is a light or greyish brown, and it possesses a short mane. The horns, which are about 18 inches long and nearly straight, are spirally keeled.

EL'ANUS, the name of certain species of raptorial birds of the genus Elanus, belonging to the kites. The type species is the black-winged kite (*E. cæruleus*) of Africa and South Asia, which strays to South-West Europe. A very similar form (*E. leucurus*) is native to tropical and subtropical America, and other species (*E. scriptus* and *E. axillaris*) are Australian.

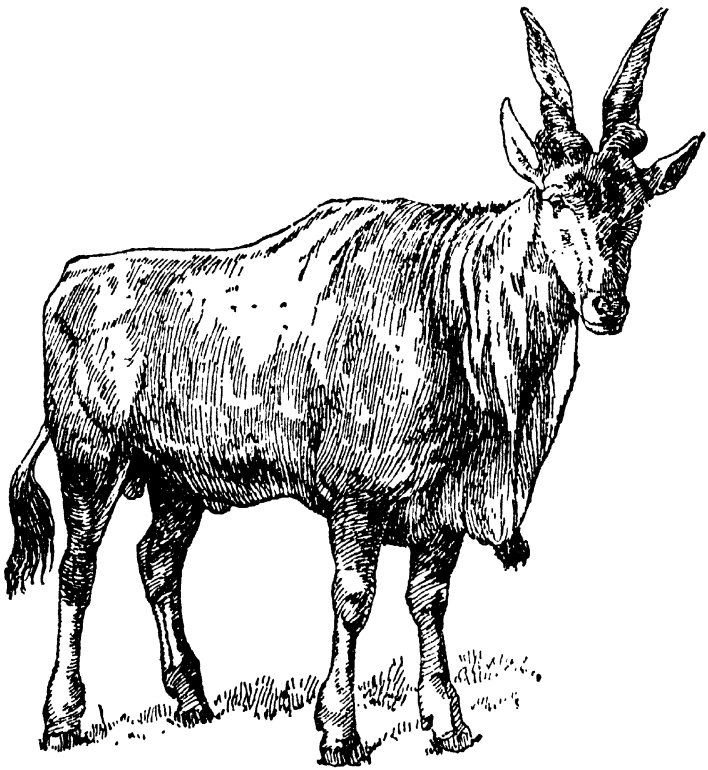
ELAPHOMYCES, a genus of Ascomycetous fungi, section Plectascineæ, with closed, subterranean ascus-fruits resembling those of the genuine truffles (Tuberineæ), but not closely allied to that family. *E. cervinus* (Hart's truffle) is not infrequent in Britain; it forms 'mycorhiza' with roots of oak, beech, and various conifers.

E'LAPS, a genus of poisonous American snakes, the type of the family Elapidæ, to which belongs the cobra de capello.

EL-ARISH, Egyptian city on the Mediterranean, on the Wadi el-Arish, and chief city of the territory bearing the same name. It was taken by the French under Kléber in 1799, but abandoned the same year. Pop. about 20,000.

ELASMOBRANCHII (-brang'ki-i), a sub-class of fishes, including sharks, dog-fishes, rays (skates); and also Chimæra (q.v.) and its allies. They are predaceous forms, in which the mouth is a transverse slit on the under side of the head, the numerous simple teeth are in several rows (except in chimæroids), the short intestine possesses a spiral valve and opens into a cloaca. The tail is asymmetrical (heterocercal), and numerous placoid scales (dermal denticles) are embedded in the skin.

The skeleton is cartilaginous; the heart possesses a muscular conus arteriosus with numerous rows of pocket-valves; and there are five (sometimes six or seven) pairs of gill-pouches opening by slits to the exterior, these not being covered by an external flap



Eland
(Oreas canna)

(operculum) except in chimæroids. Fertilization is internal, and the male is provided with a pair of copulatory organs (claspers) projecting backwards from the pelvic fins. The eggs sometimes develop within the body of the mother, but are usually laid in horny pouches (mermaids' purses). The group is of great antiquity, and many extinct fossil types are known.

ELASMOTHE'RIUM, an extinct genus of Mammalia, found in the post-Pliocene strata of Europe, comprising animals of great size allied to the rhinoceros, and having probably one large horn and a smaller nasal horn.

ELASTIC BITUMEN, ELATERITE, or **MINERAL CAOUTCHOUC,** an elastic mineral bitumen of a blackish-brown colour, and subtranslucent. It has been found at Castleton, in Derbyshire.

ELASTICITY, the property in virtue of which bodies resist change of volume or of shape, and tend to regain their original bulk or shape when the deforming forces are removed. Solids possess elasticity of volume and of shape. Liquids and gases have elasticity of volume; they resist compression, but offer only a transient resistance to change of shape (*see* VISCOSITY).

The elasticity of a gas is measured by the pressure to which the gas is subjected, if there is no change of temperature. When a gas is compressed suddenly, it has a greater elasticity on account of the rise of temperature which takes place. Liquids are less compressible than gases; water is compressed by about 1 part in 20,000 when the pressure on it is increased by one atmosphere.

A knowledge of the elastic properties of solids is of importance in all branches of applied mechanics. Homogeneous solids offer definite resistance to compression, twisting, stretching, and bending, and this resistance is expressed by a number called a modulus. Let the deforming force be reckoned per unit of area, e.g. a pressure in tons per square inch; this is called the stress. The unital deformation produced by the stress is called the strain, for example, compression per unit of volume. The modulus is obtained by dividing the stress by the strain; if this is done with the above example, the ratio will give the bulk modulus. When the applied forces cause change of shape without change of volume, the ratio of stress to strain is called the shape modulus or the rigidity of the material. This property is brought into play when mechanical power is transmitted by means of shafting. Young's modulus is employed in the cases of stretching and bending. It is given by the ratio stretching force per unit area to stretch per unit length.

In 1678 Hooke stated the law that stress is proportional to the strain which it causes. This law is found in practice to be true for metals within a certain range of stress which lies below the elastic limit. If the stress is increased beyond this limit, the material begins to give way, and permanent change of shape or volume takes place. In the processes of riveting and wire-drawing, the material is purposely strained beyond the elastic limit, whilst the correct working of a spring balance requires that the spring should never be over-strained. When metals are subjected to frequently repeated stresses, they undergo a weakening and are said to become fatigued, and are liable to give way under a smaller stress than would otherwise cause fracture. The speed with which sound waves are transmitted through a material depends on the elasticity of the material; such compressional waves in water have been employed by the Roumanian engineer, Constantinesco, to transmit power by means of water-pipes.

Mathematical Theory. Consider an elastic body at rest and free from strain. Let the body be subjected to forces, fulfilling the ordinary statical conditions of equilibrium, and therefore not tending to give the body any motion of translation or rotation as a whole. The particles of the body will move very slightly relative to each other; in other words, a system of strain will be set up in the body. To maintain this strain a definite system of stress is necessary. The problem for the mathematical theory is to determine the state of strain and stress at every point of the body when the applied forces are given. These applied forces may either be body forces (of which practically the only example is weight), or surface forces; the latter are pressures or tractions, and are defined by their directions and amounts per unit area. It is first of all necessary to show how strain and stress can be specified mathematically.

Strains. If x, y, z are the co-ordinates of a point in the unstrained body, and if this point is displaced to $(x + u, y + v, z + w)$ when the straining forces are applied, then u, v, w, which are supposed to be very small, are called the component displacements at (x, y, z). It is clear that if u, v, w were constant, the body would simply be displaced without strain. The state of strain can in fact be shown to depend on the first derivatives of u, v, w with respect to x, y, z.

The strain round any given point consists simply of three stretches parallel to a certain set of three mutually perpendicular directions. These directions vary from point to point, so that this specification of the strain is inconvenient for calculations. A suitable method depends on the fact that the strain is known round a point when we know the values of the six quantities.

$$\frac{du}{dx},\ \frac{dv}{dy},\ \frac{dw}{dz},\ \frac{dw}{dy}+\frac{dv}{dz},\ \frac{du}{dz}+\frac{dw}{dx},\ \frac{dv}{dx}+\frac{du}{dy}$$

at the point. These are called the components of strain at (x, y, z). The first three are *stretches* parallel to the axes, the other three are *shearing* strains. We may get an idea of the nature of these strains from two simple typical cases. 1. Let $u = ex$, $v = o$, $w = o$. This makes $\frac{du}{dx} = e$, and the other five strains zero. But we see that the displacement of every particle is perpendicular to the yz plane, and proportional to its distance from that plane. Every line parallel to the axis of x is therefore elongated by a definite fraction of its original length, the value of this fraction being e, which is $\frac{du}{dx}$. The strains $\frac{du}{dx}$, $\frac{dv}{dy}$, $\frac{dw}{dz}$, are therefore *stretches* parallel to the axes. 2. Let $u = 0$, $z = cz$, $w = 0$. This gives $\frac{dv}{dz}+\frac{dv}{dy} = c$, and the other five strains zero. The displacement of every particle is parallel to the axis of y, and proportional to its distance from the plane xy. The strain is therefore a slide, or *shear* of planes parallel to xy in the direction of the axis of y.

Stresses. To specify the stress round a point (x, y, z), consider a small plane area through the point. The material on one side of this acts on the material on the other side with a certain force whose components parallel to the axes are F, G, H, say, per unit area. If we know F, G, H for every orientation of the small plane area, the state of stress round (x, y, z) is defined. But it is easy to show, as below, that we can find F, G, H for every area if we know them for areas parallel to the co-ordinate planes. We are thus led to the specification of the stress round (x, y, z) by the six *components of stress*, xx, yy, zz, xy, xz, yz; where xy, for example, means the force per unit area *parallel* to Ox exerted on a plane *perpendicular* to Oy by the material on the positive side of that plane on the material on its negative side. Thus e.g. the components of the force per unit area exerted across the yz plane through (x, y, z) by the material on the positive side of that plane are $\overline{xx}$, $\overline{xy}$, $\overline{xz}$. It is important to note that $\overline{xy} = \overline{yx}$. This is easily proved by considering the equilibrium of a small rectangular volume of the material round (x, y, z) as centre, with its edges parallel to the axes; if $\overline{xy}$ were not equal to $\overline{yx}$, there would be a residual couple in the plane xy.

Relations between the Strains and the Stresses. When the strains are known, the stresses can be found from a generalized Hooke's law, which can be deduced from the principle of energy, combined with consideration of symmetry. If the solid is isotropic, i.e. is symmetrical in its elastic properties in all directions round a point, the relations between stress and strain are of the form

$$\overline{xx} = \lambda\left(\frac{du}{dx}+\frac{dv}{dy}+\frac{dw}{dz}\right)+2\mu\frac{du}{dx},$$

$$\overline{yz} = \mu\left(\frac{dw}{dy}+\frac{dv}{dz}\right);$$

the values of the other four components of strain can be written down from symmetry. Here λ and μ are constants, each being a *modulus* of elasticity. In particular μ is the *shape modulus* or the *rigidity*, already referred to. The Young's modulus and the bulk modulus can easily be found in terms of λ and μ.

Equations of Equilibrium in Terms of the Stresses. A rectangular element dx, dy, dz, of the body is held in equilibrium by the body force, and the tractions on its faces arising from the stress. The tractions per unit area, parallel to the axis of x, on the six faces, are:

on the plane x, $-\overline{xx}$; on the plane $x+dx$, $\overline{xx}+\left(\frac{d}{dx}\overline{xx}\right)dx$; on the plane y, $-\overline{xy}$; on the plane $y+dy$, $\overline{xy}+\left(\frac{d}{dy}\overline{xy}\right)dy$; and similarly for the plane z. Let the force acting on the mass of the body, such as its weight, be (X, Y, Z) per unit mass, and let ρ be the density. By equating the sum of the x components of all the forces to zero, we get

$$\frac{d\overline{xx}}{dx}+\frac{d\overline{xy}}{dy}+\frac{d\overline{xz}}{dz}+\rho X = 0;$$

Similarly

$$\frac{d\overline{xy}}{dx}+\frac{d\overline{yy}}{dy}+\frac{d\overline{yz}}{dz}+\rho Y = 0,$$

and

$$\frac{d\overline{xz}}{dx}+\frac{d\overline{yz}}{dy}+\frac{d\overline{zz}}{dz}+\rho Z = 0.$$

The Surface Tractions in Terms of the Stresses. Draw a small tetrahedron round (x, y, z) with its faces perpendicular to the axes and to the direction (l, m, n), and consider the equilibrium of this small body. Let F, G, H be the components per unit area of the force on the plane whose direction cosines, *drawn outwards*, are l, m, n. If A be the area of the face perpendicular to (l, m, n), we get, by resolving parallel to Ox,

$$F \cdot A = \overline{xx} \cdot lA + \overline{xy} \cdot mA + \overline{xz} \cdot nA.$$

Hence $$F = l\overline{xx} + m\overline{xy} + n\overline{xz},$$

and similarly

$$G = l\overline{xy} + m\overline{yy} + n\overline{yz},$$

$$H = lxz + myz + nzz.$$

If (x, y, z) is a point at the surface of the body, and l, m, n are the direction cosines of the outward normal at that point, these values of F, G, H are the component of the force that must be applied from outside to the surface at (x, y, z) to maintain the state of stress.

The Equations connecting the Displacements and the Applied Forces. By using, in the equations of equilibrium, the values of the stresses in terms of the strains, we find the body equations of equilibrium in terms of displacements,

$$\mu\left(\frac{d^2u}{dx^2} + \frac{d^2u}{dy^2} + \frac{d^2u}{dz^2}\right) + (\lambda + \mu)\frac{d}{dx}\left(\frac{du}{dx} + \frac{dv}{dy} + \frac{dw}{dz}\right) + X\rho = 0$$

with two similar equations.

The surface equations of equilibrium can also be written down at once by substituting the values of stresses in terms of strains in the expressions for F, G, H given above.

The Problem of Equilibrium. To find the strain under given forces we have to solve the body and surface equations of equilibrium, when X, Y, Z and F, G, H are given. This problem has not been completely solved except in a few cases. It was solved by Lamé and Lord Kelvin for a solid or hollow sphere; it has also been solved for an infinite solid bounded by two parallel planes, or by a circular cylinder. Many particular solutions, however, are known for bodies of other shapes. Some of these solutions are of great practical value, e.g. St Venant's solutions for the torsion and flexure of prisms. For bodies in which one or two dimensions are small, i.e. for thin plates and shells, and for thin rods, approximate theories have been given, which are partly deduced from the above exact equations, and partly from plausible hypotheses, a complete treatment based on the exact equations being in most cases impracticable.

The Problem of Vibrations. When a body is vibrating, the mass acceleration parallel to Ox of the particle at (x, y, z) is $\rho\, dx\, dy\, dz\, \frac{d^2u}{dt^2}$. The equations of vibrations are therefore found by writing $-\frac{d^2u}{dt^2}$ instead of X, in the first body equation of equilibrium, and similarly with the others. The surface conditions will usually be that F, G, H are zero. The problem has been completely solved by H. Lamb for a solid or hollow sphere. For the elastic solid theory of the luminiferous ether, *see* ETHER; for some practical solutions of the general equations of equilibrium, *see* STRENGTH OF MATERIALS.—BIBLIOGRAPHY: A. E. H. Love, *Mathematical Theory of Elasticity*; Lord Kelvin and Tait, *Natural Philosophy*; Todhunter and Pearson, *History of Elasticity and Strength of Materials*.

EL'ATERIDÆ, the name of a family of beetles, remarkable for their ability to throw themselves to a considerable height in the air, when placed on their back, by a vigorous muscular movement. Hence their names of springing-beetles, click-beetles, skip-jacks, &c. When alarmed, the elater counterfeits death. Flowers, grass, and decaying wood are the habitations of these animals, which are almost always found singly. The larvæ are often very injurious to vegetation, especially those which devour the roots of herbaceous plants (as in the genus Agriōtes), and are known from their slenderness and hardness as wire-worms.

The fireflies of America belong to the family. In these a pair of luminous organs is found on the thorax, while there is a third on the under side of the base of the abdomen. The *Pyrophōrus noctilūcus*, called *cucujo* in Brazil, is used as a personal ornament by ladies. The largest species of the genus Elater, the *Elater flabellicornis*, is 2¼ inches in length.

ELATE'RIUM, a substance obtained from the fruit of the squirting or wild cucumber (*Ecballium agreste*). The juice of the unripe fruit, when expressed and allowed to stand, deposits elaterium as a green sediment with an acrid taste, a faint odour, and powerful cathartic properties. It is a violent purgative, and is poisonous, but its action is not constant. The active principle in it is called *elaterin*.

ELBA (Lat. *Ilva*), a small island in the Mediterranean, in the province of Livorno (Legnora), Italy, separated

from the mainland by the Strait of Piombino, about 6 miles wide. The island is 18 miles long and from 2¼ to 10½ miles broad, and is traversed by mountains rising to a height of over 3000 feet. It is rich in iron, marble, granite, salt, &c.; and iron ore is exported. Excellent wine and fruits are produced. It has two seaports—Porto-Ferrajo (the capital) and Porto-Longone. The Treaty of Paris in 1814 erected Elba into a sovereignty for Napoleon, who resided in it from 4th May, 1814, to 26th Feb., 1815, when he escaped and landed at Cannes on 1st March. After Napoleon's departure the island was restored to Tuscany, which became part of Italy in 1860. Pop, 26,000.

ELBE (elb; Ger., pronounced el'be; Lat. *Albis*; Bohem. *Labe*), an important river in Central Europe. It rises on the south-west slopes of the Schneekoppe or Snowcap, one of the Riesengebirge, between Bohemia and Silesia. From this point it flows nearly due south into Bohemia for about 50 miles, when it turns to the west, and after about 40 miles takes a general north-north-west direction till it falls into the North Sea, intersecting Saxony and a considerable portion of Prussia. The finest scenery of its valley is in the Saxon Switzerland. Its length is 725 miles; drainage area, 56,865 sq. miles. The principal affluents are: on the right, the Iser, Schwarz-Elster, and Havel; on the left, the Alder, Moldau, Eger, Mulde, and Saale. In the lower part of its course the river divides into several arms, which unite again about 5 miles below Hamburg. It is more or less navigable for about 525 miles, but its estuary is much encumbered with sand-banks. In 1870 its navigation was declared free from Hamburg to Melnik in Bohemia. The North Sea and Baltic ship canal connects its estuary with Kiel Bay, and there are other important connected canals. It is well stocked with fish.

ELBERFELD (el'bêr-felt), a town of Rhenish Prussia, in the government of and 15 miles east of Düsseldorf, on both sides of the Wupper, enclosed by lofty hills. It is now joined to Barmen and is called Elberfeld-Barmen. Taken with Barmen it stretches along the Wupper valley for about 9 miles. The old streets are narrow and irregular, but the newer quarters are well built. It is a great seat of manufacturing industry, among its leading products being cottons, woollens, silks, velvet, mixed textile goods, buttons, ribbons, lace, yarns, thread, carpets, aniline dyes, iron and steel, machinery, pianofortes, and paper. Calico-printing, dyeing, and bleaching are very extensively carried on. It has given its name to a system of poor relief, combining organized voluntary effort and individual treatment. Pop. 165,100; with Barmen, 354,673.

ELBEUF (el-beuf), a town of France, department of Seine-Inférieure, 14 miles s.s.w. of Rouen, in a valley on the left bank of the Seine, connected by two bridges with St. Aubin on the opposite side of the river. It is an important centre for the production of woollen manufactures, chiefly of lighter cloths and fancy goods, and is also an entrepôt for the finer and heavier cloths of Louviers and Sedan. It communicates by steamers with Paris, Rouen, and Havre. Pop. 18,379.

ELBING, a seaport town of East Prussia, on the Elbing, near its entrance into the Frische-Haff. It was once a flourishing Hanse town, and is still a place of considerable industry and trade, the manufactures including iron goods, machinery, brass and tinplate goods. It has also shipbuilding yards. Pop. 67,878.

ELBURZ, a lofty mountain range extending over Northern Persia, parallel with and overlooking the Caspian. Highest peak, Mt. Demavend, 18,500 feet; average height, 6,000 to 8,000 feet.

ELCESAITES (el-ses'a-its), a sect of Gnostics which arose in the reign of Trajan about the beginning of the second century. They were a branch of the Essenes, and resembled the Ebionites. A Jew, named Elxai, or Elkesai, is their reputed founder.

ELCHE (el'chā), a town of Spain, in the province and 14 miles w.s.w. of Alicante, on the left bank of the Vinalopo, surrounded by palm trees. It contains various Roman remains, a fine church, and a town house of the fifteenth century. Chief industry, the culture of dates. Each summer, from the 13th to the 15th of August, an interesting fête is held at Elche, and a fourteenth century liturgical drama (*The Representation of the Assumption of Our Lady St. Mary*) is performed. Pop. 33,000.

ELCHINGEN (el'ĥng-en), **OBER** and **UNTER**, two villages of Bavaria, on the left bank of the Danube, about 3 miles apart and 5 miles north-east of Ulm. In 1805 Marshal Ney defeated the Austrians at Ober Elchingen, and won for himself the title of Duke of Elchingen.

ELDER, a name given to different species of the genus Sambûcus, nat. ord. Caprifoliaceæ. These are small trees or shrubs, with opposite and pinnated leaves, bearing small white

flowers in large and conspicuous corymbs, small berries of a black or red colour, and bitter and nauseous leaves possessing purgative and emetic properties. The wood of the young shoots contains a very large proportion of pith.

The common elder of Britain (*S. nigra*) is a wild shrub or small tree, distinguishable by its winged leaves, its clusters of small, cream-white flowers, and the small black berries by which these are succeeded, and from which a kind of wine is sometimes made. The dwarf elder or danewort (*S. Ebulus*) is also found in many parts of Britain, and was popularly supposed to have sprung from the blood of the Danes.

Two species inhabit North America: *S. canadensis*, a common plant from the 49th to the 30th parallel of latitude, the berries of which are black and have a sweet taste, and *S. pubescens*, which bears red berries, and inhabits Canada, the northern parts of New England, and the Alleghany Mountains.

Elder wood is yellow, and in old trees becomes so hard that it is often substituted for box-wood. Its toughness, also, is such that it is made into skewers and tops for fishing-rods. The light pith is utilized for balls for electric experiments, and various ointments, drinks, and medicinal decoctions are made from the bark, leaves, flowers, and berries.

ELDERS, persons who, on account of their age, experience, and wisdom, are selected for office, as, among the Jews, the seventy men associated with Moses in the government of the people. In the modern Presbyterian Churches elders are officers who, with the pastors or ministers, compose the consistories or kirk-sessions, with authority to inspect and regulate matters of religion and discipline in the congregation. As a member of the kirk-session the elder has an equal vote with his minister, and as a member of the higher Church courts, when delegated thereto, he has a right to discuss and vote on all matters under discussion in the same manner as the clergy themselves. In the Mormon Church the elder is an officer whose duty it is "to preach and baptize, to ordain other elders, to bless children, and to take the lead at all meetings." Among the Shakers there are four elders, two men and two women, in each congregation.

ELDON, John Scott, Earl of, Lord Chancellor of England, born in 1751 at Newcastle-on-Tyne, died in London, 13th Jan., 1838. His father was a coal-dealer and public-house keeper of means, and John was educated with his brother William (afterwards Lord Stowell) at Newcastle, and at Oxford, where he obtained a fellowship. He was called to the Bar in 1776, and in 1782 was made King's Counsel. Next year he entered Parliament, supported Pitt, and was made Solicitor-General, and knighted. In 1792 he purchased the estate of Eldon. In 1793 he became Attorney-General, and in 1799 was created Chief Justice of the Court of Common Pleas, and raised to the peerage and the House of Lords by the title of Baron Eldon.

On the accession of the Addington ministry he became Lord Chancellor (1801), and retained this post under the subsequent administration of Pitt until the death of the latter in 1806. A year later, however, he resumed the chancellorship under Liverpool, and held it without break fortwenty years. In 1821 he was created an earl by George IV. On the accession of the Canning ministry in 1827 he resigned the chancellorship, and never again held office. As a lawyer he was a master of English jurisprudence; as a politician he was opposed to reform, and by no means free from the charge of servility and intrigue.

EL DORA'DO, a country that Orellana, the lieutenant of Pizarro, pretended he had discovered in South America, between the Orinoco and Amazon Rivers; and which he named thus on account of the immense quantities of gold and precious metals which, he asserted, he had seen in Manoa, the capital of the country. The term El Dorado was first applied to a South American tribal king who was said to cover his body annually with gold-dust. It now designates any place abounding in gold, or offering opportunities for the acquisition of sudden wealth.

ELEANOR CROSSES (el'i-nor), memorial crosses erected on the spots where the bier of Eleanor, the wife of Edward I, rested on its way from Grantham to Westminster. Twelve were erected, but only three, those of Northampton, Geddington, and Waltham, remain.

ELEAT'IC SCHOOL, a German philosophical sect, so called because it originated in Elea (Lat. *Velia*), a town of Magna Græcia (Southern Italy), of which also three of its most celebrated teachers, Parmenides, Zeno, and Leucippus, were natives. The founder was Xenophanes of Colophon, who came to Elea late in life, bringing with him the physical theories of the Ionian school, to which he added a metaphysic. The two schools soon drifted widely apart, especially in respect of method. In opposition to the physical philosophy of the Ionian

school, and also the doctrine of Heraclitus, who taught that everything is flux, the Eleatic philosophers asserted that change and difference are only empty illusions, and that the only true reality is changeless being. Starting from the observation of external nature, the Ionians endeavoured to discover some elementary principle, as water, air, fire, or a combination of elements, by the action of which the phenomena they observed might be accounted for. The Eleans made the abstract idea of Being or God, deduced from the contemplation of the Universe as a whole, their starting-point. Their reasonings sometimes led them to deny the reality of external phenomena altogether.

ELECAMPANE (el-i-kam-pān'; *Inula Helenium*), a plant of the nat. ord. Compositæ, found in Britain and other parts of Europe, and in Asia. It is 3 or 4 feet high; the radical leaves are often 2 feet and more in length; the flowers are large and yellow; the root, which is perennial, possesses a bitter camphor-like taste. It was formerly much used as a stimulant for all the secreting organs, and in tuberculosis on account of the germicidal action of the bitter principle (helenin) which it contains.

ELECTION, in theology, the doctrine that God has from the beginning elected a portion of mankind to eternal life, passing by the remainder. It is founded on the literal sense of certain passages of Scripture, and has been amplified by the labours of systematic theologians into a complete and logical system. It dates in ecclesiastical history from the time of Augustine; but Calvin has stated it so strongly and clearly in his *Institutes* that it is generally associated with his name.

ELECTION, in politics, the selection by voting of a person or persons to occupy some post or office. The most important elections are those of the members of the legislative assemblies of the different countries, and as to the manner in which these are carried out strict laws are in force. In such elections voting by ballot is now general. The chief forms of election in Britain are parliamentary and municipal elections, in both of which the basis of the suffrage (or right of voting) is the payment of poor rates. Members of Parliament formerly required a property qualification in England and Ireland; but this restriction, which never existed in Scotland, has been abolished. In both parliamentary and municipal elections, the ballot has been in operation since 1872.

For the prevention of bribery and corrupt practices many Acts have been passed, of which that now in operation came into force in Oct., 1883, and has been annually renewed. By it persons convicted of treating, bribery, personation, and undue influence are liable to imprisonment with hard labour, and to disqualification in respect of the franchise and public offices. It also imposes many limitations with regard to the number of assistants and committee-rooms, and the use of conveyances.

By the Reform Act of 1918, the maximum expenditure for campaign purposes during parliamentary elections is to be sevenpence per elector in county constituencies, and fivepence per elector in boroughs. By this Act the cost of registration is paid half out of local rates, and half by the State. At election times the returning officer's expenses are to be paid by the Treasury.

Under the provisions of the Ballot Act the returning officer is required, in the case of a county election, to give notice of an election within two days after that on which he receives the writ; or in the case of a borough election, to give notice on the day on which he receives the writ, or at the latest on the day following.

In county or district borough elections the nomination must take place within ten days of the receipt of the writ, at least three clear days, however, being allowed to elapse between the first public notice and the day of nomination. In ordinary borough elections the candidate must be nominated not earlier than the third day after public notice, and not later than the fourth day after that on which the writ is received. A candidate is nominated in writing, with the signatures of a proposer, seconder, and eight other electors, all registered in the constituency to be represented. In the event of there being more candidates than vacancies, the returning officer adjourns the election for the purpose of taking a poll.

The polling must take place not less than two or more than six clear days after the day of nomination, if it be a county or district borough election; in the case of an ordinary borough, it must take place not more than three clear days after nomination, Sundays, Christmas Day, &c., not being counted as days.

Where the votes for rival candidates are equal, the returning officer, if registered in the constituency, may give the casting-vote. If he decline to do so, a scrutiny is demanded, which usually results in certain deductions on the ground of spoiled

papers, disqualified voters, &c., sufficient to give one candidate priority. In elections for the school boards the cumulative system of voting is employed (*see* CUMULATIVE VOTE).—Cf. C. Seymour and D. P. Frary, *How the World Votes.*

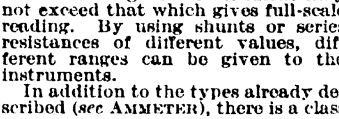
ELECTOR (Ger. *Kurfürst*, 'electoral prince'), the title of certain princes of the Holy Roman Empire, who had the right of electing the emperors. In the reign of Conrad I, King of Germany (912–918), the dukes and counts became gradually independent of the sovereign, and assumed the right of choosing future monarchs. In the thirteenth century the number of these electors was seven—the Archbishops of Mainz, Cologne, and Trèves, the King of Bohemia, the Count Palatine, the Duke of Saxony, and the Margrave of Brandenburg. In 1648 an eighth electorate was created to make room for Bavaria, and Hanover was added as a ninth in 1692. The votes of the Palatinate and of Bavaria were merged in one in 1777. In 1802 the two ecclesiastical electors of Cologne and Trèves were set aside, and Baden, Württemberg, Hesse-Cassel, and Salzburg declared electorates; so that there were ten electors in 1806 when the old German Empire was dissolved.—Cf. Viscount Bryce, *The Holy Roman Empire.*

ELECTRA, in Greek legend, the daughter of Agamemnon and Clytaemnestra, and the sister of Iphigenia and Orestes. After her father had been murdered by his wife, she assisted her brother in avenging his death. The three famous Greek tragedians, Aeschylus, Sophocles and Euripides, have written dramas dealing with the life story of Electra, the first of the three being called *Choëphoroi* from the chorus of captive Trojan women offering libations at Agamemnon's tomb, and the other two *Electra.*

ELECTRICAL FISHES, a name given to fishes possessing the property of communicating an electric shock when touched with the hand or any electric conductor. One of the best known is the electric eel (*Gymnótus electricus*), a native of South America. It is of nearly equal thickness throughout; head and tail obtuse; ordinary length, 3½ to 4 feet. The seat of the four electrical organs is along the under side of the tail, and they are said to possess the power of knocking down a man, and of painfully numbing the affected limb for several hours after the shock. After a few discharges, however, the faculty of producing a shock is impaired, and an interval of rest is required for a new storage of force. Similar but less-marked powers are possessed by an African cat-fish (*Malapterurus electricus*), in which the electric organ invests the entire body as a sort of jacket under the skin. Still feebler in this respect are the electric rays, of which the best known (species of Torpedo) are native to the Mediterranean, Red Sea, Atlantic, and Pacific Oceans. Here the electric organ consists of a large mass on each side of the front part of the body.

ELECTRICAL MEASURING INSTRUMENTS, the name given to instruments which measure electric power, energy, voltage, or current. The majority of such instruments are current-operated. Thus, with the exception of electrostatic voltmeters, all voltmeters are really current measuring instruments; but since this current is made to be proportional to the P.D. between the voltmeter terminals, the scale reading is proportional to the voltage being measured. One and the same instrument may be used as an ammeter or as a voltmeter, by providing it with shunts for use as an ammeter, and series resistances for use as a voltmeter. If the current to be measured is large, the *shunt* will have a very *low* resistance compared with that of the instrument, so that only a small fraction of the total current passes through the instrument. Similarly, when a large P.D. is being measured, the *series resistance* will have a very *high* value, so that the current through the instrument may not exceed that which gives full-scale reading. By using shunts or series resistances of different values, different ranges can be given to the instruments.

In addition to the types already described (*see* AMMETER), there is a class



Electric Fish

depending on the mutual action of current-carrying conductors placed near one another. This type is largely used in alternating-current work. It is also specially suitable for power measurements, and practically all *wattmeters* work on this principle. The Siemens Dynamometer was the first instrument of this type.

The Kelvin Standard Balance is a special form of dynamometer, in which the mechanical turning-moment due to weights on a beam is balanced by the electrical turning-moment due to currents in fixed coils and in coils attached to the ends of

the beam. The electrostatic voltmeter mentioned above is the only instrument which is operated by a P.D. instead of a current. In it a moving vane is attracted into a fixed pair of quadrants; or a set of vanes is attracted into a set of quadrant cells.

The majority of electricity meters are of the motor type, i.e. a disc is driven by motor action at a speed which is proportional to the power passing through the meter. The disc spindle engages with gearing which drives the pointers on a set of dials recording the energy units. There are also meters depending on electrolytic action (Wright meter); or on the difference in period between two pendulums, one of which is controlled by the load current (Aron meter).

ELECTRIC BATTERY, a group of primary or secondary cells, suitably arranged for the purpose of producing an electric current. Primary batteries consisting of a few cells are commonly used for intermittent work where a relatively small current is required, e.g. for electric bells. If a larger current is necessary, especially if it has to be maintained over a considerable period, a battery of secondary cells is used. Such batteries are commonly used for country house lighting. Very large batteries, used either alone or in conjunction with automatic reversible boosters, are frequently employed in public electric supply systems.

The name *electric battery* was originally given to an arrangement of Leyden jars (*see* LEYDEN JAR), but is now applied only to cells, the Leyden-jar arrangement being called a Leyden-jar battery.

ELECTRICITY, the name given to the ultimate cause of electrical phenomena. The laws governing these phenomena are well known, but the actual nature of electricity has not yet been fully revealed, although much light has been thrown on the subject by recent researches. (*See* ELECTRON.) Although the practical applications of electrical phenomena have all been developed within the last fifty years, the production of an electric charge by friction, as demonstrated by the power of rubbed amber to attract light bodies, was observed by a Greek philosopher as long ago as 600 B.C. The Greek name for amber, ἤλεκτρον (electron), is the root from which our word electricity is derived. Friction was the only artificial source of electricity known until Galvani near the close of the eighteenth century, accidentally obtained it by the contact of two metals with the limbs of a frog; and Volta, developing Galvani's discovery, invented the first galvanic or voltaic battery.

The discovery by Faraday in 1831 of the principle of the production of an electromotive force by the motion of a conductor in a magnetic field, laid the foundation for the development of the electric generator (q.v.), and thus of modern electric power supply.

The study of electrical phenomena is conveniently divided into two branches, one dealing with stationary charges of electricity (*electro-statics*), the other with electric currents (*current electricity*).

Electrostatics. If a pair of ebonite rods be electrified by friction with flannel, then by suspending the one rod and presenting the other to it, it is easily demonstrated that a mutual mechanical force of repulsion exists between them. If now a glass rod be electrified by friction with silk, it will be found that it attracts the suspended electrified ebonite rod. These experiments reveal the facts that electric charges may be of two opposite kinds, and that like charges repel one another, while unlike charges attract one another.

The charge produced on glass by friction with silk is called *positive*; that produced on ebonite by friction with flannel is called *negative*. The kind of charge produced depends not merely on the material rubbed, but also on the material of the rubber. Thus a warm dry glass rod becomes *negatively* electrified when rubbed with fur. The rubber always becomes electrified with a charge of the *opposite* kind to that produced on the material rubbed, and these two charges are *equal in amount*. All bodies may be electrified by friction, but those which allow a free movement of the charge over them (such bodies are called *conductors*, to distinguish them from *insulators*, which do not allow this free movement) must be held by an insulating handle, or else the charge will be removed as quickly as it is produced.

Coulomb proved that the magnitude of the mutual mechanical force exerted between two charged bodies depends on the amounts of the charges and the distance between them. Faraday called attention to the influence of the medium in which the charges are placed. Thus if two charges of q_1 and q_2 units respectively are placed d centimetres apart in a given medium, the mechanical force f in dynes exerted between them is given by the equation $f = \frac{q_1 q_2}{K d^2}$, provided the dimensions of the bodies on which the charges are concentrated

are small in comparison with *d*. The coefficient K is called the *dielectric constant* of the medium, and its value is taken as unity for air.

In accordance with this relationship, *unit charge* is defined as that charge which repels an equal and similar charge placed at a distance of 1 centimetre in air, with a force of 1 dyne.

If the medium surrounding a charged body be explored with a unit charge, a mechanical force varying in magnitude and direction from point to point will be found to act on the unit charge. In such a case, an *electric field* is said to exist in the medium.

The *strength of the electric field* at any point is defined as numerically equal to the mechanical force which would act on a unit charge placed in

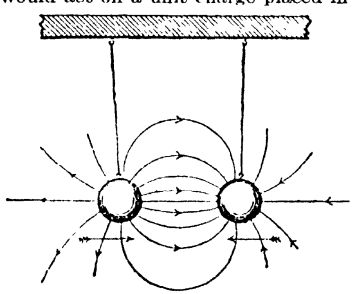


Fig. 1

air (or more strictly in a vacuum) at that point. The *direction* of the electric field at any point is defined to be the direction of the mechanical force acting on a unit *positive* charge placed at that point.

It should be noted that the strength of the electric field and the mechanical force are numerically equal only when the dielectric constant of the medium is unity. Thus if F is the field strength, K the dielectric constant, and U the mechanical force acting on a unit charge, F = KU.

It is very convenient to represent an electric field by means of what are called *lines of electric force*. If lines are drawn, starting from a positive charge and ending on a negative charge, such that the tangent to the line at any point is the direction of the electric force at that point, these lines are called lines of electric force. They can be drawn in such a way that the strength of the electric field at any point is numerically equal to the number of lines of electric force passing through unit area surrounding that point (and taken at right angles to the direction of the force). The lines of electric force will thus completely represent the electric field.

Further, if the following properties are attributed to the lines of electric

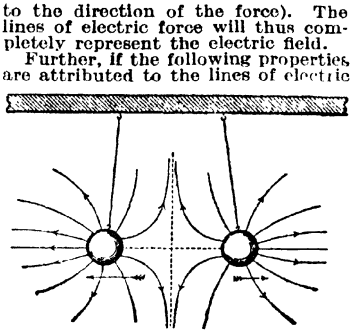


Fig. 2

force, viz. (*a*) that a line of electric force tends to shorten itself as far as possible; (*b*) that lines of electric force mutually repel one another; then all the phenomena due to the presence of an electric field may be interpreted by the behaviour of the lines of electric force.

Figs. 1 and 2 show the lines of electric force in the space surrounding two charged spheres. Fig. 1 shows the case where the charges are opposite, fig. 2 the case where they are similar. In fig. 1 the attraction between the spheres may be thought of as due to the tendency of the lines of force to shorten themselves. Similarly, the mutual repulsion of the spheres in fig. 2 may be regarded as a consequence of the mutual repulsion of the lines of force.

The distribution of a charge upon an insulated conductor isolated in space depends upon the shape of the conductor. If the conductor is

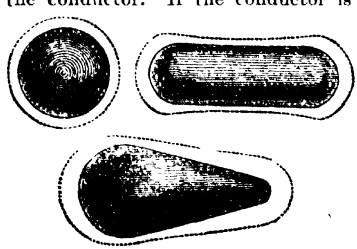


Fig. 3

spherical, the charge is uniformly distributed. If the curvature varies from point to point, the quantity of charge per unit area, or the *electric surface density*, will vary from point to point. The sharper the curvature is, the greater the surface density will

be. In fig. 3 the distance of the dotted lines from the surface of the conductors is proportional to the surface density. These lines, therefore, give a graphical representation of the distribution of charge. In sharply pointed conductors nearly the whole charge will be concentrated at the pointed end. Owing to the large charge per unit area at the pointed part, particles of dust, water-vapour, &c., will be powerfully attracted, will become charged by conduction, and will then be powerfully repelled. In this way the original charge will be rapidly dissipated. This effect may be shown by keeping a sharply pointed conductor powerfully charged by an electric machine. The streaming of the particles from the point produces a wind which is sufficient to blow out the flame of a candle.

Conductors which are intended to retain their charge for a long period must be smooth and polished, and the maximum curvature must be as small as possible. In lightning-conductors practical advantage is taken of this 'power of points' to dissipate a charge rapidly.

The distribution of the charge on a conductor is influenced by the presence of other conductors, whether charged or not. This is due to what is called *electrostatic induction*. If an uncharged insulated conductor B is brought near a charged conductor A, a charge of the *opposite* kind is induced on the parts of B nearer to A, and a charge of the *same* kind on the parts farther away from A. Since B was originally uncharged, these induced charges are equal in amount.

If B is now removed to a distance, the induced charges neutralize one another, and B returns to its original uncharged state.

While B is near A, let the induced charge of the *same* kind as the charge on A be neutralized by touching B with an earth-connected conductor, say the finger. On removing B to a distance, it will no longer be uncharged as before, but will have a charge of the *opposite* kind from that on A. B is now said to have been *charged by induction*.

It is instructive to view these phenomena in the light of the conception of lines of electric force. When B is brought up towards A, some of the lines of force associated with the charge on A, and originally linked to surrounding objects, will now, owing to the tendency of the lines to shorten themselves, be linked to B. At the same time an equal number of lines (of opposite direction relative to B) will link B to the nearest surrounding objects.

Since by definition a line of force starts from a positive charge and ends on a negative charge, the charge on the parts of B nearer to A will be of the *opposite* kind to that on A, but the charge on the part farther from A will be of the *same* kind as that on A. When the earth-connected conductor is brought near B, the lines formerly linking B to surrounding objects will link B to the earth-connected conductor. Finally, when the latter touches B, these lines shorten themselves indefinitely and disappear.

The attraction of light particles to a charged body is explained by electrostatic induction. The charge of opposite kind induced on the particle being nearer than that of the same kind, the particle is attracted. When it touches the charged body, the charge of opposite kind is neutralized,

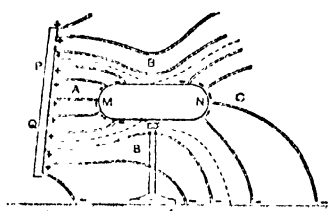


Fig. 4. Induction and Lines (or tubes) of Force

and the charge of like kind now left on the particle causes repulsion to take place. If the electrified body is an insulator, the neutralization of the charges only takes place slowly, and consequently it may be some time before the particle is repelled.

If two charged conductors be connected by a wire, in general it will be found that a flow of electricity from one to the other will take place. This flow is said to be due to a *difference of electric potential* between the two conductors. If no flow takes place, then the difference of potential is zero. Electric potential difference (the contraction P.D. is commonly used) is numerically equal to the work done in carrying a unit charge from the one conductor to the other. If the work is done *against* the electric forces, in moving a unit positive charge from A to B, then B is said to be at a higher potential than A. Although actually it is with *differences* of potential that we have always to deal, it is convenient in many cases to refer these differences to a zero, and speak of *the potential* at a point. The ideal zero of potential would be the potential at a point infinitely far removed from all electrified bodies. In practice it is convenient to regard

the potential of the earth as zero. The potential at a point is then numerically equal to the work done in carrying a unit positive charge from earth to the point. The potential at every point on a conductor is obviously the same, for if it were not so, a flow of charge would take place and equalize the potential. If an insulated uncharged conductor be connected by a wire to a charged conductor, a flow of charge will take place until every point on both conductors is at the same potential. The quantity of charge which each conductor will then have depends on what is called the *capacity* of the conductor.

The *capacity of a conductor* is defined as the quantity of electricity with which it must be charged in order to raise its potential from zero to unity. Thus if Q be the quantity, V the potential, and C the capacity, we have $C = \frac{Q}{V}$. The potential of a conductor is, therefore, directly proportional to the charge upon the conductor, and inversely proportional to the capacity of the conductor.

The capacity of a conductor may be increased by placing close to it another conductor which is kept at zero potential. Such an arrangement is called a condenser. The Leyden jar (*see* LEYDEN JAR) is a well-known example of a condenser. The capacity depends not merely on the dimensions of the conductors and the distance between them, but also upon the nature of the dielectric separating them. The ratio of the capacity of a condenser with a given dielectric to the capacity it would have with an air dielectric, is called the *specific inductive capacity* of the dielectric. Numerically the specific inductive capacity of a dielectric is

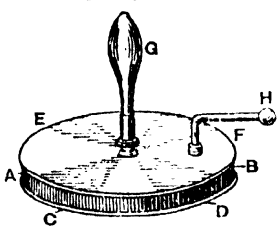


Fig. 5. Electrophorus

equal to the dielectric constant already mentioned.

In the experimental investigation of electrostatic phenomena it is convenient to have appliances which will supply charges as they are required. The simplest appliance of this kind is the electrophorus, which consists of a disc of ebonite or other suitable material with a metallic base, and a metal disc of slightly smaller diameter

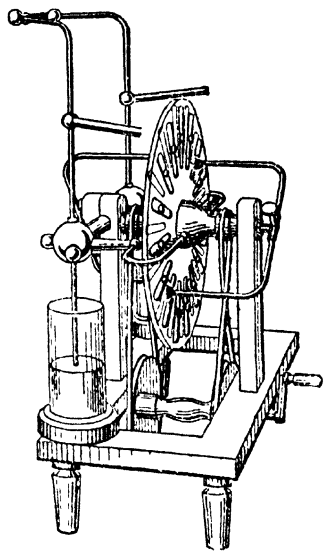


Fig. 6. Wimshurst Machine

having an insulating handle attached at right angles to its surface (*see* fig. 5). To use the electrophorus, the ebonite is given a negative charge by striking it with fur or flannel. The metal disc is then placed on top of the ebonite plate. Since the ebonite is an insulator, no general neutralization of the positive induced charge on the lower side of the metal disc can take place. The negative charge on the upper surface of the metal disc is then neutralized by touching with the finger. The disc is thus left positively charged. The disc is then lifted by the insulating handle, and the charge utilized as required. Theoretically speaking, this process may be repeated continuously without affecting the original charge on the ebonite plate, but in practice the ebonite has to be re-excited from time to time on account of the loss of charge by leakage. More elaborate appliances of many different forms have been used, but the only one of these *electric machines*, as they are called, which is now commonly employed is the *Wimshurst machine*. This machine consists of two circular plates of glass

or ebonite carrying equal even numbers of tin-foil sectors symmetrically placed on their outer surfaces. A pair of brass arms carrying wire brushes, which simultaneously make contact with diametrically opposite sectors on each plate, is so arranged as to lie at an angle of about 45° to the horizontal,and to be at right angles to one another. A pair of combs is placed at each end of the horizontal diameter of the plates, so that the sectors pass close to the teeth of these combs. The combs serve as collectors, and are connected one pair to the positive pole, and the other pair to the negative pole of the machine. The general appearance of the machine is shown in fig. 6. The machine acts on the induction

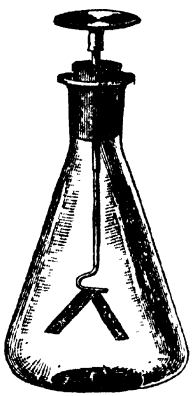


Fig. 7. Electroscope

principle, and if kept warm and dry is self-exciting.

The *electroscope* is a simple piece of apparatus for detecting the presence of an electric charge, determining its sign (positive or negative), and making a very rough comparative estimate of its potential. It consists of a pair of strips of gold-leaf attached to a brass rod terminating in a brass cap. The whole is enclosed in a glass case, or a case having glass sides. The base is made of conducting material. The sides of the case are coated internally with tinfoil (or two rods connected to the base project upwards to the level of the gold-leaf strips). The general appearance of one form of electroscope is shown in fig. 7. The gold-leaf strips, the brass rod, and the cap must be carefully insulated. When a charged body is brought near the electroscope the leaves become charged similarly by induction. The repulsion due to the similar charges causes the leaves to diverge.

If the cap be touched with the finger, the charge on the leaves is neutralized, and the leaves collapse. On removing the charged body the leaves diverge again, owing to the spreading of the charge on the cap, which was held by the inducing charge, over the whole conductor, including the leaves. The electroscope is thus charged by induction. It may also be charged by conduction, i.e. by the direct transfer of a charge to the electroscope. When we know the kind of charge, positive or negative, which has been given to the electroscope, an unknown charge can be tested. If the approach of the unknown charge causes a further divergence of the leaves, then it is of the same kind as that with which the electroscope is charged.

When accurate quantitative measurements have to be made, an instrument called an *electrometer* is used. This instrument, the development of which is due chiefly to Lord Kelvin, is capable of making accurate measurements of electrostatic potential differences down to quite low values.

Essentially an electrometer consists of a light suspended conductor which moves within four fixed quadrants. Opposite pairs of these quadrants are connected together, one pair to one terminal, and the other pair to the other terminal of the instrument. The P.D. to be measured is applied at these terminals. The suspended conductor or 'needle' is charged to a definite high potential, and the deflection produced is observed from the movement of a spot of light reflected from a mirror attached to the suspending fibre. In this case the deflection is proportional to the P.D. between the quadrants. For measuring a high P.D., the needle may be connected to one pair of quadrants. With such an arrangement the instrument is less sensitive, and the deflection is proportional to the square of the P.D. between the quadrants.

Current Electricity. The phenomena connected with the flow of electricity through a conductor come under this heading. Such a flow of electricity will take place if by some means the ends of the conductor are maintained at different potentials. An *electric current* is then said to exist in the conductor. The difference of potential may be maintained by chemical action (*see* DANIELL'S CELL; ELECTRIC BATTERY), by electrodynamic action (*see* GENERATOR), or by heat action (*see* THERMO-ELECTRICITY). The magnitude of the

current which will flow when a steady P.D. is maintained between the ends of the conductor is determined by what is called the electrical *resistance* of the conductor. The resistance R is defined as the ratio of the applied potential difference V to the current I produced, i.e. $R = \frac{V}{I}$. This is a partial expression of Ohm's Law for the Electric Circuit, which in its most general form states that the current which flows at any instant in an electric circuit is equal to the algebraic sum of the electromotive forces existing in the circuit at that instant, divided by the total resistance in the circuit at that instant (*see* ELECTROMOTIVE FORCE).

For the particular case where the algebraic sum E of the electromotive forces is steady and the total resistance R is not varying, we have $I = \frac{E}{R}$. This is the form which applies to steady direct currents. If the current is changing (whether alternating or merely varying in value), varying E.M.F.'s, in addition to the applied E.M.F., exist in the circuit, and the above expression no longer holds good.

The resistance of a conductor depends on its material, and varies directly as the length, and inversely as the cross-section of the conductor. Thus $R = \rho\frac{l}{A}$, where ρ is the specific resistance of the material, l the length of the conductor, and A the cross-sectional area of the conductor. The *specific resistance* is the resistance between opposite faces of a unit cube of the material at a definite temperature (usually 0° C.). The resistance of a conductor varies to a greater or less extent with variation of temperature.

For pure metals the resistance increases considerably with increase of temperature. With certain alloys the change is so slight as to be negligible. In some alloys, and in carbon and insulating materials, the resistance falls with increase of temperature.

Measurement of Resistance. Low resistances can most conveniently be measured by a fall of potential method, based on the relationship $R = \frac{V}{I}$. The current may be read by an ammeter, and the potential difference by a low-reading voltmeter (*see* ELECTRICAL MEASURING INSTRUMENTS). Where greater accuracy is required, a constant current is sent through the resistance to be measured, and also through a known standard resistance of about the same value. A sensitive galvanometer (*see* GALVANOMETER) is used to compare the P.D. across the unknown resistance with that across the standard. Since the current is the same through both, the resistances will be proportional to the galvanometer deflections, and from the known value of the standard resistance the value of the unknown resistance can be calculated. Resistances of moderate value are best measured by a Wheatstone Bridge, or one of its modifications (*see* WHEATSTONE BRIDGE).

A substitution method is more suitable for high resistances. A galvanometer is connected in series with a standard high resistance and a steady source of E.M.F. The deflection is noted. The unknown resistance is now substituted for the standard, and the new deflection noted. Provided the resistance of the galvanometer and other parts of the circuit is negligible in comparison with the resistance to be measured, the resistances are inversely as the deflections. The unknown resistance is, therefore, equal to the ratio of the first to the second deflection multiplied by the value of the standard resistance. For insulation tests on installations, direct-reading instruments are frequently used (*see* OHMMETER).

Effects of an Electric Current. When a current flows in a conductor, the temperature of the conductor is raised. This is due to the power dissipated on account of the resistance of the conductor. The power dissipated is equal to I^2R watts, and by giving suitable values to I and R any required amount of heat per second can be obtained. This *heating effect* of the current is made use of in electric lighting, electric heating and cooking, in electric furnaces, and in certain electro-medical appliances.

If a magnetic needle is brought near a conductor carrying a current, it will be found to be deflected. This is due to the magnetic field, which is always associated with an electric current. This *electro-magnetic effect* is of the utmost practical importance (*see* ELECTRO-MAGNETISM; GENERATOR; ELECTRIC MOTORS).

When a current is passed through a conducting liquid, such as a solution of a metallic salt or a salt in a fused state, chemical action takes place. The behaviour of such a conductor is entirely different from that of a metallic conductor, since a current can flow in it only if chemical dissociation takes place (*see* ELECTROLYSIS).

Practical use of electrolysis is made

in electro-plating, the production of electrotype blocks for printing, the refining of copper, and the production of metallic sodium and potassium. Electrolysis is also used as a means of storing electrical energy in a chemical form (*see* SECONDARY CELL).

An electric current may be constant in direction (*direct current*), or may alternate in direction with a certain frequency (*alternating current*). Alternating currents have advantages for the transmission of large amounts of power over considerable distances (*see* ELECTRIC POWER TRANSMISSION AND



Fig. 1. Positive and Negative Carbons

DISTRIBUTION), and may be used for electric lighting and the operation of electrodynamic machines and apparatus (*see* ELECTRIC MOTORS).

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ELECTRIC LIGHT, a light obtained by the conversion of electric energy into light energy. The usual method is to heat some material to incandescence by passing an electric current through it. The material may be carbon (arc lamps), tungsten wire (all modern incandescent lamps), mercury vapour (mercury vapour lamps), or volatilized metallic salts (flame arc lamps). Other materials have been used, such as zirconium, yttrium, and thorium oxides, and osmium and tantalum among the metals, but they have been displaced entirely by the materials mentioned above.

Ordinary arc lamps, and even flame arc lamps, are being displaced by the modern high-candle-power gas-filled tungsten lamp. Flame arc lamps have a high efficiency, and are still largely used for street lighting, but the cost of the frequent trimming required, even in lamps of the magazine type, gives the gas-filled lamp an advantage over them. Lamps of the mercury vapour class have a high efficiency, and the light has a high actinic value which is valuable for certain photographic processes, but the absence of the red and orange part of the spectrum gives the light a characteristically ghastly effect which limits the use of this type of lamp.

The Carbon Arc. Although the arc lamp has fallen into disuse, the carbon arc is still extensively employed for projection work, as in cinema projectors and in searchlights. The action of the carbon arc is as follows: If a potential difference of about 50 volts is maintained between a pair of carbon rods, and the tips of the rods are momentarily brought into contact and then separated by a short distance, then the current is maintained by an arc across the gap. The temperature of the positive tip rises to about 4000° C., and the tip itself soon becomes hollowed, forming what is called the *positive crater*.

The illustration below represents the two carbons of the arc light as they appear when cold, the positive carbon being marked + and the negative −. The central figure is a magnified representation such as can be obtained by throwing an image of the burning carbons on a screen by means of a lens. In fig. 1 the upper rod is the positive one, and the hollowed shape of the tip is clearly shown. The negative tip becomes roughly pointed in shape, and its temperature is about half that of the positive crater.

The positive crater has an extremely high intrinsic brilliancy, and nearly the whole of the light is emitted from its surface, the negative tip and the arc itself contributing very little. In order to stabilize the arc, a series resistance of a few ohms is necessary. The carbons gradually burn away, the rate of consumption of the positive carbon being about twice that of the negative. It is, therefore, necessary to 'feed' the carbons towards one another. This may be done automatically by the action of a pair of solenoids, one carrying the current which passes through the arc, the

other carrying a current proportional to the potential difference across the arc. These solenoids, by means of a suitable mechanism, act in opposition, the current solenoid separating the carbons, and the potential difference solenoid bringing them closer together. The actions balance one another when the arc is of the correct length.

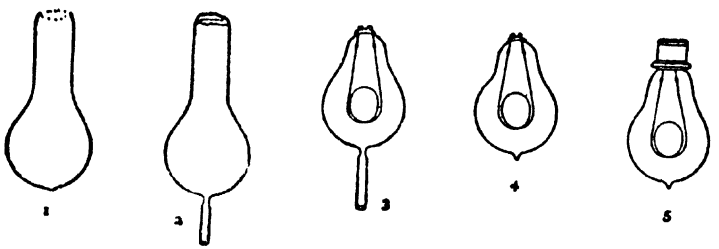
Such an arrangement also serves to strike the arc when the supply is switched on. In order to prevent the arc from wandering round the carbons, the positive carbon is cored, and sometimes the negative carbon also. The core consists of purer softer carbon of lower resistance, and the arc remains centrally placed.

Flame Arc Lamps. The carbon arc principle is modified in these lamps, so that the arc itself supplies nearly the whole of the light. The arc is made highly luminous by impregnating the carbons with metallic salts, which are volatilized and become incandescent in the arc. Their presence also lowers the resistance of the arc, so that its length can be greatly increased.

The tendency of the arc to wander is also increased, so that cored carbons are essential, and their diameter must be made as small as possible. These thin carbons burn away quickly, so that they must be made proportionately longer for the same time of burning. In order to reduce their resistance a soft-metal inner core is used. The carbons, instead of being placed one above the other, are inclined at a small angle with the arc between their lower ends. The arc is made as large as possible by the action of a small electromagnet placed just above the gap.

The feeding mechanism is similar in principle to that used for ordinary carbon arcs. For street lighting, lamps of the magazine type are used. In these lamps a number of pairs of carbons is placed in the magazine, and as each carbon is used up, a new one automatically takes its place.

Mercury Vapour Lamps. In these lamps the light is obtained from incandescent mercury vapour in a tube from which the air has been exhausted. The positive terminal is connected to a small iron electrode at one end of the tube. At the other end there is a small bulb, which contains a little pool of mercury, which is connected to the negative terminal. To start the lamp, the tube has to be tilted, so that a stream of mercury flows along it and makes contact with the iron electrode. The current which then flows vaporizes some of the mercury, and when the tube is tilted back to its original position, the discharge is maintained through the mercury vapour. A small series resistance is required in order to make the operation of the lamp stable. For small lamps a glass tube is used, but owing to the higher temperature reached in lamps consuming considerable power, it is necessary to use a quartz tube for large lamps. Quartz is transparent to ultra-violet light, and to avoid harmful effects the tube is usually enclosed in a larger one of flint glass, which stops the ultra-violet rays.



Stages in the Manufacture of an Incandescent Lamp

1, Bulb as received from furnace. 2, Stem attached for exhausting. 3, Filament sealed in. 4, Lamp exhausted of air. 5, Finished Lamp

Incandescent Lamps. This is the name commonly given to the type of lamp in which the light is produced by an incandescent filament. The filament is enclosed in a glass bulb, which is either exhausted to a high vacuum, or else contains an inert gas under pressure. The filament is heated to incandescence by the current passing through it.

The first lamp of this type to come into general use was the carbon filament lamp. This has now been ousted by the much more efficient tungsten filament lamp. The earlier tungsten lamps were very fragile, owing to the brittleness of the filament. Later, a process was dis-

covered whereby tungsten could be made malleable. The manufacture of drawn-wire filaments thus became possible, and the tungsten filament lamps which are now produced will stand a considerable amount of rough handling. This type of lamp is now in universal use for house lighting.

The limit of temperature at which the filament can be worked is set by the disintegration of the filament, which blackens the bulb and weakens the filament till it breaks. Recent research has revealed that this is due to a double chemical action between traces of water vapour and the incandescent metal. No method of entirely removing water vapour from the bulb has been found, but further research has brought to light the important fact that if the bulb is filled with an inert gas under pressure, the action is reduced to a minimum. This allows the filament to be worked at a much higher temperature, and since the light emitted increases with temperature much more rapidly than the power consumption does, the efficiency of the lamp can be greatly increased. These discoveries have led to the development of the modern *gas-filled lamp*. Owing to the high intrinsic brilliancy of the filament, high candle-power lamps of this type can be made which are not unduly bulky. For this reason, and because of their high efficiency and the absence of the need for any adjustment or attention, gas-filled lamps are coming into extensive use for street lighting and for factory and workshop lighting. Smaller lamps of this type are also being widely adopted for the illumination of shop windows.

ELECTRIC MOTORS, the name given to that division of dynamo-electric machinery in which electrical power is converted into mechanical power.

Electric motors are classified as *direct-current motors* or *alternating-current motors*, according as the electric power taken by the motor is in the form of a direct current or an alternating current. Further subdivisions of each class are made on the basis of differences in the operating characteristics of the various types.

Direct-current Motors. The motor consists of a fixed magnetic field system with a rotating armature, which carries the conductors through which the supply current is passed. The magnetic field, produced in the air-gap between the poles and the armature, reacts with the current-carrying conductors of the armature and produces the *mechanical turning-moment* or *torque*.

At the same time the motion of the conductors through the magnetic field generates an E.M.F. in the conductors. This E.M.F. is in the opposite direction to the applied E.M.F., and is, therefore, called the *back E.M.F.* of the motor. The current taken by the motor is equal to the difference between the applied and back E.M.F.'s divided by the resistance of the armature winding. Since the armature resistance is always low, and the back E.M.F. is zero at starting, some form of starter is necessary in order to limit the current to a safe value. Essentially the starter consists of a suitable resistance connected in series with the armature. As the motor gains speed this resistance is gradually reduced to zero.

The speed at which a D.C. motor runs varies inversely as the air-gap flux per pole, and very approximately, directly as the applied E.M.F. (directly as the back E.M.F. actually).

The torque produced is proportional to the product of the air-gap flux per pole and the armature current. The torque and speed characteristics of a D.C. motor, therefore, depend on the manner in which the air-gap flux per pole varies with the load current.

Series Motor. In this type the field magnet windings are connected in series with the armature winding, i.e. the same current flows in both windings. The air-gap flux per pole, therefore, depends on the current taken by the motor. Consequently, at light loads the speed of the motor is very high, and there is a very large fall in speed as the load increases. The torque increases rapidly with load for the same reason. At starting, a large torque is obtained at a low speed. These characteristics are specially suitable for traction purposes, for crane motors, and for the motors for certain machine tools.

Shunt Motor. In this case the field magnet windings are connected as a shunt to the armature windings, i.e. the current in the field coils depends upon the applied voltage, and is, therefore, constant in normal operation. Apart from the slight effect of the armature magneto-motive force, the air-gap flux per pole, therefore, remains almost constant at all loads. This means that the speed is practically constant at all loads (a very slight fall in speed with load occurs), and the torque, therefore, is almost directly proportional to the load current. The shunt motor is, therefore, suitable for all cases where an approximately constant speed at all loads is required.

Alternating-current Motors. There are wide differences between the various types, both in construction

and operation. The type most commonly used is the polyphase *induction motor*. In this motor both the field system and the armature consist of a slotted core built up of iron laminations. The field system is called the *stator*, and the armature the *rotor*. Both carry conductors in their slots, and these conductors in each case form a polyphase winding. Current is supplied to the stator winding only. The currents in the rotor winding are *induced* by the action of the rotating magnetic field set up by the stator currents. Hence the name induction motor. For starting, a polyphase resistance completes the circuits of the rotor winding. This resistance is gradually reduced to zero as the motor attains its full speed.

The rotor circuits are, therefore, closed upon themselves in normal operation. In many motors (especially small ones which are started unloaded) the rotor winding consists of a series of copper bars brazed to solid end-rings at each end of the core, thus forming a permanently short-circuited winding. Such a rotor is known as a *squirrel-cage rotor*.

The speed characteristic of the induction motor closely resembles that of the shunt D.C. motor, and induction motors are suitable for similar purposes. The induction motor gives its maximum torque at a speed only slightly below the synchronous speed (corresponding to the number of poles in the stator winding and the frequency of the supply); and the torque decreases very rapidly as the speed rises towards synchronism. The maximum torque has a definite value for a given motor, and if the load demands a greater torque than this, the motor slows down and stops.

Synchronous motors are seldom used except for special purposes. They are exactly similar to the ordinary synchronous generator or alternator in construction, and the field system is almost invariably the rotating part. As their name implies, these motors have the characteristic of running at synchronous speed at all loads. If through overloading, or for any other reason, the motor is unable to maintain its synchronous speed, it immediately falls out of step and stops.

Alternating-current Commutator Motors. These motors are in general appearance similar to the induction motor, but the rotor is fitted with a commutator. According to the electrical connections, these motors may be given characteristics similar to direct-current series or shunt motors. Single-phase commutator motors with series characteristics are used on the Southern Railway electric trains.

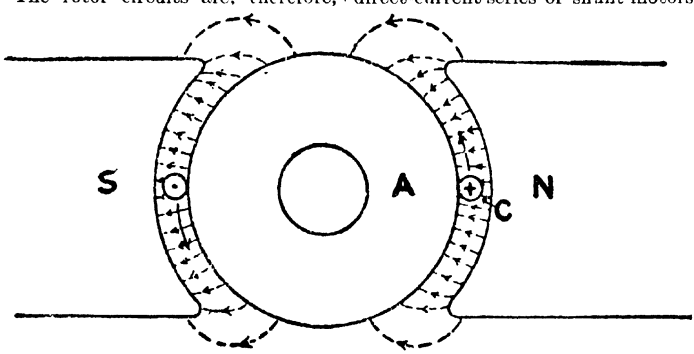


Diagram of a Simple Motor
C, Conductor on surface of iron core A, which is free to rotate between the poles N S of an electro-magnet

ELECTRIC POWER TRANSMISSION AND DISTRIBUTION. In the public supply of electric power in this country, the usual practice is to use alternating-current generators in the power stations, and to transmit the power at a high voltage to substations. The substation plant reduces the pressure to a value suitable to the consumer, and in many instances also converts the alternating current into direct current. From the substations the power is distributed to the consumers.

For a given amount of power transmitted the cross-section of the cables required varies inversely as the square of the voltage. In order to reduce the outlay on cables, it is important that the transmission voltage should be as high as the circumstances permit. Naturally this

becomes more and more important as the distance over which the power has to be transmitted increases. In America, where large amounts of power are transmitted over very great distances, the pressure used is in some cases 150,000 volts, and the tendency is to raise this still further, as switch gear, insulators, and other apparatus capable of withstanding this high pressure are becoming available. For high-tension underground cables, the pressure now coming into common use is 20,000 volts.

The nature of the low-voltage distribution from the substations, whether alternating current or direct current, depends largely on the requirements of the consumers.

In the Thury system of power transmission high-voltage direct current is used throughout. Only one supply in this country is of this kind, but several are in operation on the Continent. Pressures up to 100,000 volts are used.

The Electricity (Supply) Act, 1926, established a Central Electricity Board, charged with the duty of supplying electricity to authorized undertakers in Great Britain. Its chief functions are to construct main transmission lines ('The Grid'), to concentrate generation at standard frequency in selected stations, and to supply electricity in bulk to duly constituted authorities. Schemes covering nearly the whole country have been adopted.

ELECTRIC TELEGRAPH. *See* TELEGRAPH.

ELECTRIC TRACTION and **ELECTRIC TRAMWAY.** In electric traction the mechanical power required for the propulsion of the vehicle is obtained from electric motors. These motors are usually *series direct-current motors*, but for railway work single-phase and three-phase A.C. motors have also been successfully employed (*see* ELECTRIC MOTORS). Up to the present, electric traction on railways has been employed mostly for intense local traffic in this country. In one instance (Southern Railway electrification) single-phase alternating current is used. In all the others the power supply is direct current. *See* RAILWAYS, ELECTRIFICATION OF.

In electric tramways, except in some few instances where there are objections to the use of an overhead construction, the current is conveyed to the motors through a trolley pole carrying a wheel running on an overhead bare copper wire. A hand-operated drum controller, directly controlling the driving and electric braking of the motors, is used. A hand-brake, and commonly a separate electro-magnetic brake, are provided.

Except in very small tramway systems, the power is generated as high-tension alternating current, and transformed and converted at substations suitably placed in the area covered by the tramway (*see* ELECTRIC POWER TRANSMISSION AND DISTRIBUTION). The low-tension D.C. power is distributed from the substations to the trolley wire. The car rails are earthed, and provide a return path for the current. In order to minimize the flow of current to other conductors in the vicinity of the car rails, copper cables returning directly to the substation are connected to the rails at suitable intervals. These earth-return cables are connected in series with special low-voltage dynamos (called *negative boosters*) at the substation. This arrangement automatically keeps the P.D. between the most distant point of the car rails and the substation within a prescribed maximum, and effectively prevents the corrosion of pipes laid near the car rails.

ELECTROCUTION. Method of inflicting the death penalty adopted in the United States. It consists of the passage of a current of electricity of very high voltage through the body of the criminal, who is seated in a specially constructed chair. It is claimed by those who advocate this form of execution that it is more nearly instantaneous and less revolting than other methods. It was adopted by the state of New York in 1888, the first execution taking place in 1890, and by Ohio in 1896.

ELEC'TRODE (Gr. *hodos*, a way), a term introduced by Faraday to denote the wires or other terminals by which electricity either enters or leaves a body which is undergoing electrolytic decomposition. He called the electrode at which the current enters the *anode* (*ana*, upwards), and the electrode at which the current leaves the electrolyte the *cathode* (*kata*, downwards). (*see* ELECTROLYSIS; ELECTRO-METALLURGY). The word is now commonly used in a wider sense to denote the conductor by which contact is made with a medium. In this way electrodes are spoken of in connection with electric furnaces, electric welding appliances, vacuum tubes, and mercury vapour lamps, although the actions are not electrolytic.

ELECTROL'YSIS (Gr. *lysis*, loosening) is the name given to the decomposition of fused salts or solutions of salts, &c., by means of the electric current, and is thus a branch of

electro-chemistry. The substance through which the current is passed is termed the *electrolyte*, and must be either an acid, base, or salt in a fused state or in solution. The current enters the electrolyte by an electrode called the *anode*, or the positive terminal. The electrode by means of which the current leaves the electrolyte is termed the *cathode*, or negative terminal.

During the passage of the current the electrolyte is decomposed, and the products of decomposition are released at the electrodes or terminals. According to the modern theory of electrolysis, all electrolytes contain a greater or smaller number of free *ions*. These ions are chemical radicles carrying a definite electric charge. The kind of charge, positive or negative, depends on the nature of the radicle. The ions exhibit none of the chemical properties of the uncharged radicle.

Thus, for example, in an aqueous solution of sulphuric acid, free ions of hydrogen H_2 carrying a positive charge, and free ions of SO_4 carrying a negative charge, exist. An *uncharged* SO_4 radicle would react with the water present, and sulphuric acid would be formed and oxygen liberated. The *ion* SO_4, however, is incapable of doing this. Owing to the nature of their charges, the hydrogen ions will move towards the negative electrode, and the SO_4 ions towards the positive electrode. On reaching the electrodes the ions give up their charges, and immediately exhibit their ordinary chemical properties. Hydrogen is given off at the negative electrode, while at the positive electrode the uncharged SO_4 radicle reacts with the water present, and oxygen is released.

This is an example of a secondary chemical reaction. This occurs in many cases, and where it occurs the final product is different from that first produced by the electrolytic action. Fresh ions are formed or *dissociated* in the electrolyte as fast as the original ions give up their charges at the electrodes. If this were not so, the electrolytic action would soon cease, since there would be no ions left to move towards the electrodes. The stream of ions carrying their positive and negative charges constitutes the current flowing through the electrolyte. Since the ions carry definite charges, it follows that the amounts of the initial products of an electrolytic action are in the ratio of their chemical equivalents. Thus, if fused silver chloride be electrolysed, for every 108 grammes of silver deposited at one side of the vessel 35·5 grammes of chlorine are given off at the other side. *See* ELECTRODE; ELECTRO-METALLURGY.

The electrolytic action of the current is the same at all parts of the circuit. If the current is made to traverse several vessels, each containing the same substance, all *in series* (that is, the current that leaves the first entering the second, and so on), it will be found that in each of the cells precisely the same amount of decomposition goes on. There will be the same weight of silver deposited at one side, and a corresponding weight of chlorine set free at the other.

The same quantity of electricity decomposes chemically equivalent quantities of different electrolytes. If we pass the current through a series of cells containing different electrolytes, for example, dilute sulphuric acid, chloride of silver, sulphate of copper, and collect the products of decomposition, we find that the quantities of hydrogen, silver, and copper set free are strictly proportional to the chemical equivalents of these bodies.

The quantity of the electrolyte decomposed in a given time is proportional to the strength of the current. This fact is made use of in measuring electric currents for standardization purposes, and the practical unit of current (the ampère) is defined, "with sufficient accuracy for all practical purposes," as being "that steady and unvarying current which deposits silver from a specified solution of silver nitrate at the rate of 0·001118 grammes per second."

The practical applications of electrolysis include the refining of copper, the electro-deposition of metals, electroplating, electrotyping, and the production of metallic sodium and potassium (*see* ELECTRO-METALLURGY). Electrolytic action is also made use of in the storage of electric energy in secondary batteries. *See* SECONDARY CELL.

ELECTRO-MAGNETISM, that branch of science which deals with the mutual relations between electric and magnetic fields. *See* ELECTRICITY; MAGNETISM.

It may readily be shown that when an electric current flows in a conductor, a magnetic field is produced around that conductor, i.e. that a magnetic field is produced by the motion of an electric field. Similarly, if a magnetic field is moved at right angles to a conductor, a potential difference is established between the ends of the conductor, i.e. an electric field is produced by the motion of a magnetic field.

If a conductor is placed in a magnetic field so that its length is at right angles to the lines of magnetic force (*see* fig. 1), and a current is passed

through the conductor, a mechanical force will act on the conductor, and this force will be at right angles both to the conductor and to the original magnetic field.

From the point of view of lines of magnetic force, the magnetic field

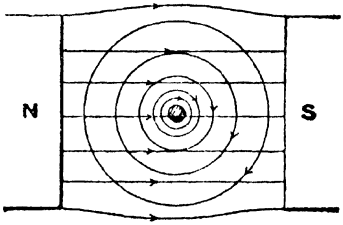


Fig. 1

produced by the current in the conductor (shown by the concentric circles in fig. 1) will react with the original magnetic field (shown by the horizontal straight lines in fig. 1), and the actual resultant magnetic field will have the form shown in fig. 2. The tendency of lines of force to shorten themselves and repel one another laterally results in a force tending to force the conductor vertically downwards. This force is, of course, mutual, and tends to move the original magnetic field in the opposite direction.

All the phenomena of electro-magnetic action have their basis in these three effects, viz. (1) the production of a magnetic field by an electric current; (2) the production of an E.M.F. or P.D. by the relative motion of a magnetic field and a conductor; and (3) the mutual mechanical action between a current-carrying conductor and a magnetic field system.

The strength of the magnetic field produced by the current may be increased by winding the conductor in the form of a helix or solenoid consisting of a number of turns. The effect can be very greatly increased by providing the solenoid with a soft-iron core. The iron is strongly magnetized as long as the current flows. Such an arrangement is called an *electro-magnet*. Electro-magnets specially designed to produce a very intense magnetic field are used commercially in handling scrap-iron, pig-iron, &c. The electro-magnet takes the place of the crane-hook in an ordinary crane. When the current is switched on, the pieces of iron are attracted and held firmly until the current is switched off again.

Electro-magnets are also used for extracting fragments of iron or steel from the eye, and for many laboratory purposes. The most important practical use is the production of the magnetic field required in dynamo-electric machinery (*see* GENERATOR; ELECTRIC MOTORS). The magnetic field produced within a coil in which a current flows is made use of to give the deflecting couple in certain types of galvanometers and measuring instruments. *See* GALVANOMETER; ELECTRICAL MEASURING INSTRUMENTS.

The absolute C.G.S. unit of current is defined in terms of the magnetic field strength produced by it, viz. "when one absolute C.G.S. unit of current flows in a circular loop of one centimetre radius, the magnetic force produced at the centre of the loop is 2π dynes."

The principle of the electro-magnetic generation of an E.M.F. is dealt with under the article ELECTRO-MOTIVE FORCE. The mechanical force produced when a current flows in a conductor placed in a magnetic field forms the basis of the action of electric motors, and certain types of galvanometers and measuring instruments. The mechanical force is a mutual one, and tends to move the conductor and the field system in opposite directions. The magnitude of the force varies as the magnetic field strength, the length of the conductor, and the intensity of the current, and also as the sine of the angle between the field and the conductor. Thus when the direction of the lines of magnetic force is parallel to the conductor, the force is zero; and when their direction is at right angles to the conductor, the force is a maximum. The direction of the force is always at right angles both to the conductor and the direction of the lines of magnetic force. In an

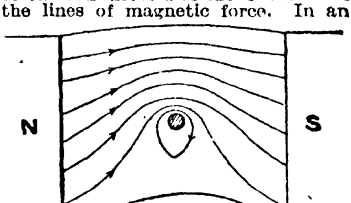


Fig. 2

electric motor the forces acting on the conductors produce the mechanical output of the machine. In a generator these mechanical forces come into existence as soon as current is taken from the machine. In this case they produce a torque which is opposite in direction to the mechanical torque which is applied to the shaft of the generator in order to drive it.

ELECTRO-MEDICAL APPARATUS. Electrical apparatus is now widely used in the treatment and diagnosis of disease. The action of the heart may be very accurately observed by means of the electric cardiograph. The cardiograph itself consists of a very sensitive 'string' galvanometer (*see* GALVANOMETER) and an arrangement whereby the spot of light is focused on a moving photographic plate. In this way a photographic record of the movements of the galvanometer mirror is obtained. The galvanometer terminals are connected to two different parts of the body of the patient (say to a hand and a foot placed in separate brine baths), and the variations of potential differences which occur during a heart-beat cause a movement of the galvanometer mirror.

The X-ray apparatus has recently been adapted for taking instantaneous photographs of the heart. A single powerful discharge from a static transformer takes place through the tube, and a photograph of the position of the heart at that instant is obtained. The X-ray apparatus is very well known from its use in locating fractures, foreign bodies, diseases of the bone, &c.

The X-ray discharge is used as a treatment for certain skin diseases (especially ring-worm), rodent ulcer, and cancer. Very high-frequency alternating currents may be passed through the body without producing the muscular contractions which are a feature of the passage of low-frequency currents through the tissues. Currents of considerable magnitude of very high frequency may thus be passed through the body without inconvenience to the patient. In this way general or local heating of the body may be obtained. This process is known as diathermy. The heating locally may be made sufficiently great to cause coagulation of the tissues, or even actual burning. This method is used in the treatment of tumours and other growths.

Another important electro-medical treatment consists of the local introduction of a drug, into the affected part, by electrolytic action. Thus in the treatment of rodent ulcer, a pad of lint saturated with a 5 per cent solution of zinc sulphate is placed over the ulcer. A zinc electrode is placed on the pad and connected to the positive pole of the supply. The negative pole is connected to a basin of brine in which the patient's hand is placed. The current is made as large as can conveniently be borne (say 30 to 60 milliamperes), and is maintained for about thirty minutes and then gradually reduced to zero. By this means zinc ions are carried into the ulcer. A number of diseases may be treated in this way, the ion used depending on the nature of the case.

Low-frequency intermittent currents from induction coils are frequently used where nerve stimulation or muscular contractions are required. Static electricity is also used for similar purposes. Large Wimshurst machines are used for the treatment of sciatica, and also for neurasthenia. In the latter case a brush discharge is used, and the patient experiences very little physical sensation. The high-frequency apparatus already referred to in connection with diathermy is valuable for the treatment of rheumatism in its earlier stages, and for the stimulation of the scalp in hair treatment. Suitable electrodes are passed backwards and forwards over the affected parts, a bluish brush discharge taking place between the patient and the electrode.

ELECTRO-METALLURGY is that branch of metallurgy which uses electrical energy, wholly or in part, for the extraction or treatment of metals. The energy may be converted into heat and used for processes in which high temperatures are necessary, or it may be used for the decomposition of a compound by electrolysis, which may proceed in a fused bath at a comparatively high temperature, or in a solution bath containing a compound of the metal dissolved in a suitable solvent.

The former method of utilizing the energy embraces electrothermal processes, and the latter method, electrolytic processes.

In electrothermal processes, the heat developed by the electric current has been used in a number of industries, including welding, annealing, heat treatment, smelting, refining, &c. Laboratory apparatus, such as tubes, muffles, and crucibles, are also frequently heated by means of an electric current.

For the electric welding of metals there are two systems in use: resistance welding, in which the portions to be welded are pressed together and heated by the resistance they offer to the passage of a current; and arc welding, in which portions of metal of the same composition as that to be welded are fused on by striking an arc from a suitable electrode. In the electrical annealing of metals, case-hardened steel plates are locally softened where rivet-holes, &c., are required by passing an electric current through copper poles placed 1 or 2 inches apart on the smooth surface. Metallic wire is frequently heated to the annealing

temperature between drawing operations, and various types of annealing furnaces are also electrically heated.

In electric smelting, the high temperature of the arc (3600° C.) may be used for the reduction of certain metallic oxides, which at the lower temperature of furnaces heated by coal, coke, gas, &c. (2000° C.), will not give up their oxygen to carbon; other ores are also sometimes smelted by electrical means, especially in localities where current is cheap and fuels are dear. The production of refined steel, special alloy steels, and certain non-ferrous alloys is also carried out in electric furnaces of various types.

The electric arc was first applied to fusion by Siemens in 1879; he fitted, into the bottom of a crucible to receive the charge, a water-cooled copper casing to form the positive pole, and suspended a carbon rod centrally in the crucible to form the negative pole. The current crosses the air-gap between the metal and the negative pole, forms an arc, and rapidly fuses the metal. In 1885 the Cowles Brothers, of Cleveland, Ohio, began to produce aluminium-copper and aluminium-iron alloys by arc smelting, and later produced other metals, difficult to reduce, by the same means. More recently, the development of electric smelting has made rapid strides. Electric furnaces not only yield higher temperature, but have other advantages over furnaces heated by carbon. They develop the heat in a small space, just where it is required for the operation, so that the furnace can be smaller, and less heat is lost by radiation; the charge can be kept free from gaseous products of combustion; the temperature and the whole operation is under better control; and the expense of running the furnace is limited to the time the current is used for doing useful work.

Electric furnaces are now used in the production of pig-iron, steel, ferro-alloys, brass, zinc, &c., and in the heat treatment of various metals. Classifying them according to the manner in which the electrical energy is converted into heat, we have:—

1. Direct resistance furnaces, in which the heat effect is produced within the metal itself by the resistance offered to the passage of the current through it. This type is used in the refining of steel.

2. Indirect resistance furnaces, to which class belong the various tube and crucible furnaces used in laboratories. The vessels to be heated are wound with wire or ribbon of high resistance, such as platinum, nickel-chrome alloys, &c., and a suitable current passed. Heat-treatment furnaces on a fairly large scale also use this method, a nickel-chrome alloy ribbon being wound on a suitable framework; the heating element in these furnaces, however, generally consists of granular carbon confined in carborundum fire-sand troughs.

3. Induction furnaces, in which a primary coil of copper wire is used, the secondary being formed by the metal charge itself, contained in a suitable annular groove. In this furnace the current passes through the primary and induces a current in the charge, thus melting it. This type of furnace has been largely used in the refining of steel, and to some extent in the melting of non-ferrous metals and alloys.

4. Direct arc-heating furnaces, as exemplified in the Siemens crucible furnace mentioned above.

5. Indirect arc-heating is used in the Stassano furnace, in which the heat is obtained by radiation from the arc, and by reflection from the roof and sides of the furnace. This furnace has been used in the production of steel from scrap, and also direct from ore. There are three electrodes, which nearly meet in the centre of the furnace.

6. Combined resistance and arc furnaces are very largely used for the production of ferrous alloys, such as ferro-silicon, ferro-chrome, and ferro-manganese; for the production of steel from scrap, and for the final refining of steel produced by other processes. In these furnaces the heat is generated largely by the arc, and to a smaller extent by the resistance offered by the whole or a portion of the furnace charge to a powerful electric current. There are several well-known commercial furnaces working on this principle, the best known probably being the Héroult. This furnace is designed for tilting and is lined with basic material, and large electrodes pass through the roof. An alternating current of 4000 amperes at 110 volts is used for a 3-ton furnace, and the intensity of the current passing through the bath is regulated by raising or lowering the electrodes.

The effect of the European War has been enormous on the development of the electric furnace in this country, for prior to the war in 1914, although the use of the electric furnace for steel-making was increasing, there were only 5 furnaces in operation in Sheffield, and two or three more in other parts of the country, producing in all about 15,000 tons per annum. Soon after

the commencement of the war, it became necessary to deal with the rapidly accumulating quantity of shell turnings, to make substitutes for Swedish iron and steel, which could not be imported, and to make large quantities of special alloy steel for various war purposes. As a result of these demands, within four years the number of electric furnaces increased to over 100, the steel produced being over 200,000 tons per annum. Since 1918 the number of furnaces has further increased, and probably reached 150 of various sizes and makes in 1920. In America a similar development has taken place, the number of furnaces increasing from 7 in 1907 to 363 in 1920, the output of electric steel in 1918 amounting to over 500,000 tons. In France, also, great strides have been made, and owing to the shortage of pig-iron, synthetic processes for its production from iron and steel scrap and ore were developed in open-pit arc-resistance furnaces, yielding 220,000 tons in 1916–8.

Electrolytic Processes. The application of electrolysis for the production of metals from a fused electrolyte is most important in the case of aluminium. This metal cannot be produced by direct electrolysis in aqueous solution, but is deposited electrolytically from a fused bath of cryolite, containing alumina in solution. As the metallic aluminium is extracted from the molten bath, further quantities of purified oxide are added. The anodes consist of carbon blocks suspended in the molten bath, and the cathode consists of the carbon lining of the furnace. Calcium, cerium, lithium, magnesium, potassium, sodium, and strontium are obtained by the electrolysis of fused chlorides, sodium being also obtained from fused hydroxide and fused nitrate.

Metallic magnesium was obtained by the electrolysis of the fused chloride by Bunsen in 1852, but the application of electrolysis as a means of recovering metals from ores by means of aqueous solutions dates back to 1836, in which year Becquerel obtained copper from sulphide ores by first extracting the copper as sulphate or chloride, and then recovering the copper by the electrolysis of the solutions, using insoluble anodes. The method has since chiefly been applied to the treatment of copper ores and products, but has also been used for the recovery of nickel, gold, zinc, &c. The production of electrolytic zinc from solutions has been encouraged as a result of the shortage of pure zinc for war purposes, and several processes have been developed. In these processes the solution used consists either of zinc sulphate or of zinc chloride, the anodes consisting of metallic lead or of carbon, and the cathodes of pure zinc sheets.

It is in connection with the refining of metals that electrolytic processes become of prime importance. Elkington, in 1865, was the first to refine impure metallic copper electrolytically and recover the silver contained in it. Pure copper is now commonly obtained from impure copper anodes in an electrolyte of copper sulphate containing free sulphuric acid, a current density of 12 to 15 amperes per square foot being used at 0·34 to 0·44 volt. Gold is also refined by a similar process, the electrolyte used consisting of gold chloride solution containing free hydrochloric acid. In this case a current density of 100 amperes at 1 volt is used. Silver is likewise refined in a silver nitrate bath, iron by the electrolysis of sulphate or chloride solution, and lead in a solution of lead fluosilicate containing free hydrofluoric acid.

In all the above-mentioned processes the anode is cast from the impure metal to be refined, and the cathode consists of a sheet or plate on which the pure metal is deposited.

It will be seen that these refining processes are very similar to electroplating methods.

ELECTRO-MOTIVE FORCE, the name given to the force tending to produce a flow of electricity in an electric circuit. The electro-motive force, or E.M.F., is measured in terms of the work done in carrying unit quantity of electricity once round the circuit.

Thus unit electro-motive force (absolute) is said to exist in a circuit if 1 erg of work is done in carrying 1 coulomb of electricity once round the circuit. The potential difference, or P.D. (in electro-magnetic units), between two points in an electric circuit is similarly defined in terms of the work done in carrying 1 coulomb of electricity from the one point to the other.

Production of an Electro-motive Force. There are several sources of E.M.F., e.g. (*a*) chemical action, as in primary and secondary cells; (*b*) thermo-electric action, as in the thermopile; (*c*) electro-magnetic action, as in generators, motors, transformers, and induction coils.

The electro-motive force due to chemical action depends on the material of the electrodes and the nature of the electrolyte, and also to a slight extent on the temperature. Thus, for any given pair of materials (say zinc and copper) immersed in

a certain electrolyte of given strength (say dilute sulphuric acid), the E.M.F. produced at a given temperature has a definite value. For a discussion of the electro-motive force produced by thermo-electric action. *See* THERMO-ELECTRICITY.

The principle of the electro-magnetic generation of an E.M.F. may be stated in its most general form as follows: If lines of magnetic force are interlinked with an electric circuit, and if by any means the number of interlinkages of the lines of magnetic force with the circuit is made to change, then an E.M.F. will be generated in the circuit, the magnitude of this E.M.F. being proportional to the time rate of change of the interlinkages. Thus, if the interlinkages are changing at the rate of one per second, one absolute unit of E.M.F. will be generated; or if the interlinkages are changing at the rate of a hundred million per second, an E.M.F. of 1 volt will be generated. It is immaterial in what manner the change of interlinkages is brought about.

A permanent magnet may be moved so as to vary the lines of magnetic force linked with an electric circuit, as in magneto-generators; or the circuit may be moved through a magnetic field (*see* GENERATOR; ELECTRIC MOTORS); or the magnetic field produced by a current in one coil linked with a second coil may be varied by varying the current in the first coil, as in static transformers and induction coils.

The electro-magnetic generation of an E.M.F. is the fundamental principle which has made possible the generation and utilization of electrical energy on a large scale.

ELECTRON, the atom of electricity, more especially of negative electricity. The first light on the question of the structure of electricity came from the laws of electrolysis (q.v.), established by Faraday. These laws are explained very naturally if we make the assumption that electricity, like matter, is atomic, the atom being the charge carried by the hydrogen ion. Clerk Maxwell even proposed to call this charge 'one molecule' of electricity, but added the remark that "it is extremely improbable that when we come to understand the true nature of electrolysis we shall retain in any form the theory of molecular charges, for then we shall have obtained a secure basis on which to form a true theory of electric currents, and so become independent of these provisional hypotheses." To-day, however, so far are we from discarding the hypothesis of the atomic nature of electricity that we find ourselves compelled by the pressure of experimental facts to interpret all electrical phenomena, in metals as well as in electrolytes, in terms of this very hypothesis. Any statical charge is supposed to be made up of a very great number of electrons, just as a material body is composed of atoms of matter. A metallic conductor is supposed to contain many free electrons, which normally bear much the same relation to the material molecules as a saturated vapour bears to the liquid in equilibrium with it. When an electro-motive force is applied, it causes a drift of the electrons in the opposite direction to the force, the charge on the electrons being negative. It is this drift of electrons which constitutes an electric current.

The striking advances that have been made in our knowledge of the nature of electricity since the last years of the nineteenth century have been due chiefly to the study of the electric discharge in gases. Hittorf in 1869 and Crookes in 1879 examined the rays, now called the cathode rays, which stream from cathode to anode in a tube containing gas of very low pressure. The phenomena suggested to Crookes that the rays consist of material particles carrying a negative charge and moving at a high speed; but many physicists rejected this explanation, holding that the rays were due to some form of wave motion in the ether. About 1897 it was conclusively shown by Perrin, Wiechert, and Sir J. J. Thomson that Crookes's view was the correct one. Sir J. J. Thomson measured the velocity of the particles, and also the ratio of the charge e to the mass m of each. His method was to subject a fine beam to the action of two fields of force, one magnetic, the other electric, and both perpendicular to the line of motion and also to each other. The electric field being X, and the magnetic field H, the forces on a particle were in the same direction, and equal to eX, evH. Either field by itself deflected a fine beam, as was shown by the motion of a spot of light where the beam struck a fluorescent screen. The value of X was adjusted till there was no deflection in the combined fields. Hence X = vH, and v was found from the measured values of X and H. The deflections under the two fields acting separately were also observed. Either of these deflections, when v is known, gives the value of the ratio e/m. The values of the velocity v were found to depend on the E.M.F. between the terminals of the discharge-tube. They varied from $\frac{1}{10}$ to $\frac{1}{3}$ of the velocity of light.

The fraction e/m, however, had always the same negative value, no matter how the material of the cathode and the nature and pressure of the gas were varied.

Many other ways of obtaining these negatively charged particles, or electrons, are now known. The β-rays from radio-active substances (*see* RADIO-ACTIVITY) are simply electrons moving with great speeds, approaching sometimes within 2 or 3 per cent of the velocity of light. Hot metals give off electrons copiously; this property is used in the construction of the Coolidge X-ray tube and of the thermionic valve (q.v.). A metal plate illuminated by ultra-violet light, from an electric arc or spark, for instance, gives off electrons moving at all velocities below a certain maximum (*see* PHOTO-ELECTRIC EFFECT). From whatever source the electrons are derived, their properties are found to be the same.

The determination of e and m separately is a much more difficult matter than the determination of their ratio. The first attempt to measure e directly was made by Townsend, and published in 1897. Townsend obtained his ions in the hydrogen and oxygen given off when caustic potash is electrolyzed. The charged gases when bubbled through water formed a cloud. This cloud could be completely removed by bubbling through concentrated sulphuric acid, but reappeared when the gas came out again into the atmosphere, owing to the condensation of water-vapour on the ions. Townsend determined the weight of the cloud and its total charge. He also found the average weight of the minute spherical drops forming the cloud by observing their rate of fall under gravity, and calculating their radius from a theoretical formula known as Stokes's law, viz. $v = \frac{2}{9}\frac{g a^2 \rho}{\eta}$, where a is the radius, ρ the density, v the velocity of the drop, and η is the viscosity of air. The weight of the cloud divided by the weight of a drop gave the number of drops, which was presumably the same as the number of ions. Finally, dividing the total charge by the number of ions, Townsend found e, the average charge carried by an ion. His value came out about three-fifths of the value accepted now.

This pioneer method of Townsend's has been improved and modified in various ways by C. T. R. Wilson, Sir J. J. Thomson, H. A. Wilson, and notably by Millikan, of Chicago. Millikan's charge carriers were minute oil drops, which were given elementary charges by means of ionizing rays from radium. Observations were made of the equilibrium and motion of these charges under the combined influence of gravity and a strong vertical electric field, the intensity of which could be varied at will. A single drop could be kept in view for several minutes at a time, and note was taken of the effect of each new charge as it was picked up by the drop. On calculation, the charge was found in all cases to have very approximately the same value. It so happened, as a consequence of the method of producing the drops, that they carried a small frictional charge, and incidentally Millikan was able to verify that this was always an integral multiple of the electronic charge e. Millikan's result, which is most probably the best yet found, is that $e = 4{\cdot}774 \times 10^{-10}$ absolute electrostatic units, or $1{\cdot}591 \times 10^{-20}$ absolute electro-magnetic units.

An indirect but very interesting method of determining e was devised independently by Regener and by Rutherford and Geiger. The special feature of this method is the actual counting of the number of α-particles (*see* RADIO-ACTIVITY) shot out per second through a given solid angle by a small speck of radium. Each α-particle produces a scintillation on a sensitive screen placed in its path, and these scintillations are counted one by one by the observer. The total quantity of electricity carried by the α-particles emitted in one second is measured independently. The charge on each particle is then found by simple division. This charge is found to be almost exactly twice Millikan's value for e, as it ought to be, as it is practically certain that the α-particle is an atom of helium which has lost two electrons.

The value of e/m, as determined by Thomson's method described above, is $1{\cdot}76 \times 10^{7}$ e.m.u. per gramme, or $5{\cdot}29 \times 10^{17}$ e.s.u. per gramme. Taking this with Millikan's value for e, we find $m = 0{\cdot}902 \times 10^{-27}$ grammes. The exact determination of e has made it possible to assign precise values to several other important physical constants, which formerly were only known roughly from data depending on the Kinetic Theory of Gases. Thus Avogadro's constant N, or the number of molecules in one gramme-molecule (molecular weight in grammes) of any gas can be connected with e by the exact measurements of electrolysis, which give $Ne = 9650$ e.m.u. It follows that $N = 6{\cdot}06 \times 10^{23}$, and that the number of gas molecules per cubic

centimetre at 0° C. and 76 centimetres pressure is $2{\cdot}70 \times 10^{19}$. We find at once also the mass of the hydrogen atom as $1{\cdot}66 \times 10 \times -^{24}$ grammes, the density of hydrogen being known to be ·0899 grammes per litre. The mass of the electron is therefore about 1/1840 of the mass of the hydrogen atom, which till the isolation of the electron was the smallest mass known.

It is necessary, however, to scrutinize with some care the meaning of the word mass as applied to an electron. The determination of the mass of the hydrogen atom ultimately depends on weighing, that is, on finding its gravitational inertia. We cannot weigh an electron, but must determine its mass by experiments involving its motion, the word mass here meaning the ratio of the force acting on the electron to the acceleration produced, and the force being calculated from the charge and velocity of the electron on the principles of electrodynamics. An electron being entirely different in its physical nature from ordinary matter, the question arises whether its mass, as calculated in this way, is actually a definite constant, as it is for a material particle, according to the accepted principles of Newtonian dynamics. It can even be shown, as was first done by Sir J. J. Thomson, that a moving charged body possesses inertia in virtue of the mere fact that it carries a charge. The value of this inertia, or electromagnetic mass, when the velocity is small compared with that of light is, in a vacuum, for a small sphere of radius a, $\frac{4}{3}e^2/a$, where e is the charge. If the velocity is greater than, say, $\frac{1}{10}$ the velocity of light, the formula for the electro-magnetic mass is more complicated, and, indeed, cannot be calculated without some assumption as to the internal distribution of charge in the electron itself. Two formulæ for the mass have been given, one by Abraham, the other by H. A. Lorentz. Abraham started from the supposition that the electron is a rigid sphere carrying a uniform surface charge. Lorentz showed that a simpler theory could be obtained by the hypothesis that the electron contracts, in the direction of its motion, by a certain definite amount depending on its velocity. On both theories the value found for the mass depends on the relation between the direction of the force and the direction of the motion. On Lorentz's theory the longitudinal mass, or mass when the force is in the direction of the motion, is $m_0/(1-\beta^2)^{\frac{3}{2}}$; and the transverse mass, or mass when the force is perpendicular to the velocity, is $m_0/(1-\beta^2)^{\frac{1}{2}}$; where m_0 is the mass for very small speeds, and β is v/c, the ratio of the velocity of the electron to the velocity of light. The two theories have been tested by various experimenters, with somewhat conflicting results. On the evidence of experiments by Bucherer, however, Lorentz's theory of the contractile electron is now generally accepted, and it is regarded as highly probable that electrons are devoid of all mass except the electro-magnetic mass due to their charge of negative electricity.

No fundamental positive electron has been isolated which at all corresponds to the negative electron, or corpuscle, as it is called by Sir J. J. Thomson. The nearest approach to a positive electron is the nucleus of the hydrogen atom, which carries a positive charge of the same magnitude as the charge on an electron. Practically the whole mass of the atom resides in this nucleus. According to the modern theory of the structure of matter, the neutral atom of any element is built up of a comparatively small number of electrons and an equal number of these positive nuclei. Electrons being present everywhere, and their action influencing all natural phenomena, their properties will naturally come up for consideration from various points of view in other articles. *See* IONIZATION; ISOTOPES; MATTER; RADIO-ACTIVITY; RAYS, ELECTRIC.

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ELECTRO-PLATING, the process of depositing a coating of some selected metal on a given surface by means of electrolysis (q.v.). The most important classes of electro-plating commonly carried out are nickel-plating, used very largely for a variety of articles made of iron, steel, &c.; copper-plating, used for facing printing-blocks and as a first coating to non-metallic substances prior to silver- or gold-plating; silver-plating, for imitation silverware and for cutlery, &c.; gold-plating, for ornamental ware, jewellery, &c. Previous to plating it is necessary to remove all grease, dirt, oxide, &c., from the surface, this cleansing of the articles being the first step in the operations necessary. The exact procedure for cleansing varies with the nature of the articles to be plated, but for the removal of grease a strong caustic alkali bath is generally used. To remove oxide and dirt, scratch-brushing is used, also scour-

ing with pumice-stone. Acid-dipping baths are also employed, muriatic acid or sulphuric acid for iron or steel articles, dipping-acid, which is a mixture of sulphuric acid and nitric acid, for brass. For the actual deposition an electrolytic cell is prepared, containing a solution of a suitable salt of the metal to be deposited, with an anode, generally consisting of a plate of the same metal, attached to the positive pole of the battery used, the article to be treated being connected with the negative pole and thus forming the cathode. When a current of electricity is passed through the solution, a thin coating of metal is deposited on the article forming the cathode, and an equivalent portion is carried into solution from the anode. In the case of nickel-plating, the solution used is made from the double chloride or sulphate of nickel and ammonium, to which salt, sal-ammoniac, &c., may be added. The bath is used at a temperature of 100° F., and cast-nickel plates are used as anodes.

For copper-plating the bath used generally consists of an acid solution of sulphate or acetate of copper, cyanide of potash also being added; in case the article is made of zinc, an alkaline bath is used. The bath may be used cold, but is sometimes kept at about 120° F. For iron simple dipping is sometimes used, as copper is readily deposited on iron without the use of an electric current. For electro-plating of copper, anodes of metallic copper, having a surface equal to that of the articles to be coated, are used.

For silver-plating the solution consists of the double cyanide of silver and potash, and may be used either hot or cold. An article to be silver-plated is often prepared by a preliminary dip in a solution of nitrate of mercury, which causes a slight amalgamation with mercury. After this preliminary treatment it is placed in the bath and a slight deposit of silver obtained, after which it is removed, well brushed, washed, and replaced in the bath. A silver plate is used as an anode. A density of 1½ to 1¾ ounces of silver to the square foot gives an excellent plate about the thickness of common writing-paper.

In gold-plating baths, a hot solution of the double cyanide of gold and potash is used at 170° F., and for the anode platinum foil is frequently used, the strength of the bath being maintained by the addition of fresh quantities of chloride of gold. After all kinds of plating as described above, the goods are thoroughly washed in water, and dried by means of sawdust or in a drying-chamber. In ordinary circumstances the deposited metal presents a dead or matted appearance, and if a bright polished effect is desired, it is burnished and buff-polished. Certain chemicals added to the solution will cause the original deposit to have a metallic lustre.

ELECTRO-THERAPY. Medical term for application of electricity to treatment of disease. Direct and high frequency alternating current and static discharges of suitable strength are used. The results include benefit to the nervous system, the creation of heat at greater depths than can be reached by external application, and the destruction of certain growths.

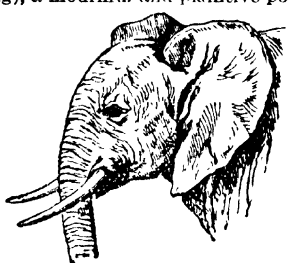
ELECTROTYPE. The production of copper facsimiles by the electric current is called *electrotype*, and is the oldest branch of electro-metallurgy. One of its most important applications is the copying of type set up for printing, and of wood blocks for wood-cuts. A mould is first obtained in gutta-percha or some similar material. This, being a non-conductor, is brushed over with plumbago in its interior, so as to give it a conducting surface to receive the deposit. After several hours the deposit is detached from the mould and backed by pouring in melted solder, the surface being first moistened with chloride of zinc to make the solder adhere. In the copying of steel engravings the mould is obtained by electro-deposition of copper on the steel, the surface of which must first be specially prepared to prevent adhesion; and a second electro-deposition of copper, on the mould thus obtained, gives the required copy, from which impressions can be printed.

ELEC'TRUM (Gr. *ēlektron*), in antiquity, a term applied to native gold, which frequently contains notable quantities of silver, copper, and other metals. According to Pliny, the term electron was applied to native gold containing at least 20 per cent of silver. The term was afterwards transferred from this native alloy to the artificial alloy of gold and silver on account of its colour and inferior lustre. The word originally meant "amber," and was given to impure gold on account of a supposed resemblance. Electrum was used since the eighth or seventh century B.C.

ELEC'TUARY, or **CONFECTION,** is a pharmacopœial preparation. It is solid, but of soft consistence, and contains sugar or honey, impregnated with some more active body. The best known is the confection of senna.

ELE'GIT, in English law, a writ by which a creditor who has obtained a judgment against a debtor, and is hence called the *judgment-creditor*, may be put in possession of the lands and tenements of the person against whom the judgment is obtained, called the *judgment-debtor*, until the debt is fully paid. The writ is addressed to the sheriff, who enforces it. The writ of elegit was first authorized by the Statute of Westminster the Second, which gave the *judgment-creditor* the right to choose between a writ against the debtor's land, and until 1883 his goods also, and an execution by writ against the latter's person or chattels. The new writ, representing the choice of the creditor, was therefore called an elegit, Lat., he has chosen. *See* FIERI FACIAS.

EL'EGY (Gr. *elegos*, mourning, song), a mournful and plaintive poem



Head of African Elephant

or funeral song, or any serious poem of a melancholy contemplative kind. In classic poetry what is known as *elegiac verse* is composed of couplets consisting of alternate hexameter and pentameter lines.

Famous English elegies are *Daphnaida* by Spenser, *Lycidas* by Milton, *Adonais* by Shelley and *Thyrsis* by Matthew Arnold, all commemorating, under classical names, friends of the poets. Tennyson's *In Memoriam* is another elegy; other famous ones are the *Elegy written in a Country Churchyard* by Gray, and Swinburne's *Ave atque Vale* in memory of Baudelaire.

ELEMEN'TAL SPIRITS, according to a belief common in the Middle Ages, spirits proper to and partaking of the four so-called elements, viz. salamanders or fire spirits, sylphs or aerial spirits, gnomes or earth spirits, and undines or water spirits.

EL'EMENTS, the simplest constituent principles or parts of anything; in a special sense, the ultimate indecomposable constituents of any kind of matter. In ancient philosophies the term was applied to fire, air, earth, and water. The mediæval chemists, however, absorbed in the study of metals and mineral substances, supposed that the metals consisted of an elemental sulphur and an elemental mercury mixed together more or less perfectly and in different proportions.

To these were subsequently added salt and some others, so that about the middle of the seventeenth century the first principles amounted to five, divided into two classes; the active, consisting of mercury or spirit, sulphur or oil, and salt; and the passive, consisting of water or phlegm, and earth or the terrestrial part. The names remained, not so much as denoting substances or ultimate principles as gradually coming to denote functions; the first great modification being the expansion of the idea of elemental sulphur into phlogiston by Stahl, as the result of which the adherents of the phlogistic theory applied the term phlogiston to the gases then discovered, the mineral, vegetable, and animal acids, the alkalies, earths, and metallic calces, oil, alcohol, and water.

The substances considered as simple naturally changed with the change of theory introduced by Lavoisier, who considered as elements, oxygen, nitrogen, hydrogen, sulphur, phosphorus, and carbon, the metals and the earths, and, as Boyle had already suggested, practically defined an element as a body not yet decomposed, the definition now commonly adopted. For list of known elements, *see* CHEMISTRY.

EL'EMI, the fragrant resinous exudation from various trees, such as the *Canarium commune*, from which the Eastern or Manila elemi is obtained; the *Icica Icicariba*, the source of the American or Brazilian elemi; and the *Elaphrium elemiferum*, from which the Mexican elemi comes. It is a regular constituent of spirit varnishes, and is used in medicine, mixed with simple ointment, as a plaster.

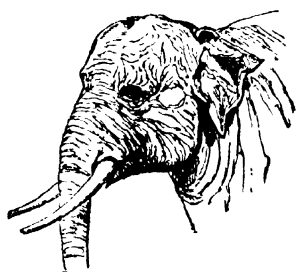
EL'EPHANT, the popular name of a genus, family, or sub-order of five-toed proboscidian mammals, usually regarded as comprehending two species, the Asiatic (*Elephas indicus*) and the African (*E. africānus*). From a difference in the teeth, however, the two species are sometimes referred to distinct genera (Euelephas and Loxodon). The so-called white elephants are merely albinos. The African elephant is distinguished from the Asiatic species by its greater height, its larger ears, its less elevated head and bulging or convex forehead, the closer approximation of the roots of the tusks, and the greater density of the bone. It has also only three external hoofs on the hind-feet, while the Asiatic has four.

All elephants are remarkable for their large, heavy, short bodies supported on columnar limbs, a very short neck, a skull with lofty crown and short face-bones, with the exception of the premaxillaries, which are enlarged to form tusk-sockets. To compensate for the short neck, they have the long proboscis, often 4 or 5 feet in length, produced by the union and development of the nose and upper lip. It is made up of muscular and fibrous tissue. The trunk is of great strength and sensibility, and serves alike for respiration, smell, taste, suction, touch, and prehension. The tusks, which are enormously developed upper incisor teeth, are not visible in young animals, but in a state of maturity they project in some instances 7 or 8 feet. The largest on record (undoubtedly that of an extinct species) weighed 350 lb. Elephants sometimes attain the height of 12 feet or more, but their general height is about 9 or 10 feet. Their weight ranges from 4,000 to 9,000 lb. The period of gestation is twenty months, and the female seldom produces more than one calf at a birth: this, when first born, is about 3 feet high, and continues to grow till it is sixteen or eighteen years of age. It is said that they live to the age of 150 years. They feed on vegetables, the young shoots of trees, grain, and fruit. They are polygamous, associating in herds of a considerable size under the guidance of a single leader. An elephant leaving or driven from a herd is not allowed to join another, but leads a lonely, morose, and destructive life. Such solitary elephants are known as 'rogues'.

Elephants are caught either singly or in herds. In the former case it is necessary to catch adroitly one of the elephant's legs in the noose of a strong rope, which is then quickly attached to a tree; another leg is then caught, until all are securely fastened. His captors then encamp beside him, until under their treatment he becomes tractable. When a herd is to be caught a strong enclosure is constructed, and into this the elephants are gradually driven by fires, noise, &c. With the aid of tame elephants the wild ones are tied to trees and subjected to the taming process.

The domesticated elephant requires much care, and a plentiful supply of food, being liable to many ailments. The daily consumption of a working elephant is, according to Sir J. E. Tennent, 2 cwt. of green food, about half a bushel of grain, and about 40 gallons of water. Their enormous strength, docility, and sagacity make them of great value in the East for road-making, building, and transport. They are used by the great on occasions of pomp and show, being often richly caparisoned, and bearing on their back a howdah containing one or more riders, besides the mahout or driver sitting on the animal's neck. Tiger-shooting is often practised from an elephant's back. Several extinct species are known, the most notable being the mammoth (*E. primigenius*), a contemporary of prehistoric man. The allied genus Mastodon was of very wide distribution, and the Tertiary deposits of the Fayum (Egypt) have yielded the remains of types that bridge over the gap between elephants and more typical quadrupeds. *See* MAMMOTH; MASTODON.—BIBLIOGRAPHY: Andersson, *The Lion and the Elephant*; Sir J. E. Tennent, *The Wild Elephant in Ceylon*; Sanderson, *Wild Beasts of India*; R. Lydekker, *The Game Animals of Africa*.

ELEPHAN'TA ISLE, or GHARAPURI, a small island in the Bay of Bombay, between Bombay and the mainland, 6 miles north-east of the



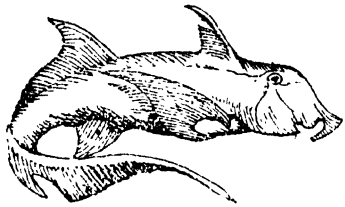
Head of Indian Elephant

former; circumference about 5 miles. It consists of two long hills chiefly overgrown with wood. A city is supposed to have flourished on the island between the third and tenth centuries, but now it has only a few inhabitants, who rear sheep and poultry for the Bombay market. It is celebrated for its rock temples or caves, the chief of which is a cave-temple supposed by Fergusson to belong to the tenth century, 130 feet long, 123 broad, and 18 high. It is supported by pillars cut out of the rock, and containing a colossal figure of the trimurti or Hindu Trinity: Brahma, Vishnu, and Siva. The temple is still used by the Bania caste for the Sawa at certain festivals.

ELEPHANT-FISH (*Callorhynchus antarcticus*), a fish of the sub-class Elasmobranchii (rays and sharks), so named from a proboscis-like structure on the nose: called also Southern

Chimæra. It inhabits the Antarctic seas, and is edible.

ELEPHANTIASIS is a disease characterized by progressive enlargement of a limb, or portion of the body, and occurs most frequently in the legs. The enlargement begins below the knee and gradually involves the entire limb. The onset may be slow and painless, or sudden with fever



Elephant-Fish

and rapid swelling. The disease is common in all countries in which the Filariæ prevail. No drug destroys the embryos in the blood, and in infected districts the drinking-water should be boiled or filtered. In rapid cases rest, liquid diet, purgation, and firm bandaging of the legs are indicated. Surgical treatment for removal of adult Filariæ in enlarged glands has met with some success.

ELEPHANTI'NE, the Greek name of a small island of Egypt, in the Nile, just below the First Cataract and opposite Assouan (Syene). It is partly covered with ruins of various origins—Egyptian, Roman, Saracen, and Arabic, the most important being a gateway of the time of Alexander, a small temple dedicated to Khnum and founded by Amenophis III, and the ancient Nilometer mentioned by Strabo. The latter was restored in 1870 by the Khedive Ismail Pasha.

ELEPHANT ISLAND, a small uninhabited island in the South Shetlands, almost entirely covered with ice and snow. It was the starting-point of Shackleton's memorable boat journey to South Georgia in 1916.

ELEPHANT LORE. The cult of the elephant is found among many nations in Asia and Africa. It exists in Indo-China, Cambodia, Abyssinia, Siam, and Sumatra. The Aryo-Indian god Indra rides on an elephant. Buddha had a white elephant form. One of the Sanskrit names for the elephant is *Naga*, which connects the animal with the sacred snake, possibly on account of its trunk; another name is *Hastin*, "having a hand". The Wambuwogs believe the elephant to be the abode of the souls of their ancestors.

ELEPHANT RIVER, a river of Cape Province, running into the Atlantic after a course of 140 miles.

ELEPHANT-SEAL, the Proboscis Seal, or Sea-elephant, the largest of the seal family (Phocidæ). There are probably two species, one (*Macrorhinus angustirostris*) found only on the coast of California and Western Mexico, the other (*Macrorhinus leoninus*) found in Patagonia, Kerguelen Island, Heard's Island, and other parts of the Southern Seas. They vary in length from 12 to 30 feet, and in girth at the chest from 8 to 18 feet. The proboscis of the male is about a foot long when the creature is at rest, but elongates under excitement. The females have no proboscis and are considerably smaller than the male. Both species are becoming rare owing to the wholesale slaughter of them which takes place.

ELEPHANT'S-FOOT, the popular name of *Testudinaria elephantipes*, a plant of the nat. ord. Dioscoreaceæ (yams, &c.), distinguished by the shape of its rootstock, which forms a nearly hemispherical mass rising a little above the ground, covered with a thick corky bark. It has a slender climbing stem growing to a length of 30 or 40 feet, with small heart-shaped leaves and greenish-yellow flowers. It is known in the Cape Province as Hottentots' Bread.

ELEUSI'NE, a genus of grasses, several of which, e.g. *E. coracana*, are cultivated as grain plants in India, Japan and Tibet.

ELEUSINIAN MYSTERIES, the sacred rites anciently observed in Greece at the annual festival of Dēmētēr or Ceres, so named from their original seat Eleusis. According to the Homeric hymn to Dēmētēr, the goddess, while wandering in search of



Elephant-Seal

Persephonē, came to Eleusis, where she was hospitably received by King Celeus. He directed the establishment of a temple in her honour, and showed the use of grain to Triptolemus and other princes. As a preparation for the greater mysteries cele-

brated at Athens and Eleusis, lesser Eleusinia were celebrated at Agræ on the Ilissus. The greater Eleusinia were celebrated in the month Boedromion (September–October), beginning on the 15th of the month and lasting nine days. The celebrations, which were varied each day, consisted of processions between Athens and Eleusis, torch-bearing and mystic ceremonies attended with oaths of secrecy. They appear to have symbolized the old conceptions of death and reproduction, and to have been allied to the orgiastic worship of Dionysus (Bacchus). They are supposed to have continued down to the time of Theodosius I.

ELEU'SIS, in ancient geography, a small city of Attica, about 12 miles from Athens, near the shore opposite the Island of Salamis. Its temple of Dēmētēr was one of the most beautiful buildings of Greece. The sacred buildings were destroyed by Alaric in A.D. 396. In 1882 the Greek Archæological Society undertook excavations, and numerous remains have been unearthed. There is now a large straggling village here.

ELEU'THERA, one of the largest of the Bahama Islands. It is of very irregular shape, its length being about 70 miles, and its breadth in general from 2 to 4 miles, though in one part 10. Pop. 6,533.

ELEVATION. In astronomy, the elevation of an object above the horizon is measured by the arc intercepted between the horizon and the object on the circle which passes through the object and the zenith. In geometry, solids can be represented be means of two projections; one on a horizontal plane, and the other on a plane perpendicular to the horizontal. The former is called the plan, and the latter the elevation.

ELEVATION OF THE HOST (Lat. *hostia*, a victim), in the ritual of the Mass, is the lifting up of the element immediately after consecration, to be worshipped by the people. It was introduced into the Latin Church in the eleventh century, in consequence of the denial by Berengarius of the real presence in the sacrament. The Council of Trent ordered that the host should be worshipped with the highest adoration, that of *latria*, which is offered to God only.

EL'EVATOR, (1) a mechanical contrivance consisting of a series of boxes or buckets attached to a belt travelling round two drums, one above and one below, for hoisting grain, meal, coal, coke, &c. In America large buildings which contain such contrivances, and in which grain is stored, receive the same name. (2) An apparatus for raising or lowering persons or goods to or from different levels in warehouses, hotels, &c., consisting usually of a cage or movable platform worked by hydraulic power; also called a *lift* or *hoist*.

ELF-ARROWS, ELF-BOLTS, or **ELF-SHOT,** popular names in Europe for stone arrow-heads and axes. They were worn as charms against lightning; cattle and men are said to have been struck and wounded by them. In the Far East they are 'thunderstones.'

ELGAR, Sir Edward, K.C.V.O., composer, was born at Broadheath,



Elephant Flower

Worcestershire, 2nd June, 1857. For some time he acted as conductor of the Worcester Instrumental Society, and as organist at St. George's, Worcester, but when later he turned to composition he resigned both these positions. In 1892 he produced *The Black Knight*, and this was followed by several oratorios, cantatas, and other works, including *The Light of Life*, a short oratorio (Worcester Festival, 1896); *King Olaf*, a cantata (North Staffordshire Festival, 1896); *Imperial March* (1897); *Te Deum* (Hereford Festival, 1897); *Caractacus* (Leeds Festival, 1898); and *Orchestral Variations* (1899).

In 1900 his famous sacred cantata, *The Dream of Gerontius*, was produced at the Birmingham Festival (repeated at Düsseldorf in 1901 and at the Niederrheinische Musik Fest in 1902), and added immensely to his

already considerable reputation. In 1902 the *Coronation Ode* proved extremely popular, and in 1903 the Birmingham Festival introduced *The Apostles*, a fine oratorio, which, like the *Gerontius*, was honoured at the Niederrheinische Musik Fest the following year.

In March, 1904, an 'Elgar Festival', lasting three days, was held at Covent Garden, London, at which, in addition to *The Dream of Gerontius*, *The Apostles*, and other compositions by Dr. Elgar, was produced *Alassio*, a new concert overture, the outcome of a visit to Italy. In 1904 Dr. Elgar was knighted. From 1905 to 1908 he was professor of music at Birmingham University. He holds several honorary musical degrees. Since 1924 he has been Master of the King's Musick; in 1928 he was made K.C.V.O., and he was made a baronet in 1931.

ELGIN, James Bruce, eighth Earl of, and twelfth Earl of Kincardine, Governor-General of India, born in 1811, died in 1863. Educated at Eton and Christ Church, he entered Parliament in 1841 as member for Southampton, and in the same year succeeded to the earldom. He was appointed Governor-General of Jamaica in 1842, and in 1846 Governor-General of Canada. In 1849 he was raised to the British peerage as Baron Elgin of Elgin. In 1857 he went as special ambassador to China, and concluded the Treaty of Tientsin (1858). In 1859 he became Postmaster-General in Palmerston's Cabinet, in 1860 was sent on a special mission to Peking, and in 1861 became Governor-General of India.

Victor Alexander Bruce, ninth Earl of Elgin, son of the preceding, born 1849, died 1917, was also Governor-General of India (1894–9), and Colonial Secretary in the Campbell-Bannerman Ministry from Dec., 1905, to April, 1908.

ELGIN (el'gin), a royal and parliamentary burgh of Scotland, capital of Elgin County, situated on the Lossie, about 5 miles from its influx into the Moray Firth, 66¼ miles N.W. of Aberdeen. The town largely consists of mansions and villas. The most interesting edifice is the cathedral, now in ruins, which was once the most magnificent in Scotland.

History. It was founded by Bishop Andrew Moray in 1224; plundered and burned in 1390 by the 'Wolf of Badenoch', and again in 1402 by Alexander, third son of the Lord of the Isles; restored 1390 to 1424; and again plundered in 1568. Until 1918 the Elgin Burghs sent one member to Parliament. Pop. (1931), 8,810.

ELGIN, county of, now called *Morayshire*, is a maritime county, bounded by the Moray Firth, Banffshire, Inverness-shire, and Nairnshire; area, 304,931 acres. Along the seacoast, which extends for more than 30 miles, the surface is flat, but inland it rises into hills of moderate elevation, intersected by fine and fertile valleys. The chief rivers are the Spey, Lossie, and Findhorn, the Spey and Findhorn having excellent salmon fishing. Inexhaustible quarries of freestone (rich in fossils) are worked.

The climate is noted for its general mildness, dryness, and salubrity. The lower tracts of land are fertile and highly cultivated, the principal crops being wheat, oats, potatoes, and turnips. The great majority of farms are small. A portion of the surface is still covered with native forests. The county unites with Nairnshire in returning one member to Parliament. Pop. (1931), 40,805.

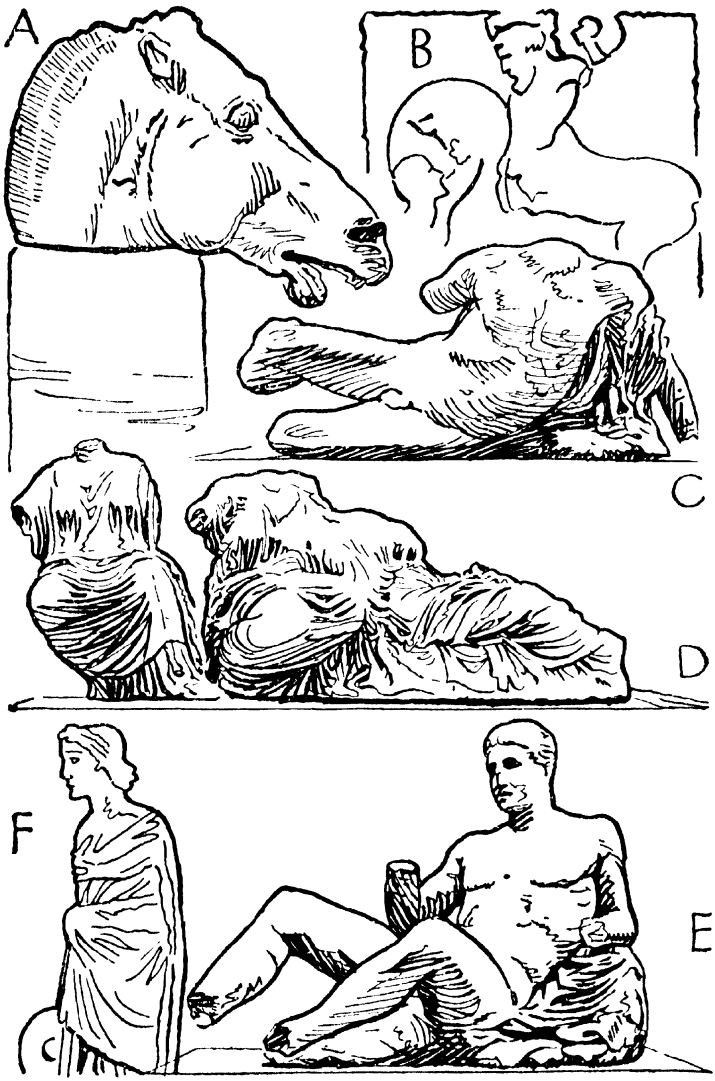
ELGIN, a town of the United States, in Illinois, on Fox River, 36 miles N.W. of Chicago. It has a watch-factory and various flourishing industries. Pop. 35,929.

ELGIN MARBLES, the splendid collection of antique sculptures brought chiefly from the Parthenon of Athens to England by the seventh Earl of Elgin (1766–1841) in 1814, and afterwards purchased by Parliament for the British Museum at the cost of £35,000. They consist of figures in low and high relief and in the round, representing gods, goddesses, and heroes; the combats of the Centaurs and Lapithæ; the Panathenaic procession, &c. They exhibit Greek sculpture at its highest stage, and were partly the work of Phidias. The historical and artistic value of the Elgin marbles was at first doubted, and Lord Elgin himself was not spared. The removal was denounced as vandalism.

EL HASA, a fertile district of Eastern Arabia, on the Persian Gulf. It produces dates, wheat, millet, and rice. Area, 31,000 sq. miles; pop. estimated at 175,000.

ELI, one of the Hebrew judges, the predecessor of Samuel. He was high-priest and judge for forty years, but was less successful as head of his own household. His two sons having been slain, and the ark taken in battle by the Philistines, the news proved so severe a shock that he fell and broke his neck, at the age of ninety-eight. Little is really known of the history of Eli, since he is only shown to us in the weakness of old age, unable to control his sons Hophni and Phinehas, whose wickedness disgusted and alienated the people.

ELIBANK, village of Selkirkshire,



ELGIN MARBLES

A. Horse of Selene
B. Centaur
C. Ilissos
D. Group of the Fates
E. Theseus
F. Maiden with Sacrifice

All these statues are portions of the Parthenon

Scotland. It gives the title of viscount to the family of Murray. In 1643 Patrick Murray was made a baron and this title passed to his descendants. In 1911 the 10th baron was made a viscount. His eldest son, Alexander Murray (1870–1920) was a Liberal politician. After serving as chief whip, he was made a peer in 1912 as Baron Murray of Elibank. He died before his father and the title passed in 1927 to Gideon Murray, as 2nd viscount.

ELI'JAH, the most distinguished of the prophets of Israel, flourished in the ninth century B.C., during the



George Eliot

reigns of Ahab and Ahaziah, and until the beginning of the reign of Jehoram, his special function being to denounce vengeance on the kings of Israel for their apostasy. He incurred the anger of Jezebel, wife of Ahab, for slaying the prophets of Baal, but escaped to Horeb, afterwards returning to Samaria to denounce Ahab for the murder of Naboth. Elijah at length ascended to heaven in a chariot of fire, Elisha, his successor, being witness. See 1 *Kings,* xvii to xxi, and 2 *Kings,* i and ii.

ELIMINATION, in mathematics, the process of treating a given set of equations so as to deduce from them an equation free from a selected letter, or from several selected letters. For instance, if the system of equations

$$a_1x + b_1y + c_1z = 0,$$
$$a_2x + b_2y + c_2z = 0,$$
$$a_3x + b_3y + c_3z = 0,$$

has a solution in which one at least of x, y, z is different from zero, then

$$\begin{vmatrix} a_1, & b_1, & c_1 \\ a_2, & b_2, & c_2 \\ a_3, & b_3, & c_3 \end{vmatrix} = 0.$$

(*See* DETERMINANT.) BIBLIOGRAPHY: Burnside and Panton, *Theory of Equations*; Salmon, *Higher Algebra.*

EL'IOT, George, the assumed literary name of Mary Ann, or, as she preferred to write the name in later years, Marian Evans, English novelist. She was the daughter of a Warwickshire land agent and surveyor, was born at Griff, near Nuneaton, on 22nd Nov., 1820, and died on 22nd Dec., 1880. She received at Coventry an excellent education, comprising the classical and modern languages, and shortly after her twenty-first year became a convert to Rationalism.

Her first literary undertaking was the completion of Mrs. Hennell's translation of Strauss's *Life of Jesus* (1846). Towards the end of her task she seems, however, to have wearied of it, and when the work appeared she declared herself 'Strauss-sick.' After spending two years abroad, she boarded at the house of John Chapman, editor of the *Westminster Review,* of which she became sub-editor.

It was not, however, until January, 1857, that she came prominently into public notice, when the first of a series of tales entitled *Scenes from Clerical Life* appeared in *Blackwood's Magazine.* The series came to an end in Nov., 1857, and in the following year the publication of *Adam Bede* placed her in the first rank of writers of fiction. It was succeeded by *The Mill on the Floss* (1860), *Silas Marner* (1861), *Romola* (1863), *Felix Holt* (1866), *Middlemarch* (1872), and *Daniel Deronda* (1876).

In addition to those prose works she published three volumes of poems, *The Spanish Gypsy* (1868), *Agatha* (1869), and *The Legend of Jubal* (1874). Her last work published during her life was the series of essays entitled *The Impressions of Theophrastus Such* (1879), but a volume of mixed essays was issued posthumously.

For many years she was happily associated both in life and work with George Henry Lewes, though a legal union was impossible during the lifetime of Mrs. Lewes. In May, 1880, after Lewes's death, she married Mr. John Cross, but did not survive the marriage many months, dying rather suddenly at Chelsea.—BIBLIOGRAPHY: Haton, *George Eliot in Derbyshire*; J. W. Cross (editor), *George Eliot's Life as Related in Her Letters and Journals* (3 vols.); O. Browning, *Life of George Eliot*; Deakin, *The Early Life*

of George Eliot; Sir Leslie Stephen, *George Eliot* (in English Men of Letters Series).

ELIOT, Sir John, one of the ablest of the popular leaders of Charles I's reign, of an old Cornwall family, born in 1592, died in 1632. He entered Parliament in 1614 as member for St. Germans, winning immediate reputation as an orator. As vice-admiral of Devon he was energetic in suppressing piracy. In the three Parliaments of 1623, 1625, 1626, he made his way to the front of the constitutional party, joined Hampden and the rest in refusing contributions to the forced loan, and took a prominent share in drawing up the Remonstrance and Petition of Right. He was imprisoned in the Tower in 1629, and died in confinement.

During his imprisonment he wrote a work on constitutional monarchy entitled *The Monarchie of Man*. Among his other works are: *An Apologie for Socrates*, and *Negotium Posterorum* (an account of the Parliament of 1625).

E'LIS, a maritime state of ancient Greece in the west of the Peloponnesus, bordering on Achaia, Arcadia, and Messenia, and watered by the Rivers Alphēus and Penēus. Olympia, where the famous games were held, was near the Alphēus. Since 1899 Elis has formed a nomarchy of Greece.

ELISAVETGRAD. *See* ELIZABETHGRAD.

ELI'SHA, a Hebrew prophet, the disciple and successor of Elijah. Many miracles of prediction and cure, and even of raising the dead, are ascribed to him, but his figure is less original and heroic than that of his master. He held the office of prophet for fully sixty-five years, from the reign of Ahab to that of Joash (latter half of ninth century B.C.).

ELIX'IR, a word of Arabic origin (*al iksir*, the philosopher's stone), applied by the alchemists to a number of solutions employed in attempting the transmutation of metals into gold, and also to a potion, the *elixir vitæ*, or elixir of life, supposed to confer immortality. It is still used for various popular remedies, for the most part composed of various aromatic and stimulative substances held in solution by alcohol.

ELIZABETH, British princess. Born April 21, 1926, she was baptised as Elizabeth Alexandra Mary. The daughter of the Duke and Duchess of York, the princess is the third in succession to the throne.

ELIZABETH, Queen of the Belgians. Born July 25, 1876, she was a daughter of Charles, Duke of Bavaria. In 1900 she was married to Albert, who in 1909 became King of the Belgians. Their family consists of two sons and a daughter.

ELIZABETH (*Carmen Sylvia*), Dowager Queen of Roumania, born at Neuwied, principality of Wied, in 1843, died at Bucharest, 2nd March, 1916. In 1869 she was married to Prince Charles of Hohenzollern, who became King of Roumania in 1881. Queen Elizabeth, or, as she was generally known, Carmen Sylva (her pen-name), was not only a patron of Roumanian writers and artists, but herself a distinguished author.

Among her works, which were all, with the exception of one, written in German, are: *The Bard of the Dimbovitza*, *Pilgrim Sorrow*, *A Real Queen's Fairy Tales*, and *From Memory's Shrine*. In 1914 she was made an honorary fellow of the Royal Society of Literature of Great Britain.

ELIZABETH, Queen of England, daughter of Henry VIII and of Anne Boleyn, was born at Greenwich, 7th Sept., 1533, and almost immediately declared heiress to the crown. After her mother had been beheaded (1536) both she and her sister Mary were declared bastards, and she was finally placed after Prince Edward and the Lady Mary in the order of succession. On the accession of Edward VI Elizabeth was committed to the care of the Queen-Dowager Catherine; and after the death of Catherine and execution of her consort Thomas Seymour she was closely watched at Hatfield, where she received a classical education under William Grindal and Roger Ascham.

At the death of Edward Elizabeth vigorously supported the title of Mary against the pretensions of Lady Jane Grey, but continued throughout the whole reign an object of suspicion and surveillance. In self-defence she made every demonstration of zealous adherence to the Roman Catholic faith, but her inclinations were well known. On 17th Nov., 1558, Mary died, and Elizabeth was immediately recognized queen by Parliament. The accuracy of her judgment showed itself in her choice of advisers, Parker, a moderate divine (Archbishop of Canterbury 1559), aiding her in ecclesiastical policy; while William Cecil, Lord Burleigh, assisted her in foreign affairs.

The first great object of her reign was the settlement of religion, to effect which a Parliament was called on 25th Jan., and dissolved on the 8th May, its object having been accomplished. The nation was prepared for a return to the Reformed faith,

and the Parliament was at the bidding of the Court. The ecclesiastical sytem devised in her father's reign was re-established, the royal supremacy asserted, and the revised Prayer Book enforced by the Act of Uniformity. While, however, the formal establishment of the reformed religion was easily completed, the security and defence of the settlement was the main object of the policy and the chief source of all the struggles and contentions of her reign.

Freed from the tyranny of Mary's reign, the Puritans began to claim



Queen Elizabeth

predominance for their own dogmas, while the supporters of the Established Church were unwilling to grant them even liberty of worship. The Puritans, therefore, like the Catholics, became irreconcilable enemies of the existing order, and increasingly stringent measures were adopted against them. But the struggle against the Catholics was the more severe, chiefly because they were supported by foreign powers; so that while their religion was wholly prohibited, even exile was forbidden them, in order to prevent their intrigues abroad.

Many Catholics, particularly priests, suffered death during this reign; but simple nonconformity, from whatever cause, was pursued with the severest penalties, and many more clergymen were driven out of the Church, by differences about the position of altars, the wearing of caps, and such like matters, than were forced to resign by the change from Rome to Reformation.

Elizabeth's first Parliament approached her on a subject which, next to religion, was the chief trouble of her reign, the succession to the Crown. They requested her to marry, but she declared her intention to live and die a virgin; and she consistently declined in the course of her life such suitors as the Duc d'Alençon, Prince Erik of Sweden, the Archduke Charles of Austria, and Philip of Spain. While, however, she felt that she could best maintain her power by remaining unmarried, she knew how to temporize with suitors for political ends, and showed the greatest jealousy of all pretenders to the English succession.

With the unfortunate Mary, Queen of Scots, were connected many of the political events of Elizabeth's reign. On her accession the country was at war with France. Peace was easily concluded (1559); but the assumption by Francis and Mary of the royal arms and titles of England led to an immediate interference on the part of Elizabeth in the affairs of Scotland. She entered into a league with the Lords of the Congregation, or leaders of the Reformed party; and throughout her reign this party was frequently serviceable in furthering her policy.

She also gave early support to the Huguenot party in France, and to the Protestants in the Netherlands, so that throughout Europe she was looked on as the head of the Protestant party. This policy roused the implacable resentment of Philip, who strove in turn to excite the Catholics against her both in her own dominions and in Scotland.

The detention of Mary in England (1568–87), whither she fled to the protection of Elizabeth, led to a series of conspiracies, beginning with that under the Earls of Northumberland and Westmorland, and ending with the plot of Babington, which finally determined Elizabeth to make away with her captive. The execution of Queen Mary (1587), though it has stained her name to posterity, tended to confirm her power among her contemporaries. The state of France consequent on the accession of Henry IV, who was assisted by Elizabeth, obviated any danger from the indignation which the deed had caused in that country; and the awe in which King James stood of Elizabeth and his dread of interfering with his own right of succession to England made him powerless.

But Philip of Spain was not to be so appeased, the execution of Mary lending edge to other grievances. The fleets of Elizabeth had galled him in the West Indies, her arms and subsidies had helped to deprive him of the Netherlands; the Armada was already in preparation. Accordingly he called the Queen of England a murderess, and refused to be satisfied

even with the sacrifice she seemed prepared to make of her Dutch allies. The Armada sailed on 29th May, 1588. The war with Spain dragged on till the close of Elizabeth's long reign.

During her reign the splendour of her government at home and abroad was sustained by such men as Burleigh, Bacon, Walsingham, and Throgmorton; but she had personal favourites of less merit who were often more brilliantly rewarded. Chief of these were Dudley, whom she created Earl of Leicester, and whom she was disposed to marry, and Essex, whose violent passions brought about his ruin. He was beheaded in 1601, but Elizabeth never forgave herself his death. Her own health soon after gave way, and she died on 24th March, 1603, naming James VI of Scotland as her successor.—BIBLIOGRAPHY: M. A. S. Hume (editor), *Calendar of State Papers* (Spanish Series); J. Bruce (editor), *Letters of Elizabeth and James VI*; W. Camden, *History of Queen Elizabeth*; J. A. Froude, *History of England*; M. Creighton, *Queen Elizabeth*; E. S. Beesley, *Queen Elizabeth*.

ELIZABETH, a city of New Jersey, United States, 14 miles S.W. of New York, with which it has ample communication by railway and steamer. It is a favourite residence of New York business men. The Singer Sewing-machine Company has a large factory here, and there are also foundries and oil-cloth factories. Pop. 114,589.

ELIZABETH, ST., of Thuringia, daughter of Andreas II, King of Hungary, was born at Pressburg 1207, and in 1221 married to Louis IV, landgrave of Thuringia. She erected hospitals, fed a multitude of poor from her own table, and wandered about in a humble dress, relieving the wretched. Louis died on a crusade, and her own life terminated 19th Nov., 1231, in a hospital which she had herself established. The church over her tomb at Marburg is one of the most splendid Gothic edifices in Germany.

ELIZ'ABETHAN ARCHITECTURE, a style of architecture which prevailed in England during the reigns of Elizabeth and James I. It succeeded to the Tudor style, properly so called, with which it is sometimes confounded. The Elizabethan is a mixture of inferior Gothic and debased Italian, producing a singular heterogeneousness in detail, with, however, wonderful picturesqueness in general effect, and domestic accommodation more in accordance with the wants of an advancing civilization than was afforded by the styles which preceded it.

The chief characteristics of Elizabethan architecture are: windows of great size both in the plane of the wall and deeply embayed, ceilings very richly decorated in relief, galleries of great length, very tall and highly decorated chimneys, as well as a profuse use of ornamental strapwork in the parapets, window-heads, &c.

The Elizabethan style is the last stage of the Tudor or Perpendicular, and from its corresponding in point of period with the Renaissance of the Continent has sometimes been called the English Renaissance.

The epithet Jacobean has sometimes been given to the very latest stage of the Elizabethan, differing from the Elizabethan proper in showing a greater admixture of debased Italian forms.

The princely houses which arose during the reign of Elizabeth are numerous, and many even yet remain to attest the splendour of the time. Of these may be mentioned Burghley House, Hardwick Hall, and Bramhall Hall.—Cf. Gotch and Brown, *Architecture of the Renaissance in England.*

ELIZABETH FARNESE (fär-nā, zā), Queen of Spain, daughter of Edward II, Prince of Parma, born 1692, died in 1776. On becoming the second wife of Philip V she surprised those who had counselled the marriage by assuming the practical headship of the kingdom, and her ambition and that of her minister Alberoni disturbed the whole of Europe. Carlyle calls her a "termagant tenacious woman".

ELIZABETHGRAD, a town of the Ukraine, on the Ingul, with an imperial palace, a theatre, manufactures of soap and candles, and several great fairs. Pop. 75,800.

ELIZABETH ISLANDS, a group of sixteen American islands south of Cape Cod, with a permanent population of about 150.

ELIZABETH OF VALOIS, or **ISABELLA,** Queen of Spain, was born in 1545, died in 1568. She was the daughter of Henry II of France and Catherine de' Medici. By the Treaty of Cateau-Cambrésis she was destined to be the wife of the Infante, Don Carlos, but his father, Philip II, being left a widower, became fascinated and married her himself. The stories of a romantic relationship existing between Elizabeth and Don Carlos are entirely groundless, but have furnished tragic subjects to Otway, Campistron, Chénier, Schiller, and Alfieri.

ELIZABETH PETROVNA, Empress of Russia, daughter of Peter the Great and Catherine, born in 1709 or

ELIZABETHAN ARCHITECTURE
Moreton Old Hall, Cheshire



ELIZABETHAN ARCHITECTURE: AN INTERIOR
Reconstruction in the Victoria and Albert Museum, London

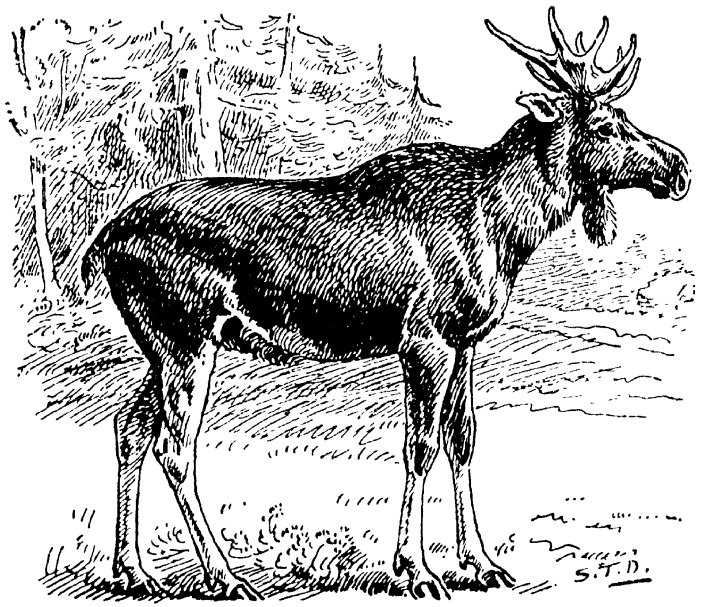
1710, died in 1762. She ascended the throne on 7th Dec., 1741, as the result of a conspiracy, in which Ivan VI, a minor, was deposed. Elizabeth is said to have rivalled her mother in beauty, and to have surpassed her in her love of pleasure, and her government was largely conducted by favourites. She was a patron of literature, founded the University of Moscow, and corresponded with Voltaire. A war with Sweden, in 1743, was advantageously concluded by the peace of Abo. In 1748 she sent an army to assist Maria Theresa in the War of the Succession, and joined in the Seven Years' War against Prussia. She died before this war was concluded.—BIBLIOGRAPHY: Nisbet Bain, *The Daughter of Peter the Great*; A. S. Rappoport, *The Fair Ladies of the Winter Palace*.

ELIZABETHPOL, a town of Russia, in the Caucasus, capital of the government of same name, covering a great space of ground from the gardens and open areas it contains, but very unhealthy. Pop. 18,505.

The government has an area of 17,000 sq. miles, a pop. of 636,316. It is partly mountainous, partly steppes, and produces grain, cotton, tobacco, and wine.

ELIZABETH STUART, Queen of Bohemia, daughter of James I of England and VI of Scotland, born in Falkland Palace, Fifeshire, 1596, died on 13th Feb., 1662. Her marriage with the Palatine Frederick was celebrated at Whitehall in 1613. Her husband, then at the head of the Protestant interest in Germany, accepted in 1619 the Crown of Bohemia offered to him by the revolted Protestants of that country. After his defeat, however, by the imperialists at the battle of Prague in 1620, he and his wife were obliged to flee, first to Breslau and Berlin, and then to the Hague. Elizabeth returned to England at the Restoration with her nephew Charles II, but mingled very little in society.

Elizabeth had thirteen children, of whom Charles Louis, the eldest surviving, was reinstated in the Palatinate by the Treaty of Westphalia in 1648. By her daughters, Elizabeth Charlotte and Sophia, she was the ancestress of Louis Philippe and of George I, and her sons, Rupert and Maurice, became famous Cavalier leaders.



Elk (*Alces Machlis*)

ELK, MOOSE, or **MOOSE DEER** (*Alces Machlis*), the largest of the deer family, a native of Northern Europe, Asia, and America. The

American form (to which the name moose is usually given) is sometimes separated from the European as *Alces americānus*, but most naturalists find no specific difference between them.

The elk or moose has a short compact body, standing about 6 feet in height at the shoulders, a thick neck, large clumsy head, and horns which flatten out almost from the base into a broad palmate form with numerous snags. In colour the elk is greyish brown, the limbs, sides of head, and coarse mane being, however, of a lighter hue. Its flesh resembles beef rather than venison.

For the most part elks are inoffensive, and so exceedingly wary that they are approached only with difficulty. In America the Indians and half-breeds are the most skilful moose-hunters. By trampling down a restricted area of ground (moose-yard) and browsing on the edge of this, the moose is able to protect itself efficiently against the attacks of wolves.

The moose has a wide range in Canada, extending from the Arctic Ocean and British Columbia to New Brunswick and Nova Scotia; and it is found also in Maine. It feeds largely on the shoots of trees or shrubs, such as the willow and maple, and on bark, &c. In Sweden its destruction is illegal, and in Norway there are many restrictions upon the hunting of it.

ELK, IRISH (*Megacĕros hibernicus*, or *Cervus giganteus*), a large deer found in the Pleistocene strata, and distinguished by its enormous antlers, the tips of which are sometimes 11 feet apart. Though a true deer, its antlers differ from those of living species in that the beam is flattened into a palm. To sustain the great weight unusually large and strong limbs and neck vertebræ were required. Its remains are found not only in Ireland but in Scotland and England, and on the Continent, where they occur in bogs, lacustrine deposits, brick-clay, and ossiferous caves.

EL KANTARA, town of Egypt. It stands on the Suez Canal, about 20 miles from Port Said and has a station on the railway line to the coast. In Jan. and Feb., 1915, the Turks attacked British forces defending the canal here, but were beaten back.

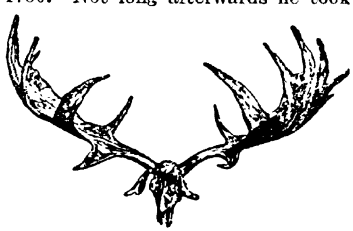
EL KHARGEH. *See* KHARGEH.

ELK'HART, a town of Indiana, United States, on Elkhart River, with railroad works and paper-mills. Pop. 32,949.

ELL (Lat. *ulna*, Gr. *ōlenē*, forearm), an old measure whereby cloths, stuffs, &c., are sometimes measured. The ell English is 5 quarters (45 inches), the ell Flemish 3 quarters (27 inches). In Scotland an ell contained 37·2 inches English.

ELL'AND, a town of England, W. Riding of Yorkshire, between Halifax and Huddersfield, with an old church and town-hall, manufactures of cottons and woollens, and quarries. It gives its name to a parliamentary division. Pop. (1931), 10,327.

ELLENBOROUGH, Edward Law, Lord, English lawyer, Lord Chief Justice of the King's Bench, born in 1750 at Great Salkeld, Cumberland, died in 1818. He was educated at the Charterhouse and at Peterhouse, Cambridge, and called to the Bar in 1780. Not long afterwards he took



Antlers and Skull of Irish Elk

silk, and at the trial of Warren Hastings, in 1785, acted as leading counsel. The defence did not come on until the fifth year of the trial, but after eight years Hastings was acquitted and Law's success assured. In 1801 he was made Attorney-General, and in 1802 became Lord Chief Justice of the King's Bench, and was created baron. He held the office of Chief Justice for fifteen years, resigning in 1818.

ELLENBOROUGH, Edward Law, first Earl of, son of Lord Chief Justice Ellenborough (*see* above), born in 1790, died in 1871. He was educated at Eton and St. John's College, Cambridge, and in 1818, having succeeded his father as second baron, he entered the House of Lords. In 1818 he took office as Lord Privy Seal, and was President of the Board of Control from 1828–30, and again in 1834.

In 1841 he accepted the governor-generalship of India, and arrived in Calcutta in 1842, in time to bring the Afghan War to a successful issue. The annexation of Scinde in 1843 was followed by the conquest of Gwalior, but the conduct of the Governor-General gave dissatisfaction at home, and he was recalled early in 1844. On his return, however, he was defended by Wellington, and received the thanks of Parliament, an earldom, and the Grand Cross of the Bath. He then held the post of First Lord of the Admiralty (1845–6), and was President

of the Board of Control from Feb. to June, 1858. His dispatch censuring the policy of Lord Canning as Governor-General of India led to his resignation.

ELLERMAN, Sir John Reeves. English shipowner. Born May 15, 1862, he became a clerk in a shipping office. In 1902 he purchased part of the Leyland line of steamers and founded the Ellerman Line. Soon he controlled a large shipping fleet, including the Ellerman, Hall, City and Bucknall Lines. In 1905 he was made a baronet.

ELLESMERE, British island. Situated in the Arctic regions of North America, it is 40,000 sq. m. in area, but uninhabitable.

ELLESMERE, market town and urban district of Shropshire. It is 11 miles from Whitchurch, on the G.W. Rly., and is also served by a canal. Near are several meres. Pop. (1931) 1,872.

The title of **Earl of Ellesmere** has been held since 1846 by the family of Egerton. The first earl was Lord Francis Leveson-Gower, a younger son of the 1st Duke of Sutherland. On the death of the last Earl of Bridgewater in 1829, he inherited the estates of the Egertons and took that name. He was made an earl in 1846 and the present earl is his descendant. The earl's seat is Worsley Hall, Manchester, and his eldest son is called Viscount Brackley.

ELLESMERE PORT, town of Cheshire. It is 7 miles from Chester and stands on the Mersey at the junction of the Ellesmere and Manchester Ship Canals. There are large docks and the other industries are dyeing and the manufacture of chemicals. With Whitby it forms an urban district. Pop. (1931) 18,898.

ELLICE ISLANDS consist of nine groups of coral islands lying north of Fiji and extending about 350 miles. The population of the whole group is about 3,500, mainly Polynesians. The islands grow coco-nut palms, and copra and guano are the main exports. They have been a British protectorate since 1892, and now form part of the Gilbert and Ellice Islands Colony. *See* GILBERT ISLANDS.

ELLICHPUR (el-ich-pör'), a town of India, in Ellichpur district, Berar, once a large and prosperous town. There is a military cantonment within two miles. Pop. 23,899.

EL'LICOTT, Right Rev. Charles John, English divine, born in 1819, died in 1905. Educated at Cambridge, he was professor of divinity in King's College, London, Hulsean lecturer and Hulsean professor of divinity at Cambridge, and Dean of Exeter, and in 1863 was appointed Bishop of Gloucester and Bristol. He was for eleven years chairman of the scholars engaged on the revision of the New Testament translation, and published commentaries on the Old and New Testaments, as well as sermons, addresses, and lectures.

ELLINGTON, Sir Edward, the British Chief of Air Staff. Born in London Dec., 1877, he was educated at Clifton College, and the Royal Military Academy. He graduated at the Staff College, Camberley, in 1907–8. In 1912 he became a Pilot, and in the following year he was appointed to the Royal Flying Corps.

He served in the Great War, (1914–18); and was mentioned in dispatches three times; he was also awarded the Legion of Honour.

He became Director-General of Supply and Research, Air Ministry (1919-21). He was a member of the Air Council (1918–22), and commander of the Royal Air Force in the Middle East from 1922–33.

He also served in India and Iraq. In Sept., 1931, he became Air Member of the Council for Personnel at the Air Ministry. In 1933 he was appointed Chief of the Air Staff, in succession to the late Air Chief, Marshal Sir W. Geoffry H. Salmond.

ELLIOTT, Ebenezer, English poet, known as the 'Corn-law Rhymer', born in 1781 near Rotherham, Yorkshire, died in 1849. At the age of seventeen he published his first poem, *The Vernal Walk*, which was soon followed by others. In 1829 *The Village Patriarch*, the best of Elliott's longer pieces, was published. From 1831 to 1837 he carried on business as an iron merchant in Sheffield. His *Corn-law Rhymes*, periodically contributed to a local paper devoted to the repeal of these laws, attracted attention, and were afterwards collected and published with a longer poem entitled *The Ranter*. Commercial losses compelled him in 1837 to contract his business, and in 1841 he retired from it altogether. In 1850 two posthumous volumes appeared, entitled *More Prose and Verse by the Corn-law Rhymer*.

ELLIOT, Walter Elliot, British politician. Educated at Glasgow Academy and at the university there, he became a doctor. In 1914–18 he served with the R.A.M.C. in France. In 1918 he was elected Conservative M.P. for Lanark; in 1923 he lost his seat, but in 1924, 1929 and 1931 was elected for Kelvingrove. In 1923–24, and again in 1924–26, Major Elliot was Under-Secretary for Health for Scotland; in 1926–29 he was Under-

Secretary for Scotland, and in 1931 Financial Secretary to the Treasury, proving himself one of the ablest debaters and administrators among the younger Unionists.

He became Minister of Agriculture and Fisheries in 1932.

ELLIPSE, one of the conic sections. The curve generated by a point which moves so that its distance from a fixed point bears a constant ratio (less than unity) to its distance from a fixed straight line. Kepler discovered that the paths described by the planets in their revolutions round the sun are ellipses, the sun being placed in one of the foci.

To describe an ellipse: At a given distance on the surface on which the ellipse is to be described fix two pins, A and B, and pass a looped string round them. Keep the string stretched by a pencil, C, and move the pencil round, keeping the string at the same tension, then the ellipse EGFH will be described. A and B are the *foci*, D the centre, EF the major axis, GH the minor axis, and the fraction DA/DE the *eccentricity* of the ellipse. A line drawn from any point in the curve perpendicularly to the axis is an ordinate to the axis. Any straight line drawn through the centre and terminated both ways by the curve is called a diameter.

ELLIPSIS, figure of speech in which a word or words are omitted, although their meaning is implied. The nominative is often omitted as in the sentences, "Who steals my purse steals trash," and "Would he were here," or the antecedent is omitted before the relative pronoun as in "Whom the gods love die young."

ELLIPSOID, a surface bearing the same sort of relation to a spherical surface as an ellipse bears to a circle. The name is also given to the solid bounded by such a surface.

The equation of an ellipsoid, referred to its principal axes, is

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1.$$

Here a, b, c, are the lengths of the principal semi-axes. A plane section is an ellipse, but there are two particular directions of the section for which the ellipse reduces to a circle.

The ellipsoid has important applications in dynamics, as a means of interpreting algebraic formulæ for physical quantities; examples are the ellipsoids of strain and of gyration, and Poinsott's momental ellipsoid.

Two ellipsoids in which the principal sections lie in the same planes, and have the same foci, are called *confocal*.

Ellipsoidal Harmonics are mathematical functions by means of which certain physical problems in heat and electricity relating to ellipsoidal surfaces can be solved. For ellipsoids of revolution, *see* SPHEROID.

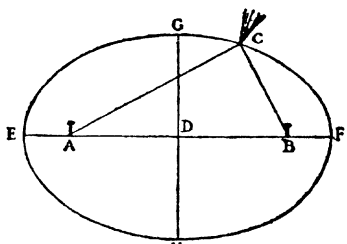
ELLIPTIC FUNCTIONS are generalizations of the circular functions *sine*, *cosine*, &c. If

$$u = \int_0^x \frac{dx}{\sqrt{(1-x^2)}} = \sin^{-1}x,$$

we have $x = \sin u$. Similarly, if

$$u = \int_0^x \frac{dx}{\sqrt{(1-x^2)(1-k^2x^2)}},$$

we may write $x = sn\,u$, $\sqrt{1-x^2} = cn\,u$, $\sqrt{1-k^2x^2} = dn\,u$. These are Jacobi's elliptic functions. They obviously reduce to $\sin u$, $\cos u$, 1, when k is 0. The circular functions have the period 2π; the elliptic functions are



Ellipse

doubly periodic, having both a real and a pure imaginary period when k^2 is real and less than 1. Like the functions *sine* and *cosine*, the elliptic functions have *addition theorems*, e.g.

$$sn(u+v) = \frac{sn\,u\,cn\,v\,dn\,v + sn\,v\,cn\,u\,dn\,u}{1 - k^2 sn^2 u\,sn^2 v}.$$

Another method and notation has been introduced by Weierstrass, and is now much used. The functions are needed for the solution of many physical problems, such as those of the motion of a top and of a pendulum. —BIBLIOGRAPHY: A. G. Greenhill, *Elliptic Functions*; Appell and Lacour, *Fonctions Elliptiques*; Whittaker and Watson, *Modern Analysis*.

ELLIS, Alexander John, English philologist, born 1814 (name originally Sharpe), died in 1890. He was a distinguished graduate of Trinity College, Cambridge, was elected to the Royal Society in 1864, and was long a prominent member of the Philological Society, being more than once its president. Though phonetics was the subject in which he most highly distinguished himself, he was equally at

home in mathematical and musical subjects. His chief published work is *Early English Pronunciation* (in five parts), between 1869 and 1889; but his publications in the form of books, papers, and articles on phonetics, music, and mathematics are numerous.

ELLIS, George, English man of letters, born in 1753, died in 1815. Educated at Westminster School and Trinity College, Cambridge, he became one of the junta of wits concerned in the well-known political satire, *The Rolliad*, and contributed to the *Anti-Jacobin*. He also wrote a preface, notes, and appendix to Way's translation of Le Grand's *Fabliaux*, and published *Specimens of the Early English Poets, with an Historical Sketch* (1790), and *Specimens of Early English Metrical Romances* (1805). He was an intimate friend of Sir Walter Scott.

ELLIS, Henry Havelock, British psychologist. Born at Croydon, 2nd Feb., 1859, after teaching for four years in New South Wales, he took his medical degree in London. He soon afterwards abandoned his practice for literary and scientific work. He writes on scientific subjects in a clear literary style, and has written amongst other books: *Man and Woman* (1894–1904), *The Soul of Spain* (1908), *The Task of Social Hygiene* (1912), *Essays in Wartime* (1916), *Kanga Creek* (1922), *The Dance of Life* (1923), *Essays of Love and Virtue* (1931). His greatest work is to be found in his *Studies in the Psychology of Sex*, in seven volumes published over a number of years.

ELLIS, William, English missionary, born 1794, died 1872. He was sent out to the South Sea Islands in 1816 by the London Missionary Society, and returned in 1825, one result of his labours being *Polynesian Researches* (1829). From 1830 to 1844 he was secretary to the society, and afterwards on its behalf made several visits to Madagascar, the longest being from 1861 to 1865. These visits led him to publish three books on Madagascar.

ELLIS ISLAND, a small island in the upper New York Bay. It is an immigrant station to which immigrants are sent while their papers are being examined. People awaiting deportation are also sent to Ellis Island. Its administration and the conditions under which the immigrants are forced to live have been the subject of much criticism and inquiry.

ELLO'RA, or ELO'RA, a ruined village, India, Deccan, Hyderabad, 13 miles north-west of Aurangabad, famous for its rock and cave temples excavated in the crescent-shaped scarp of a large plateau. They run from north to south for about a mile and a quarter, and consist of five Jain caves towards the north, seventeen Brahmanical caves at the centre, and towards the south twelve Buddhistic caves.

Of the temples some are cut down through the rock, and left open above like isolated buildings, others are excavated under the hill in the manner of caves properly so called. The interior walls are often richly carved with mythological designs. The most magnificent of the whole is the Hindu temple called Kailasa or Cailasa, the central portion of which forms an isolated excavated mass or immense block 500 feet in circumference and 100 feet high. It is surrounded by galleries or colonnades at the distance of 150 feet, in which the whole Hindu pantheon is cut in the perpendicular rock. Another fine temple, much smaller, but cut under the hill, is the Buddhist cave of Visvakarma, the only one excavated with a curved roof.

The date of the caves is not certainly known, but they were probably the work of the reigning families at the neighbouring Deoghir, now Daulatabad, which, prior to the Mohammedan conquest, A.D. 1293, was the capital of a powerful Hindu principality.—Cf. Fergusson and Burgess, *The Cave Temples of India*.

ELLORE, a town of India, Godavari district, Madras presidency, once the capital of the Northern Circars. Pop. 45,862.

ELLWOOD, Thomas, an early writer among the Quakers, born in 1639, died in 1713. About 1660 he was induced to join the Society of Friends, and soon after published *An Alarm to the Priests*. He was imprisoned on account of his religion, but subsequently became reader to Milton, and upon reading the MS. of *Paradise Lost* is said to have suggested to the poet the idea of writing the *Paradise Regained*. In 1705 and 1709 he published the two parts of his *Sacred History*. His works include a poetical life of King David, the *Davideis*, *Forgery no Christianity*, and an autobiography, *The History of the Life of Thomas Ellwood: written by his own hand*.

ELM, a genus of trees (Ulmus; nat. ord. Ulmaceæ), consisting of eighteen species, natives of the northern temperate zone and mountains of Tropical Asia. They have bisexual flowers with a campanulate calyx, as many stamens as there are divisions in the limb of the calyx, and two styles. Two species are common in Britain, *Ulmus campestris* and *Ulmus montana*, with many varieties.

The *Ulmus campestris*, or common

elm, is a fine tree, of rapid and erect growth, and yielding a tall stem, remarkable for the uniformity of its diameter throughout. It is very common as a timber tree in England; but as it rarely produces seed it is questionable whether it is indigenous. It is a native of the south and middle of Europe, and the west of Asia. The average height of a mature tree is 70 or 80 feet, but some reach a height of 150 feet. The wood is brown, hard, of fine grain, not apt to crack, and is used for many purposes. The tree generally attains maturity in seventy or eighty years.

Ulmus montāna (the mountain or wych elm), a native of Scotland, grows to a less height than the English elm, is of slower growth, and yields a much shorter bole, but it is far bolder in its ramification and more hardy. It usually attains to the height of about 50 feet. It does not produce suckers, like the English elm, but yields seed freely. The timber is strong and elastic, and the tree often yields large protuberances of gnarled wood, finely knotted and veined, and much esteemed for veneering.

Ulmus glabra, the smooth-leaved elm, is a variety common in some parts of Britain. It first appeared about the middle of the eighteenth century. The most ornamental tree of the genus is *Ulmus montāna*, variety *pendūla*, the weeping elm.

The American or white elm (*Ulmus americāna*) is abundant in the Western States, attaining its loftiest stature between lat. 42° and 46°; here it reaches the height of 100 feet, with a trunk 4 or 5 feet in diameter, rising sometimes 60 or 70 feet, before it separates into a few primary limbs. Its wood is not much esteemed.

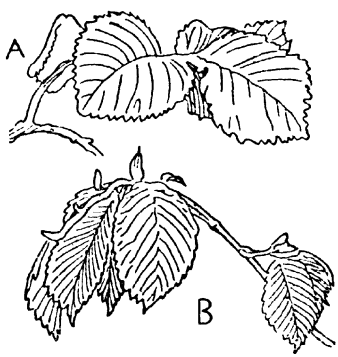
The red or slippery elm (*Ulmus fulva*) is found throughout a great extent of country in Canada, Missouri, and as far south as lat. 31°; it attains the height of 50 or 60 feet, with a trunk 15 or 20 inches in diameter; the wood is of better quality than that of the white elm. The leaves and bark yield an abundant mucilage.

The wahoo (*Ulmus alāta*), inhabiting from lat. 37° to Florida, Louisiana, and Arkansas, is a small tree, 30 feet high. The branches are furnished on two opposite sides with wings of cork 2 or 3 lines wide; the wood is fine-grained and heavy.

ELMAN, Mischa. Russian violinist. Born Jan. 20, 1891, son of a Jewish schoolmaster, he made his first appearance in public in St. Petersburg in 1904. In 1905 he played in London and was soon recognised as one of the world's masters. In 1920 he was naturalised as an American and made his home in New York.

ELMI'NA, a British town and seaport on the west coast of Africa, 8 miles west of Cape Coast Castle. It was acquired by Britain in 1872 with the other Dutch possessions on the Gold Coast, when it was claimed by the King of Ashanti, the result being the Ashanti Wars of 1873–4. Pop. 20,000.

ELMI'RA, a town of the United States, N. York, on the Chemung River; with a college for women, founded in 1855, the State reformatory, and a fine court-house. Its industrial establishments comprise



A.—Leaves of English Elm
B.—Leaves of Wych Elm

rolling-mill, blast-furnace, foundries, and machine-works. Pop. 47,397.

ELMO'S FIRE, ST., a meteoric appearance often seen playing about the masts and rigging of ships. If two flames are visible (Castor and Pollux) the sailors consider it a good omen; if only one (Helena), they regard it as a bad one. The name is derived from St. Elmo, or St. Erasmus, who was broken on the wheel A.D. 304.

ELMSHORN, a town in Schleswig-Holstein, 20 miles north-west of Hamburg, on the Krückau, a navigable stream. Pop. 15,392.

ELMSLEY, Peter, D.D., English scholar, born in 1773, died in 1825. Educated at Oxford, he was one of the original contributors to the *Edinburgh Review*, and wrote occasionally, at a subsequent period, in the *Quarterly*. He finally settled at Oxford, on obtaining the headship of St. Alban's Hall and the Camden professorship of ancient history in 1823. He published editions of the *Œdipus Tyrannus* (1811), *Heraclidæ* (1815), *Medea* (1818), *Bacchæ* (1821), and *Œdipus Coloneus* (1823).

EL OBEID. *See* OBEID.

ELOBEY, GREAT AND LITTLE, two islands in the Gulf of Guinea, belonging to Spain. Great Elobey has an area of ¼ sq. mile and a population of 123, while the area of Little Eloboy is 22 acres and the population 222.

ELOCUTION. Art of speaking effectively in public. A course in elocution is part of the training of an actor. It is also studied by preachers and those who wish to become public speakers. Much depends upon the natural qualities of the voice, but, however good these are, they can be improved by some knowledge of correct pronunciation, the control of the breath, the right use of expression and gesture and other such matters.

ELODEA, a genus of submerged water-plants, nat. ord. Hydrocharitaceæ. *E. canadensis*, the Canadian water-weed, was accidentally introduced into Britain about 1840. It is much used for physiological experiments, e.g. for showing the movements of protoplasm.

ELO'HIM (plural of *Eloah*), one of the Hebrew names for God, of frequent occurrence in the Bible. Elohim is used in speaking both of the true God and of false gods, while Jehovah is confined to the true God. The plural form of Elohim has caused a good deal of controversy, some considering it as containing an allusion to the doctrine of the Trinity, others regarding it as the plural of excellence, others holding it as establishing the fact of a primitive polytheism.

The Elohistic passages in the *Pentateuch*, or, in other words, the passages in which the Almighty is always spoken of as Elohim, are supposed to have been written at an earlier period than those in which he is spoken of as Jehovah. The Elohistic passages are simpler and more primitive in character than the Jehovistic; thus *Gen.* i, 27 is Elohistic; *Gen.* ii, 21–4 is Jehovistic.

EL PASO ('the pass' or crossing), a town of the United States, in Texas, at an important ford or crossing of the Rio Grande del Norte, where there is now a railway bridge, with extensive railway connections and large trade with Mexico (the river is the boundary). Pop. in 1930 (including suburbs), 102,421.

ELPHINSTONE, Hon. Mountstuart, Indian administrator, son of the eleventh Lord Elphinstone, born in Scotland in 1778, died in 1859. He joined the Bengal Civil Service in 1795, was Ambassador to the Afghan Court in 1808, Resident at the Court of Poonah from 1810 to 1817, and British commissioner to that province from 1817 to 1819, when he became Governor of Bombay. During a government of seven years he established a code of laws, lightened taxes, and paid great attention to schools and public institutions. He resigned in 1827. A college established by the natives was called after him Elphinstone College.

He was the author of an *Account of the Kingdom of Cabul and its Dependencies* (1815), and a *History of India* (1841). He was offered the governor-generalship of India in 1835, and afterwards that of Canada, both of which he declined.

ELPHINSTONE, William, a Scottish prelate, founder of King's College and University, Aberdeen, born at Glasgow in 1431, died in 1514. He was educated at Glasgow College, and served four years as priest of St. Michael's in that city. He then went to France and became professor of law, first at Paris and subsequently at Orleans, but before 1474 he returned home at the request of Muirhead, Bishop of Glasgow, who made him commissary of the diocese. In 1478 he was made commissary of the Lothians, and in 1479 Archdeacon of Argyle. Soon after he was made Bishop of Ross; and in 1483 was transferred to the see of Aberdeen.

In 1484 and 1486 he was commissioned to negotiate truces with England, and in 1488 was Lord High-Chancellor of the kingdom for several months. He was next sent on a mission to Germany, and after his return held the office of Lord Privy Seal till his death in 1514. In 1484 he obtained a papal bull for the erection of the university of King's College at Aberdeen.

ELSINORE' (Dan. *Helsingör*), a seaport of Denmark, in the Island of Zealand, at the narrowest part of the Sound, here only 3¼ miles broad, 24 miles north by east of Copenhagen, opposite Helsingborg in Sweden, and connected with it by train-ferry. Near Elsinore is the castle of Kronberg, built by Frederick II of Denmark about 1580, and commanding the Sound. The castle, now chiefly used as barracks, is associated with Shakespeare's *Hamlet*. Before the abolition of the Sound dues in 1857 all merchant ships passing through were bound to pay toll here. Pop. 15,841.

ELSTER, two German rivers, the White or Great Elster, a tributary of the Saale; the Black Elster, a tributary of the Elbe.

ELSTREE, town of Hertfordshire. It is 7 miles from St. Albans, on the L.M.S. Rly. and is also reached by the Metropolitan Rly. The place has become a centre of the film industry

and here and at Boreham Wood are large studios. Pop. 2,230.

ELSWICK (elz'ik), a suburb of Newcastle, England, containing the great ordnance-works of Armstrong, Mitchell, & Co.

ELTON, Charles Isaac, English jurist and archæologist, born 1839, died 1900. He was educated at Cheltenham and Oxford, became a barrister and a member of Parliament, and wrote various works on legal and other subjects, the most important being *Origins of English History*. In this work he traces the development of England and its inhabitants, from the earliest times regarding which we have any knowledge, to the acceptance of Christianity by the Anglo-Saxons, the investigation of the evidence furnished by Greek and Roman writers, and the discussion of prehistoric ethnology and archæology being especially thorough. Other works are: *Commons and Waste Lands*, and *W. Shakespeare: His Family and Friends*.

ELU'TRIATION (Lat. *elutriare*, to wash out), the process of separating the finer particles of a clay, earth, or similar mass, from the coarser, consisting in stirring up the substance in water, letting the coarser particles subside, running off the liquid containing the finer particles, and then waiting till they subside.

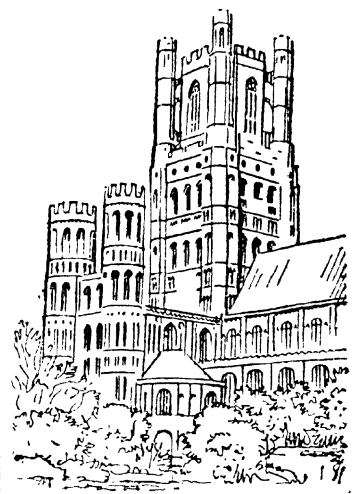
ELVAS, a fortified city of Portugal, province of Alemtejo, near the Spanish frontier, 10 miles north-west of Badajoz, on a height flanked by two others, each crowned by a castle. It has a cathedral, partly Moorish and partly Gothic, and a Moorish aqueduct, a magnificent work which brings water from a distance of 15 miles. Pop. 11,747.

ELY (ē'li), an episcopal city of England, in the county of Cambridge, on an eminence on the left bank of the Ouse. The ecclesiastical structures comprise the cathedral, one of the largest in England, and the churches of St. Mary, and the Holy Trinity, the last belonging to the time of Edward II, and one of the most perfect buildings of that age. The superb cathedral occupies the site of a monastery founded about the year 763 by Etheldreda, daughter of the King of East Anglia.

Its entire length, east to west, is 517 feet, and its west tower is 270 feet high. The whole structure comprises an almost unbroken series of the various styles of architecture which prevailed in England from the Conquest to the Reformation, yet with no loss of impressiveness as a whole. It was begun in 1083, completed in 1534, and since 1847 has undergone extensive additions and restoration. A fine gateway, built in the reign of Richard II, forms the principal entrance to the cathedral precincts.

There are a few manufactures, but most of the inhabitants are engaged in agriculture. Pop. (1931), 8,382.

ELY, ISLE OF, a portion of the county of Cambridge, separated by the Ouse from the rest of the county, and forming itself a sort of county. It is about 28 miles long by 25 miles broad; area, 238,073 acres. The name is also given to a smaller tract, about 7



Ely Cathedral

miles long by 4 miles broad. The soil is very fertile. Pop. (1931), 77,705.

ELYMUS, a genus of grasses, natives chiefly of the north temperate zone. The British species, *E. arenarius* (lyme grass) is a good sand-binder.

ELYS'IUM, or **ELYSIAN FIELDS,** among the Greeks and Romans the regions inhabited by the blessed after death. They are placed by Homer at the extremities of the earth, by Plato at the antipodes, and by others in the Fortunate Islands (the Canaries). They were at last supposed to be in the interior of the earth, where Virgil described them as being. The happiness of the blessed consisted in a life of tranquil enjoyment in a perfect summer land, where the heroes, freed from all care and infirmities, renewed their favourite sports.

ELY'TRA, the horny cases into which the front wings of beetles are modified, and which meet in a straight line down the middle of the back. The membranous hind-wings are here the organs of flight, and when not in use are folded longitudinally and transversely, and tucked away under the elytra.

ELZE (el'tse), **Karl,** German writer, distinguished for his studies in English literature, born 1821, died 1889. He studied in Leipzig and Berlin, was long a teacher in the gymnasium of his birth-place, Dessau, and in 1875 was appointed to the chair of English language and literature at Halle. Among his writings were valuable biographies of Sir Walter Scott and Lord Byron (the latter translated into English), and a biographical and critical work on Shakespeare, also translated into English (1888).

EL'ZIVER, or **ELZEVIER,** the name of a family of publishers and printers, residing at Amsterdam and Leyden, celebrated for the beauty of the editions of various works published by them, principally between 1595 and 1680. Louis, the founder of the family (born 1540, died 1617), settled in Leyden, and between 1583 and his death produced about 150 works.

Five of his seven sons followed his business: — Matthæus at Leyden; Louis (II) at the Hague; Gilles at the Hague and afterwards at Leyden; Joost in Utrecht; and Bonaventure, who in 1626 associated himself with Abraham, the son of Matthæus. From the press of Abraham and Bonaventure issued the exquisite editions of the classics which have made the name of Elzevir famous. Of these the *Livy* and *Tacitus* of 1634, the *Pliny* of 1635, the *Virgil* of 1636, and the *Cicero* of 1642 are perhaps the most beautiful.

The Elzevir books are distinguished by the types and the choice of the paper rather than by the critical preparation of their texts.

EMANATION, in a specific sense, an idea at the centre of many philosophic systems which seek to explain the universe as an eternal efflux or emanation from the Supreme Being, comparable with the efflux of light from the sun. The idea of emanation came from the East, and traces of the doctrine are found in the system of Zoroaster. It had a powerful influence on the ancient Egyptian philosophy, as also on that of the Greeks, as may be seen in Pythagoras. It was subsequently developed by Plotinus, the Gnostics, Manicheans, Pantheists, and other sects.

EMAN'UEL THE GREAT, King of Portugal, born in 1469, died in 1521. He ascended the throne in 1495, and during his reign were performed the voyages of discovery of Vasco da Gama, of Cabral, of Americus Vespucius, and the heroic exploits of Albuquerque, by whose exertions a passage was found to the East Indies, the Portuguese dominion in Goa was established, and the Brazils and Moluccas were discovered. The commerce of Portugal, under Emanuel, was more prosperous than at any former period. The treasures of America flowed into Lisbon, and the reign of Emanuel was justly called 'the golden age of Portugal.'

He died at the age of fifty-two, deeply lamented by his subjects, but hated by the Moors and the Jews, whom he had expelled from the country. He was a patron of learned men, and himself left memoirs on the Indies. He married three times: in 1497 Isabella, daughter of Ferdinand and Isabella, heiress of Castile; in 1500 her sister Maria; and in 1519 Eleonora of Austria, sister of Charles V.

EMBALMING (em-bäm'ing; Gr. *balsamon*, balm), the process of so treating dead bodies with aromatic and antiseptic substances as to preserve them from corruption and decomposition. The ancient Egyptians employed this art on a great scale, embalming not only human corpses, but also the bodies of cats, ibises, crocodiles, and other animals held sacred. The mummy of King Mer-en-rē, who lived about 2,500 years before our era, found in 1880, was in an excellent state of preservation.

Other peoples, such as the Assyrians and Persians, also followed the practice, though hardly equalling Egyptian methods. The abdomen was emptied through an incision, and the brains drawn through the nostrils by means of a special instrument. The ancient Peruvians appear to have injected and washed the corpses with a fluid that flows from imperfectly burned wood, in which pyroligneous acid, creosote, and other antiseptics are present. Pliny alludes to the use of a similar fluid by the Egyptians.

In more recent times bodies have been preserved for centuries by embalming, especially when they have remained at a low and uniform temperature and have been protected from the air. The corpse of Edward I, buried in Westminster Abbey in 1307, was found entire in 1770. Canute died in 1036, and his body was discovered very fresh in Winchester Cathedral in 1776. The bodies of William the Conqueror and of his wife Matilda were found entire at Caen in the sixteenth century.

Of the various modern artificial

means of preserving bodies, impregnation with corrosive sublimate appears to be one of the most effective, next to immersion in spirits. An injection of sulphate of zinc into the blood-vessels is also stated to be satisfactory; while natron, various spices, and other aromatic compounds are sometimes employed.

The original reason for embalming was most probably the preservation of the body to await a resurrection and a future life.—BIBLIOGRAPHY: W. Budge, *The Mummy*; G. Elliot Smith, *A Contribution to the Study of Mummification in Egypt*; Myers, *Textbook of Embalming*.

EMBANK'MENT, a mound of earth, &c., thrown up either for the purpose of forming a roadway at a level different from that of the natural surface of the ground, or for keeping a large body of water within certain limits. When constructed wholly of earth or clay, it is triangular in cross-section, with the apex cut off parallel to the base line, the angle of the sloping sides varying with the nature of the material used. Thus the slope of loose rubble, chalk, stone, loamy sand, or gravel requires about 1½ base to 1 vertical; dry, loose, and ordinary clay, 2 horizontal to 1 vertical, while some clays require a much wider base.

To prevent subsidence on marshy or peaty soils, either the weight of the heart of the embankment is diminished, as in Holland, by introducing layers of reeds or fascines, or artificial foundations are prepared. The embankment may be prevented from slipping laterally by forming steps in the earth of the subsoil, or by cutting deep trenches at the feet of the slopes.

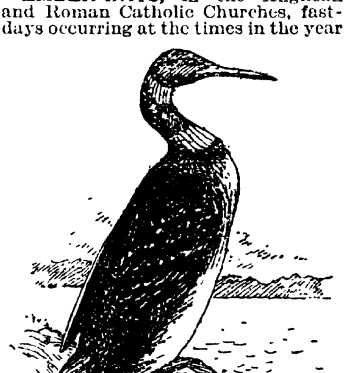
In cases where embankments are raised for the storage of water, a 'puddle-dike,' that is, a water-tight wall, must be inserted through the whole depth of the bank down to the impermeable strata beneath. To resist the action of wind and rain, or of the waters of a slow-flowing stream, the banks should in all possible cases be covered with turf.

Among the largest embankments hitherto executed are those on the banks of the Po, the Meuse, the Scheldt; on the shores of the Netherlands; the Oberhäuser embankment on the Augsburg and Lindau Railway, the Gadelbach cutting on the Ulm and Augsburg line, and the Tring cutting on the London, Midland and Scottish Railway.

EMBAR'GO, in commerce, an arrest on ships or merchandise by public authority; or a prohibition of State, commonly on foreign ships, in time of war, to prevent their going out of or coming into port. A breach of embargo, under knowledge of the insured, discharges the underwriters of all liability.

EM'BASSY, in its strict sense, signifies a mission presided over by an ambassador, as distinguished from a legation or mission entrusted to an envoy. An ambassador, as the representative of the person of his sovereign, can demand a private audience of the sovereign to whom he is accredited, while an envoy must communicate with the Minister for Foreign Affairs.

EMBER-DAYS, in the Anglican and Roman Catholic Churches, fast-days occurring at the times in the year



Ember Goose

appointed for ordinations. As now observed they are the Wednesday, Friday, and Saturday after the first Sunday in Lent, after the feast of Pentecost or Whitsunday, after the festival of the Holy Cross (14th Sept.), and after the festival of St. Lucia (13th Dec.). The weeks in which these days fall are called *Ember-weeks*.

EMBER-GOOSE (*Colymbus septentrionalis*), an aquatic bird, known also as the great northern diver and loon. The latter name, however, is also applied to the great crested grebe.

EMBERIZI'DÆ, a family of small perching birds, typical genus Emberiza. It includes the buntings, the snow-flake, the yellow-hammer, and reed sparrow. The ortolan belongs to this family. By some naturalists it is classified as a sub-family of the finches.

EMBEZ'ZLEMENT is the appropriation, by a clerk or servant, to himself, of money or property put

into his hands in trust. In English law it is a felony punishable by penal servitude for not more than fourteen years, or by imprisonment; and in the case of a male under the age of sixteen, by whipping in addition to the imprisonment.

EMBLEM, device or picture made to embody a spiritual idea or to symbolise a quality. In art, emblems have been attached to most of the saints, and even to Jesus Christ. Instances are the lily of the Virgin, the keys of St. Peter and the lamb of St. John the Baptist, and there are thousands of others. Printers call the marks they use on their works emblems. The modern substitute of the emblem is the badge.

EM'BLEMENTS (Fr. *emblaver*, to sow with grain), in law, the crops actually growing at any time upon land. They are considered in law as personal property, and pass as such to the executor or administrator of the occupier, if the latter die before he has actually cut, or reaped, or gathered the same.

EM'BOLISM is the obstruction of a blood-vessel by an embolus, the name given to a blood-clot or other body carried by the blood-stream, and obstructing the circulation at the point of lodgment. An embolism in a vital organ gives rise to serious symptoms which may cause death in a short time, or more remotely by the production of gangrene or pyæmia.

EMBOS'SING, the art of producing raised figures upon plane surfaces, such as on leather for bookbinding; on paper for envelopes; on wood or bronze, in architecture or sculpture. Embossing in needlework is effected by embroidery over figures padded with wool felt.

EMBRA'CERY, an attempt to corrupt or influence a jury by money, promises, letters, entertainments, persuasions, or the like.

EMBRA'SURE, in fortification, an opening in the breastwork or parapet of a battery or fortress, to admit of a gun being fired through it.

EMBROI'DERY (O.Fr. *embroder*, from *bord*, border), figured work in gold, or silver, or silk thread, wrought by the needle, upon cloths, stuffs, or muslins. In embroidering stuffs a kind of stretching-frame is used, because the more the piece is stretched the easier it is worked.

The art was common in the East in very ancient times. The Jews appear to have acquired it from the Egyptians; Homer makes frequent allusion to it; and Phrygia was celebrated for its embroidery, which was in great demand at Rome. The Nineveh mural reliefs in the British Museum show Assyrian robes with floral ornaments, and a relief (now in the Louvre, Paris) from the palace of Darius I shows Persian robes with embroidery. The Anglo-Saxons had a Continental reputation, and from the eleventh to the sixteenth century the art of pictorial needlework was of the highest importance both as a recreation and as an industry.

Embroidery is commonly divided into two classes: white embroidery applied to dress and furniture, in which the French and the Swiss excel; and embroidery in silk, gold, and silver, chiefly in demand for ecclesiastical vestments. The Chinese, Hindus, Persians, and Turks excel in such work.—Cf. Christie, *Embroidery and Tapestry Weaving.*

EMBRUN (An-brun), a picturesque walled town, France, department Hautes-Alpes, on a rocky eminence on the Durance. It was sacked successively by Vandals, Huns, Saxons, and Moors, by the Protestants in 1573, and by the Duke of Savoy in 1692. It has a fine cathedral. Pop. 3,556.

EM'BRYO, an immature organism, especially in the earlier stages of development from the fertilized ovum onwards. The embryo of a mammal (except in the egg-laying duck-bill and spiny ant-eater), which develops internally, is known as a *fœtus*. The dormant plantlet in a seed is also known as an embryo.

EMBRYOL'OGY, the branch of biology concerned with the fertilization of the ovum and its development into the adult. Aristotle and Galen made some observations on the subject, as regards animals, while Harvey and his successors considerably advanced our knowledge, but as a distinct and important subject embryology only dates from the nineteenth century.

In the course of its development an organism repeats the evolution of its group in an abbreviated fashion, thus furnishing a clue to its actual affinities. The subject also throws light on the problems of heredity.

EMBRYO-SAC, the name given to the megaspore of seed-plants. In Angiosperms the ripe embryo-sac is typically a large ovoid sac enclosed in a thin membrane and lined by cytoplasm; it contains seven or sometimes eight nuclei with associated masses of cytoplasm, distributed in a characteristic manner. At the apical end, next the micropyle, is the egg-apparatus, comprising the egg-cell or ovum flanked by the two synergidæ or helping-cells, while the basal or chalazal end is occupied by the three antipodal 'cells.' The

cavity of the sac is filled with cell-sap traversed by stout protoplasmic strands, suspended in which, near the centre, are two polar nuclei, or a single fusion-nucleus formed by the union of these.

A characteristic feature of Angiosperms is the process of 'double fertilization.' The pollen-tube contains two male gametes, both functional; one fertilizes the egg-cell, the resulting zygote or oospore giving rise by cell-division and growth to the embryo; the other unites with the fusion-nucleus (or the two polar nuclei), and the product is the origin of the special nutritive tissue or endosperm, which is used up by the embryo, either during ripening of the seed (exalbuminous seeds), or at germination (albuminous seeds). *See* GYMNOSPERMS; OVULE.

EM'DEN, a town of Prussia, province of Hanover, near the mouth of the Ems, occupying a low flat intersected by numerous canals. It was raised to the rank of a free Imperial city in 1595, was made a free port in 1751, was incorporated with the kingdom of Hanover in 1815, and in 1866 was united to Prussia. The principal building is the great church, built in 1455. The harbours admit large vessels, and several canals run inland. It exports grain, dairy produce, and gin, and has shipbuilding yards, and manufactures hosiery and leather. Pop. 27,770.

EM'ERALD, a variety of beryl, a well-known gem of pure green colour, somewhat harder than quartz; specific gravity, 2·67 to 2·73. It is a silicate of aluminium and the rare element glucinum or beryllium, which was detected in it by Vauquelin after it had been discovered by the same chemist in the beryl. Its colour is due to the presence of chromium, of which there may be 0·2 to 0·3 per cent present. Its natural form is either rounded or that of a short six-sided prism. It is one of the softest of the precious stones, but is not acted on by acids.

Emeralds of large size and at the same time free from flaws are rare and more valuable than diamonds or rubies; the largest on record is said to have been possessed by the inhabitants of the valley of Manta in Peru when the Spaniards first arrived there. It was as big as an ostrich egg, and was worshipped as *the mother of emeralds*. The ancients, who valued them, especially for engraving, are said to have procured them from Ethiopia and Egypt. The finest are now obtained from Colombia. The Oriental emerald is a variety of the ruby, of a green colour, and is an extremely rare gem.

EMERALD GREEN, a vivid light-green pigment, an aceto-arsenite of copper, used both in oil and water-colour painting. It is extremely poisonous. Hydrated chromium sesquioxide is another mineral emerald green. There is also an aniline dye of this name.

EMERALD LORE. The emerald as a sacred stone was anciently believed to blind a serpent which gazed at it, but to strengthen human eyes, and was, according to Theophrastus, worn as a ring-stone on account of this property. It was confused with 'false emerald,' a kind of malachite. This fact explains the reference to ancient kings presenting blocks of emerald 1 or 2 cubits long to temples.



Ralph Waldo Emerson

The Babylonian name was *barraktu*, the Sanskrit *marakata*, the Hebrew *bareket* or *barkat*, the Greek *maragdos* or *smaragdos*.

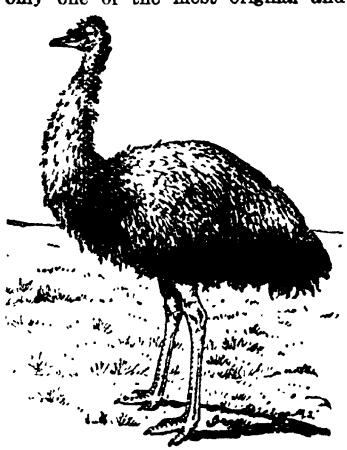
EMERGENCES, in botany. *See* HAIRS OF PLANTS.

EM'ERSON, Ralph Waldo, an American poet and prose writer, born at Boston, 25th May, 1803, died 27th April, 1882. He graduated at Harvard in 1821, for five years taught in a school, and in 1829 became minister of a Unitarian Church in Boston, but in 1832 resigned his charge. He spent the greater part of 1833 in Europe, and on his return began his career as a lecturer on various subjects, in which capacity he acted for a long series of years. In 1835 he took up his permanent residence at Concord, Mass., and in 1836 published a small volume called *Nature*. He was one of the original editors of *The Dial*, a transcendental magazine begun in 1840.

Two volumes of his essays were

published, in 1841 and 1844, and his poems in 1846. His miscellaneous addresses had been published in England in 1844, and on visiting Great Britain in 1847 he was welcomed by a large circle of admirers. In 1850 he published *Representative Men*; in 1856, *English Traits*; in 1860, *The Conduct of Life*; in 1869, *May Day and Other Poems*, and *Society and Solitude*; in 1871, *Parnassus*, a collection of poems; in 1876, *Letters and Social Aims*.

Emerson showed certain similarities with Carlyle, of whom he was a friend and correspondent. Their correspondence appeared in 1883. He was not only one of the most original and



Emeu or Emu
(*Dromæus novæ-hollandiæ*

influential writers that the United States have produced, but also one of the most helpful and influential ethical teachers of the nineteenth century. His gospel of self-reliance, his insistence on the duty of self-respect, and the obligation to listen to the voice of one's own soul, have exerted a wide influence which has grown steadily. — BIBLIOGRAPHY: J. E. Cabot, Emerson's Complete Works (11 vols.); G. W. Cooke, *Ralph Waldo Emerson: his Life, Writings and Philosophy*; J. Elliott Cabot, *A Memoir of Ralph Waldo Emerson*; R. Garnett, *Life of Ralph Waldo Emerson*; G. S. Woodberry, *Ralph Waldo Emerson*; J. A. Hill, *Emerson and his Philosophy*.

EM'ERY (formerly *emeril*, from O.Fr. *emeril*; Gr. *smiris*, emery), an impure variety of corundum, of blackish or bluish-grey colour, chiefly found in shapeless masses and mixed with other minerals. It contains about 82 per cent of alumina, and a small portion of iron; is very hard; is practically infusible, and is not attacked by acids. The best emery is brought from the Levant, chiefly from the Island of Naxos. It is employed in cutting and polishing precious stones; in smoothing the surface of the finer kinds of lenses preparatory to their being polished; in the polishing of marble; by cutlers, locksmiths, glaziers, and other artisans. For all these purposes it is pulverized in large iron mortars or in steel mills, and the powder, which is rough and sharp, is carefully washed and sifted into eight or ten different degrees of fineness.

Emery-paper and emery-cloth are made by laying a thin coat of glue upon the fabric, and dusting the emery from a sieve of the required size.

EMET'IC is a substance given to produce vomiting, either acting directly on the nerves of the stomach, or indirectly through the blood-stream on the vomiting centre in the brain. In the first group are common salt, mustard, ipecacuanha, and sulphate of zinc; and apomorphine, which is given hypodermically, is an example of the second. Emetics are not now so widely used, as in many cases the stomach can be more effectively emptied and then washed out by the passage of the stomach-tube.

EM'ETINE is an alkaloid present in ipecacuanha. It is a powerful emetic, and whether given by the mouth or hypodermically produces vomiting with nausea and depression. It acts chiefly as a local irritant to the lining of the stomach. In minute doses it stimulates expectoration from the lungs.

EMEU, or **EMU,** a large flightless running bird (*Dromæus novæ-hollandiæ* and *D. irroratus*), formerly dispersed over the whole Australian continent, but now almost extinct in many districts. It is allied to the cassowary, but is distinguished by the absence of a 'helmet' on the top of the head. It nearly equals the ostrich in bulk, being thicker in the body, though its legs and neck are shorter. Its feet are three-toed (the ostrich has two toes), and its feathers, which are double, are of a dull sooty-brown colour, those about the neck and head being of a hairy texture. The wings are small and useless for flight, but the bird can run with great speed. The flesh of the young emeu is by some considered a delicacy.

cause an industry merely to be transferred from one country to another, as in the case of the fourteenth-century Flemish emigration to England.

The importance of these results of emigration in any particular case depends on the class of people who emigrate, and on the volume of emigration. Deportation of criminals obviously benefited only the deporting country. Emigration on political or religious grounds has frequently deprived one country of, and given to another, a vigorous and industrious stock, as in the case of the French Huguenots driven from France to England in the late seventeenth century by the revocation of the Edict of Nantes. Economic pressure tends to send abroad agricultural and other unskilled labour. The majority of emigrants from Great Britain in the nineteenth century belonged to this class. Youth and adaptability, however, are more important qualities for an emigrant than a high level of skill in any trade; and it is probable, therefore, that on the whole emigration has relieved Europe of labour whose supply was in excess of the demand for it, and has never given newer countries the material they require.

The political consequences of emigration may also be important. Some writers claim that it has assisted the spread of democracy. Emigration may certainly have much influence in creating and maintaining friendly relations between States; or, as shown by Irish influence in the United States, it may embitter the feeling between them.—BIBLIOGRAPHY: Mayo-Smith, *Emigration and Immigration*; S. C. Johnson, *History of Emigration from the United Kingdom to North America, 1763–1912.*

ÉMIGRÉS (ā-mi-grâs), a name given more particularly to those persons who left France during the Revolution of 1789. At the head of these emigrants stood the royal princes of Condé, Provence, and Artois, the first of whom collected a part of the fugitives to co-operate with the allied armies in Germany for the restoration of the monarchy. At Coblentz a particular court of justice was established to settle causes relating to the French *émigrés*. The corps of Condé was finally taken into the Russian service, and was disbanded in the Russian-Austrian campaign of 1799.

When Napoleon became emperor he granted permission to all but a few of the emigrants to return to their country; but many declined to return until after his downfall. By the Charter of 1814 they were shut out from the recovery of their estates and privileges; and though, by a law of 27th April, 1825, some compensation was decreed to them, the grant was withdrawn again after the July revolution.

EMILIAN PROVINCES, a term applied to certain Italian provinces annexed to the kingdom of Sardinia in 1860. They comprised the northern part of the States of the Church (Romagna) and the Duchies of Modena and Parma.

EM'INENCE, an honorary title formerly applied to the Emperor and higher officials of the Empire, but restricted in 1630 by Pope Urban VIII to cardinals. Up to that time they had been called *illustrissimi* and *reverendissimi*.

EMIR (em'ēr), the title given by Mahommedans to independent chiefs or princes, *Amir* or *Ameer* being the same word (the *Amir* of Afghanistan). When associated with other words it may designate various dignitaries. Thus the caliphs styled themselves *Emir-al-Mumenin*, Prince of the Faithful; *Emir-al-Omrah*, Prince of Princes, was the title of governors of certain provinces.

EMMAHAVEN, a seaport, west coast of Sumatra, 5 miles from Padang. Pop. 76,138.

EMMEN, a town, Netherlands, 30 miles S.S.E. of Groningen. Pop. (1932), 42,903.

EMMERICH (em'e-rih), a town, Rhenish Prussia, on the right bank of the Rhine. It carries on an active trade chiefly with Holland. Pop. 13,600.

EM'MET, Robert, an Irish rebel, born at Cork in 1778. He was expelled from Trinity College, Dublin, in 1798, on the ground of exciting disaffection and rebellion, and having become an object of suspicion to the Government, quitted Ireland. He returned there on the repeal of the suspension of the Habeas Corpus Act, and became a member of the Society of United Irishmen for the establishment of the independence of Ireland. In July, 1803, he was the ringleader in the foolish rebellion in which Lord Kilwarden and others perished. He was arrested a few days afterwards, tried, and executed.

His fate excited special interest from his attachment to Sarah Curran, daughter of the celebrated barrister. Their sad fates were commemorated by his college friend, Moore, in *Oh, Breathe Not His Name*, and *She is Far from the Land where her Young Hero Sleeps.*

EMOTION, a term variously used by psychologists; sometimes as one of the divisions of feeling, the other being sensation; sometimes as opposed to feeling when the latter is identified with sensation, and sometimes as distinct from both sensation and feeling, when the last term is rigidly confined to the sense of pleasure or pain. In any of these uses, however, emotions are distinguished from sensations in that sensations are primary forms of consciousness arising by external excitation, are comparatively simple and immediately presentative phenomena, and are definite in character and capable of localization; while emotions are secondary or derived forms of consciousness, are complex and representative, and are vague and diffused. Sensations are said to be 'peripherally initiated,' while emotions are centrally initiated.

When, in addition to its being distinguished from sensation, it is also distinguished from feeling, emotion is applied to the whole physical condition accompanying the sense of pleasure or pain (feeling). The muscles of the body and the organic functions of the system are often considerably influenced by emotion, which naturally seeks an outward expression unless held in check by what Darwin has called serviceable associated habits.—BIBLIOGRAPHY: A. Bain, *The Emotions and the Will*; J. M'Cosh, *The Emotions*.

EMPED'OCLES (-klēz), a Greek philosopher of Agrigentum, in Sicily, born about 490 B.C. He is said to have introduced the democratic form of government into his native city, and the Agrigentines regarded him with the highest veneration as public benefactor, poet, orator, physician, prophet, and magician.

Aristotle states that he died in obscurity, at the age of sixty years, in the Peloponnesus; but he is also said to have thrown himself into the crater of Mount Etna, in order to make it be believed, by his sudden disappearance, that he was of divine origin, and had been translated to heaven alive (cf. Matthew Arnold's *Empedocles on Etna*). According to Lucian, however, his sandals were thrown out from the volcano, and the manner of his death revealed.

Empedocles held earth, water, fire, air, as the four fundamental and indestructible elements from whose union and separation everything that exists is formed. To these material elements are added the two moving or operative principles of love and hatred, or attraction and repulsion. He wrote his philosophy in verse; of his chief work, *On Nature*, about 400 lines out of the original 5,000 are preserved.

EM'PEROR (from the Lat. *imperātor*; in Ger. *Kaiser*, from *Cæsar*), the title of the highest rank of sovereigns. The word *imperator*, from *imperāre*, to command, in its most general sense signified the commander of an army. After the overthrow of the Roman republic *imperator* became the title of the rulers or emperors, and indicated their supreme power. Victorious generals were still, however, sometimes saluted with the title *imperator*, in its original sense.

With the fall of Rome the title was lost in the West, but was kept up in



Empedocles, the Greek philosopher

the Eastern or Byzantine Empire for nearly ten centuries. In 800 it was renewed in the West when Charlemagne was crowned, by Leo III, as 'Carolus Augustus, the God-sent, pious, and great emperor of Rome.' It was, however, for many centuries considered necessary to be crowned at Rome, in order to be formally invested with the title of *emperor*.

The imperial dignity became extinct in the East after the conquest of Constantinople in 1453, but the title was adopted by Peter I of Russia in 1721. Napoleon I adopted the old idea of an empire as a general union of states under the protection, or at least political preponderance, of one powerful state; and he was followed in this by his nephew, Napoleon III.

In 1806 the first German Empire, 1,000 years old, became extinct, and the German Emperor, Francis II, adopted the title of Francis I, Emperor of Austria. In Dec., 1870, the second German Empire was formed, King William of Prussia having accepted the imperial office and title offered him at Versailles.

This empire came to an end in Nov. 1918.

Britain is considered as an empire, the crown as imperial, and the Parliament is styled the *Imperial Parliament of Great Britain and Northern Ireland*. Queen Victoria assumed the title of *Empress of India* in 1876, but the British sovereign has not the imperial title in reference to the home dominions. The sovereigns of Japan and Morocco are often, though with little propriety, called *emperors*. —Cf. Articles *Imperator* and *Princeps* in Smith's *Dictionary of Greek and Roman Antiquities*.

EMPEROR MOTH (*Saturnia pavonia*) a British moth belonging to a family Saturniidæ, of which some Indian species produce tussore silk. The colour is greyish-brown, with a faint purple tinge. The wings are about 3 inches in expanse, and in the centre of each is a large eye-like spot. The larva is of a bright-green colour, and studded with large rose-coloured or yellow tubercles.



Emperor Moth

EMPETRA'CEÆ, a small nat. ord. of heath-like Dicotyledons, of which the type is the crowberry.

EM'PHASIS, in rhetoric, a special stress or force given to some syllable, word, or words in speaking, in order to impress the hearers in some desired manner, thus differing from *accent*, the position of which is fixed.

EMPHYSE'MA is a distention of the tissues with air or other gases. Several forms are recognized: *pulmonary emphysema*, due to dilatation of the minute air-passages with loss of elasticity of the lung tissues; *surgical emphysema*, due to distention of the subcutaneous tissues by air, seen in certain wounds and injuries; *atrophic emphysema*, due to a senile condition of the lung tissues.

EMPIRE DAY, a British imperial celebration which is held annually on the 24th of May, the birthday of Queen Victoria. The celebration was officially held for the first time in 1904, and has since gained wide recognition, mainly owing to the unremitting efforts of the twelfth Earl of Meath.

EMPIRE MARKETING BOARD, British Government organisation. Founded in 1926, it advises the government on matters connected with marketing Empire produce. Publicity is an important activity, while by grants to suitable institutions at home and in the colonies it encourages research in connection with Empire agricultural products suitable for the home market.

EMPIRE STYLE. Neo-classical style of French decoration, in vogue during Napoleon's consulate and empire. Following the Directoire style, it derived its impulse from Napoleon's campaigns in Egypt, which popularised the sphinx, and from the discoveries then recently made at Pompeii and Herculaneum. Architecture simulated Roman grandeur; furniture displayed rectangular forms, sometimes with swelling curves, as in sofas, and curvilinear motives, such as wreaths and bows; textiles bore the bee, eagle and Napoleonic N. Its influence lasted until 1840.

EMPIR'IC (Gr. *empeiria*, experience) was used in medical history to denote one of a sect of physicians who held that observation and experience were the basis of medicine. The modern use of the term, medically, is restricted to one who practises medicine without any professional education or training.

EMPIRICISM (Gr. *empeiria*, experience), the philosophical theory according to which sense-experience is the source of all knowledge, i.e. that we can investigate the world only through the experience of our senses. It denies the existence of any *a priori* possibility of knowledge, and maintains that the mind is at first a *tabula rasa*, a clean slate, upon which all the characters are inscribed by experience.

The term empiricism is, however, now applied to any philosophical system which finds all its material in experience.

The philosophy of empiricism has been particularly developed by English writers of the seventeenth, eighteenth, and nineteenth centuries, such as Locke, Hume, and J. S. Mill. John Locke was the first to express the view in a systematic form. Among more modern empiricists are William James and John Dewey.—BIBLIOGRAPHY: Green, *Prolegomena to Ethics*; James, *Essays in Radical Empiricism*.

EMPLOYERS' LIABILITY ACT, a British Act of Parliament passed in 1880, by which, within certain limits, an injured workman or, in event of his death, his relatives or representatives may claim from the employer compensation for injuries received in his service. The law on this subject was

improved by the Workmen's Compensation Act (1897) and its Amending Act (1900). These applied to those employed on, in, or about railways, factories, mines, quarries, engineering works, buildings, and to agricultural labourers. An Act of 1906 added other classes of workers, including domestic servants. The law relating to Workmen's Compensation is now contained in the Workmen's Compensation Act, 1925.

The maximum compensation on death is £600. Contracting out is carefully safeguarded. The maximum weekly benefit is thirty shillings in cases of total incapacity. Ambulance rooms or 'first-aid' appliances must be provided in all factories.

EMPLOYMENT BUREAUS were first established on a considerable scale in the United Kingdom by the Labour Exchanges Act, 1909. They were to some extent based upon the German public labour exchanges, which came into being after 1893 in most large towns, and were either municipal or maintained by voluntary associations and supported by the municipality. Their chief object was to put employers and work-people into touch with a view to employment.

Before 1909 a few public employment bureaus had been established in Great Britain. An Act of 1905 established distress committees in boroughs and urban districts, which were given power to establish labour exchanges. These powers were in some cases exercised, either by taking over existing bureaus or establishing new ones. Only in London was the system of importance. The 1909 Act gave the Board of Trade power to establish labour exchanges; and by regulations under the Act, the United Kingdom has been divided into divisions in each of which are a number of exchanges of different grades.

The system is industrial and not eleemosynary, aiming solely at providing a recognized market-place for labour. No fees are charged, and use of the exchanges is voluntary. Work-people may register at an exchange between certain hours, and, when a suitable vacancy occurs, the applicant is sent to the employer. Applications for work-people are generally received by telephone, and are recorded if no suitable applicant is available.

An important part of the work of the labour exchange is in connection with Unemployed Insurance, under Part II, National Insurance Act, 1911. This provided for payment of unemployed benefit in a limited number of occupations. Subsequent Acts (notably that of 1920) have extended the system to cover the majority of occupations. The scheme is contributory, but the State shares the cost with employers and work people. — BIBLIOGRAPHY; W. H Beveridge, *Unemployment*; F. A Kellor, *Out of Work: a study of unemployment*.

EM'POLI, a town in North Italy, on the left bank of the Arno, 16 miles W.S.W. of Florence; it has an old collegiate church with good paintings, and manufactures of straw-bonnets. Pop. 21,250.

EMPO'RIA, a town of the United States, in Kansas, on the Neosho River, with a normal school, and a good trade in grain and cattle. Pop. 14,067.

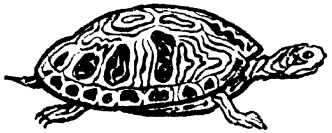
EMPYREU'MA, the smell arising from organic matter when subjected to the action of fire, but not enough to carbonize it entirely. The products of imperfect combustion, as from wood heated in heaps or distilled in close vessels, are frequently distinguished as empyreumatic.

EMS, or **BAD EMS**, a beautiful watering-place in the Prussian province of Hesse-Nassau, on the River Lahn, not far from its confluence with the Rhine. Its mineral waters are warm—from 70° to 118° F—contain large quantities of carbonic acid gas, and are used in chronic catarrhs, pulmonary complaints, diseases of the stomach, gout, and some diseases of the urinary vessels. There are about 8,000 visitors each season. Pop. 7,160.

EMS, a river of North-West Germany, which flows north-west through Rhenish Prussia and Hanover, and falls into the Dollart Estuary near Emden; length 200 miles.

EMU. *See* EMEU.

EMUL'SINE, or **SYNAPTASE**, originally the name given to the mixture of enzymes in bitter and sweet almonds. Emulsine has the



Emys

property of being able to hydrolyse the glucoside amygdalin to glucose, benzaldehyde, and hydrocyanic acid.

E'MYS, a genus of water-tortoises native to Europe and North America, and belonging to the family Testudinidæ, which includes most reptiles of the tortoise kind.

ENALIOSAU'RIANS ('sea-lizards'), a group of gigantic Mesozoic reptiles of which the ichthyosaurus and plesiosaurus were the chief.

ENAM'EL, a vitreous glaze coloured with metallic oxides, and, when first introduced, made to adhere by fusion on metals, &c. The ancient Babylonians enamelled bricks. No finer enamelling on bronze was done than that done in early Britain. The ancient Britons achieved great skill in decorating bronze shields, armlets, chariot pieces, helmets, &c., with red, blue, and white enamels during the Late Celtic (Early Iron Age) period and later. Indeed it is believed that the *champlevé* process



Alfred's Jewel

A jewel of blue enamel enclosed in a setting of gold, with the words round it: "Ælfred had me wrought," found at Athelney, Somersetshire, in the seventeenth century

of excavating hollows for enamel on metal in various flowing and artistic designs of symbolic character was developed in pre-Roman Britain. Philostratus, a third-century classical writer, referring to the enamelled trappings of horses, remarks that "the barbarians who reside in Ocean pour these colours on heated bronze, so that they adhere and become hard as stone."

Beautiful specimens of enamelled bronze found in England, Scotland, and Ireland, preserved in the British Museum, include the Battersea and Witham shields, bridle-bits from Dumfries, and Rise, near Hull, and an enamelled 'terret' from the Fayum, Egypt, whither, archæologists believed, it was taken by some Roman soldier. Enamelling on bronze and iron was practised in Central Europe and at Koban in the Caucasus at an earlier date than in Italy and Egypt. Byzantine enamels on gold date from the tenth century.

M. Salomon Reinach was the first to point out that red enamels were used as substitutes for coral, which, by the way, had a religious value as a 'life giver' and 'protector.' The later blue enamel may have been a substitute for lapis-lazuli, and other enamels, white, violet, green, and yellow, for, other sacred stones. The ancient enamels are more or less opaque. Transparent enamels were favoured in the thirteenth century by Italian goldsmiths.

A favourite method of applying enamel is known as *cloisonné*, which means inlaid between partitions. The design is outlined in bent-wire fillets, which are fastened to the plate by means of silver solder or the enamel itself. In *champlevé* work the plate itself is scooped out into channels for the enamel. The distinction between *cloisonné* and *champlevé* work, therefore, is something like the distinction between a breastwork and a trench. Enamelled glass is really deeply coloured glass. Bicycle enamel is made of asphalt or resin dissolved in oil, each coat being hardened by heat.

Enamel paint is made by mixing copal varnish, &c., with metallic oxides. A special preparation is applied to leather which is afterwards heated—this is 'patent leather.' Enamel painting dates back to the sixteenth century and is used nowadays chiefly for street signs and advertisements. The term 'enamel' is applied to the hard protective coating of teeth.—BIBLIOGRAPHY: E. Molinier, *Dictionnaire des émailleurs*; H. Cunynghame, *Art of Enamelling*; A. Fisher, *The Art of Enamelling upon Metal*; H. M. Chapin, *How to Enamel.*

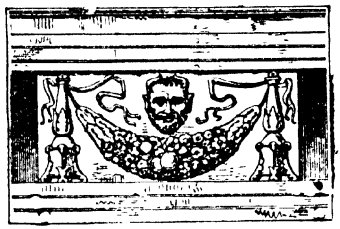
ENA'RA, a lake in the north of Finland, about 50 miles long by 30 miles broad. It is studded by innumerable islets, receives several streams, and is connected by the Patsjoki with the Arctic Ocean. At its south-west extremity is a small fishing-town of the same name, with an annual fair.

ENARE'A, a region belonging to the country of the Gallas, south of Abyssinia. Sakha is the principal town. Coffee and ivory are the chief exports. The inhabitants are the most civilized of the Gallas.

ENCAENIA, annual festivals in memory of the dedication of particular churches. An instance is that commemorating the Temple at Jerusalem. The annual commemora-

tion of the founders and benefactors of Oxford University in June is called the Encaenia.

ENCAR'PUS, in architecture, a sculptured ornament in imitation of a garland of fruits, leaves, or flowers



Encarpus, from Palazzo Niccolini, Rome

suspended between two points. The garland is widest in the middle, and diminishes gradually to the points of suspension, from which the ends generally hang down. The encarpus is sometimes composed of an imitation of drapery similarly disposed, and sometimes of an assemblage of musical instruments, implements of war or of the chase.

ENCAUSTIC PAINTING, a kind of painting practised by the ancients, for the perfecting of which heating or burning-in was required. Pliny distinguishes three species, in all of which wax was used with colours, and applied either with bronze instruments (cauteria), a sharp-pointed tool (cestrum), or brushes. The art has been revived in modern times, but has not been greatly employed.

As the chief aim in encaustic painting was the securing of permanence and durability by the application of heat, the word *encaustic* has been applied to other and widely different processes. Thus it has been used for painting on earthen vessels, for painting on porcelain and work in enamel; and in the same way it was given to the painting on glass of the Middle Ages.—Cf. A. P. Laurie, *Greek and Roman Methods of Painting.*

ENCAUSTIC TILES, ornamental paving-tiles of baked pottery, much used during the Middle Ages in the pavements of churches and other ecclesiastical buildings. The encaustic tile, strictly so-called, was decorated with patterns formed by different coloured clays inlaid in the tile and fired with it. The art appears to have originated in the latter part of the twelfth century, to have attained its highest perfection during the thirteenth, and to have sunk into disuse in the fifteenth. During the whole of this period it was principally carried on in England and Normandy. After a long lapse the art was revived in England in 1830 by Wright, a Shelton potter.

In modern manufacture two methods are employed, the 'plastic' and the 'semi-dry' or 'dust' method. The first is, in all essentials, that used in the Middle Ages, except, perhaps, in the perfection of modern moulding appliances; the second consists in ramming pulverized clay with a minimum of moisture into metal dies, the subsequent firing of tiles thus consolidated being attended with less risk from shrinkage.

ENCEPHALARTOS, a genus of Cycads, natives of Africa. Meal (Kaffir-bread) is made from the pith by the natives.

ENCHANTER'S NIGHTSHADE, a name common to plants of the genus Circæa, nat. ord. Onagraceæ, of which there are two British species, *C. lutetiana* and *C. alpina.* The



Enchanter's Nightshade

former is about a foot and a half high, and has delicate ovate leaves, small white flowers tinged with pink, and small roundish fruits covered with hooked bristles. It abounds in shady woods. *C. alpina,* which is similar, but smaller and more delicate, is found in Scotland and north of

England. They have no affinity with the nightshades.

ENCHORIAL (en-kō'ri-al) **WRITING**, the form of writing used by the old Egyptians for the common purposes of life, as distinct from the hieroglyphic and hieratic (used by the priests). It is also called *Demotic*.

ENCKE (en'ke), **Johann Franz**, German astronomer, born at Hamburg in 1791, died in 1865. He studied under the astronomer Gauss at Göttingen. During the War of Liberation (1813-5) he served as artillerist in the German army, and after the peace became assistant in the observatory of Seeberg, near Gotha. Here he calculated the orbit of the comet observed by Mechain, Miss Herschel, and Pons, predicted its return, and detected a gradual acceleration of movement, ascribed by him to the presence of a resisting medium. The comet is now known as Encke's comet. The fame of his works *Die Entfernung der Sonne* (The Distance of the Sun) and *Der Venusdurchgang von* 1769 (Transit of Venus of 1769) led to his appointment as director of the Berlin Observatory (1825), a position which he held till his death. From 1830 he edited the *Berliner Astronomisches Jahrbuch*.

ENCKE'S COMET. This object was seen in 1786, and at some subsequent returns, before it was discovered by Encke in 1819 to be a periodic comet. It has since been observed at numerous returns. It revolves round the sun in about three and one-third years, having the shortest period of any comet known. It has exhibited very prominently the feature, shown by many comets, of a contraction of the head or coma on approaching the sun.

Encke's comet long manifested the most remarkable feature of a shortening of its period by about two and a half hours in each revolution. The suggestion was made that this was due to resistance by a rare medium generally diffused in the solar system, which had the effect of reducing its aphelion distance and diminishing its orbit. This, however, is improbable, as other comets show no similar effect. The cause remains undiscovered, and a further extraordinary fact is that the shortening of period is found since 1868 to have been only half of its previous amount.

ENCLAVE (àn-klàv), a term used in German and French to denote a place or country which is entirely surrounded by the territories of another power.

ENCLOSURE, common land converted to the use of a private individual. In England, in the Middle Ages, there was an enormous amount of common land, but gradually much of it was enclosed by the lords of the manor. By law they could do this, provided they left enough unenclosed for the use of the tenants. In the 18th century by special Acts of Parliament dividing the land between the lord of the manor and the tenants, about 5,000,000 acres were enclosed, and the practice continued until 1845, when commissioners were appointed and further enclosures were few and small.

EN'CRINITE, or **CRINOIDEA** (Gr. *krinon*, lily, and *eidos*, form), a name often applied to all the marine animals of the class Crinoidea or stone-lilies, phylum Echinodermata, except feather-stars; but more specifically restricted to the genera having rounded, smooth stems attached to the bottom, and supporting the body of the animal, which has numerous jointed arms radiating from a central disc, in which the mouth is situated. Encrinites were exceedingly numerous in past ages of the world's history; of those still existing our knowledge has been greatly increased of recent years through deep-sea dredging. Some of these forms are very graceful and interesting. *See* CRINOIDEA; ECHINODERMATA.

ENCY'CLICAL, a sort of circular letter or manifesto issued by a pope and directed to the Roman Catholic clergy generally or to those of a certain country or area, giving instructions as to conduct to be observed at certain conjunctures, condemning erroneous doctrines, &c. The encyclical, which is a somewhat less formal document than a bull, was especially favoured by Pope Pius IX and Leo XIII. Pope Pius IX issued one in 1864, wherein he condemned eighty alleged errors in modern ideas of religion and civilization, and Pius X issued another in 1907, wherein he condemned modernism. A number of encyclicals was issued by Pope Leo XIII on Bible Study, Socialism, Capital and Labour.

ENCYCLOPEDIA (Gr. *en*, in, *kyklos*, a circle, and *paideia*, instruction), a systematic view of the whole extent of human knowledge or of particular departments of it, with the subjects arranged generally in alphabetic order. Varro and Pliny the elder, among the Romans, attempted works of an encyclopedic nature, the latter in his well-known *Historia Naturalis*, or *Natural History*. Other ancient encyclopedic works were those of Stobæus and Suidas, and especially of Marcianus Capella.

In the thirteenth century a work

on a regular plan was compiled by the Dominican Vincent of Beauvais (died 1264), in which was exhibited the whole sum of the knowledge of the Middle Ages. His work was entitled *Speculum Historiale, Naturale, Doctrinale*, to which an anonymous author added, some years later, a *Speculum Morale*. Roger Bacon's *Opus Majus* also belonged to the encyclopedic class.

An exceedingly popular work was the *De Proprietatibus Rerum* of Bartholomeus de Glanvilla, an English Franciscan friar, which maintained its reputation from 1360 to the middle of the sixteenth century. In the seventeenth century various encyclopedic works were compiled, such as the Latin one of Johann Heinrich Alsted (in 7 vols., Herborn, 1620). In 1674 appeared the first edition of Moreri's *Le Grand Dictionnaire Historique*; in 1677 Johann Jacob Hoffmann published at Basel his *Lexicon Universale*; and in 1697 appeared Bayle's famous *Dictionnaire Historique et Critique*, which is still of great value.

The first English alphabetical encyclopædia was the *Lexicon Technicum*, published in 1704. Among the chief English works of this kind are: 1 Ephraim Chambers's *Cyclopædia, or A Universal Dictionary of Arts and Sciences*, published in 1728 in 2 vols. folio. 2 *The Encyclopædia Britannica*, published in Edinburgh, in nine editions—the first in 1788, the ninth in 1875–88 (24 vols. 4to, with supplement, 11 vols., 1902–3). The tenth edition was published in 1902, the eleventh in 1910–11, the twelfth in 1922, and the thirteenth in 1926. 3 Recs' *Cyclopædia*, 39 vols. 4to, illustrated, 1802–20. 4 *Edinburgh Encyclopædia*, 1810–30, 18 vols. 4to, conducted by Sir David (then Dr.) Brewster. 5 *Encyclopædia Metropolitana*, London, 29 vols. 4to, and containing some valuable complete treatises. 6 *The London Encyclopædia*, by Thomas Curtis, 22 vols. 4to; London, 1829. 7 *The Penny Cyclopædia*, in 28 vols. small folio, 1833–43; since recast under the name of the *English Cyclopædia*. 8 *Chambers's Encyclopædia*, in 10 vols. 9 *The Popular Encyclopædia*, issued in 14 vols. 10 Harmsworth's *Universal Encyclopedia*. 11 Nelson's *The New Age Encyclopædia*. 12 *The New Gresham Encyclopedia*, 12 vols. (one being index).

The chief American encyclopædias are the *Encyclopædia Americana*, in 13 vols.; the *New American Cyclopædia*, in 16 vols.; *Johnson's Universal Cyclopedia*, 8 vols. *The New International Encyclopædia*, 25 vols.

Of the French cyclopædias the most famous is the great *Dictionnaire Encyclopédique*, by Diderot and D'Alembert (*see* next article); the *Encyclopédie Méthodique, ou par Ordre des Matières*, Paris, 1781–1832, in 201 vols. 4to, of which 47 are plates; the *Encyclopédie Moderne*, 1824–32, 26 vols.; the *Encyclopédie des Gens du Monde*, 1835–44, 22 vols.; the *Dictionnaire de la Conversation et de la Lecture*, 1851–58; the excellent *Grande Encyclopédie*, 31 vols.; and the large and valuable *Grand Dictionnaire Universel du XIX^e^ Siècle*, published by Larousse, 16 vols. folio (with supplementary vols.); *The Nouveau Larousse Illustré*, 7 vols.

Numerous works of this kind have been published in Germany, the most popular being the *Conversations-Lexikon* of Brockhaus; Meyer's *Konversations-Lexicon*; Pierer's *Konversations-Lexikon*, and that issued by Spamer. The most comprehensive is the *Allgemeine Encyklopädie*, originally edited by Professors Ersch and Gruber, begun in 1818, and not yet completed. *The Rousskiy Entsiklopeditsheskiy Slovarj*, the best Russian encyclopedia, in 43 vols., was published between 1905 and 1908.

ENCYCLOPÈDIE (àn-sik-lo-pā-dē), **THE FRENCH,** one of the most important literary enterprises of the eighteenth century, originated in a French translation of Ephraim Chambers's *Cyclopædia*. Diderot was appointed to edit it, and enlisted the ablest men of the time as contributors. D'Alembert (who wrote the famous *Discours préliminaire*) edited the mathematics; Rousseau wrote the musical articles; Daubenton, those connected with natural history; the Abbé Yvon, those on logic, metaphysics, and ethics; Toussaint, those on jurisprudence; Buffon contributed the article *Nature*; and Montesquieu, Voltaire, Euler, Marmontel, D'Holbach, Turgot, Grimm, and Condorcet took some share in the great work. Diderot himself was a prolific contributor on a wide variety of topics. The prospectus appeared in Nov. 1750, and the first volume in 1751, the whole being completed, despite fierce opposition, in 1765.

The contributors to the *Encyclopédie*, the majority of whom held unorthodox views on religious, political, and social subjects, are known as the *Encyclopédistes*.

ENDEM'IC (Gr. *en* and *demos*, people) is a term applied to diseases peculiar to people of a particular district or of a nation or country. The cause of this may be due to the physical characters of the place, or to the mode of living, habits, &c., of the people. Diseases endemic in one

region may appear elsewhere when similar influences arise.

EN'DERBY LAND, an island in the Antarctic Ocean, long. 50° E., crossed by the Antarctic Circle. It was discovered by John Biscoe in 1831.

EN'DIVE. *See* CHICORY.

ENDLESS SCREW, a mechanical contrivance, consisting of a screw the thread of which gears into a wheel with skew teeth, the obliquity corresponding to the angle of pitch of the screw. It is generally employed as a means of producing slow motion in the adjustments of machines, rather than as transmitter of any great amount of power.

ENDLICHER (end'li-*her*), **Stephen Ladislaus,** Hungarian botanist, born at Presburg in 1804. He was successively court-librarian at Vienna, and keeper of the natural history museum; and in 1840 was appointed professor of botany in the University of Vienna, and director of the botanic garden, which he immediately began to reorganize. He took part on the popular side in the German revolution of 1848, and died by his own hand in 1849. Among his chief botanical works are his *Genera Plantarum,* a systematic treatise on botany; and his *Enchiridion Botanicum,* or *Manual of Botany.*

ENDOCARDI'TIS, is inflammation of the endocardium, which is the lining membrane of the internal surface of the heart.

ENDOCRINOLOGY, study of the endocrine (internal secreting) glands and their secretions (hormones). These glands include the thyroid, thymus, supra-renal, pituitary, pineal body, carotid and coccygeal glands, which yield up their secretion to the blood stream without the intermediary of a duct; and others (pancreas, ovary, testes) which though provided with ducts for certain secretions, manufacture also others (endocrines) which reach the blood directly. Thus the term "ductless glands" is not synonymous with endocrine glands.

The internal secretions govern nutrition, growth, metabolism; deficiency in some may produce abnormalities such as cretinism or dwarfism; excess may cause giantism, and in the case of the thyroid, exophthalmic goitre. Both physical conformation and mental make-up are affected by their functioning. Defects may be remedied by the administration of glandular preparations or by surgical removal of portions of the glands. *See* GLAND.

ENDODERMIS, the innermost layer of the cortex. It acts as a 'physiological barrier' between the vascular tissues and the cortex, its structure being such as to compel all interchange of water and other materials between the two to pass through the living protoplasm of the endodermal cells. *See* TISSUES OF PLANTS.

ENDOG'AMY (Gr. *endon,* within, *gamos,* marriage), a custom among some savage peoples of marrying only within their own tribe; opposite to *exogamy.*

ENDOGENOUS PLANTS, old name for monocotyledons. *See* MONOCOTYLEDONOUS PLANTS.

ENDOGENOUS STRUCTURES, in botany, are those which arise in the interior of the parent organ. Lateral roots furnish the best example. Opposed to exogenous structures (*see also* BRANCHING *and* ROOT).

EN'DOMORPH, a term applied to crystals of minerals enclosed in those of other minerals.

EN'DOPARASITE (Gr. *endon,* within), a parasite living within, and at the expense of, another organism, as opposed to an *ectoparasite,* which attacks its host from the exterior.

ENDORSEMENT, writing on the back of a document constituting a sanction. Cheques, bills of exchange and other documents must be endorsed before they can be paid into a bank. The endorsement usually takes the form of the signature of the person to whom the document is made out.

EN'DOSKELETON, in anatomy, a term applied to the internal bony structure of man and other animals (Gr. *endon,* within), in contradistinction to *exoskeleton,* which is the outer and hardened covering of such animals as the crab and lobster.

EN'DOSMOSE, or **ENDOSMO'SIS,** the transmission of liquids or gases through porous septa or partitions from the exterior to the interior of a vessel. When two different liquids or gases are separated by a porous vessel, the two fluids pass through the walls of the vessel at different rates, causing a change of volume and of pressure inside and outside the vessel. Endosmose is the name applied to the flow towards the fluid which is increasing in volume. When the transfer of liquid across the porous partition takes place in a cell through which an electric current is flowing the effect is called electrical endosmose.

EN'DOSPERM, the tissue surrounding the embryo in many seeds and contained with it within the testa. It forms a supply of food for the germinating embryo, and is also called albumen.

ENDOWMENT, money settled on an institution or society. The term

is generally used for money given or bequeathed to a religious, educational or philanthropic institution which, being corporations, can hold land or other property in perpetuity. In Great Britain a vast sum of money is held as endowments, some of it being controlled by the Charity Commission.

ENDOWMENT POLICIES, as they are called, are issued by insurance companies to provide money for educating a son or daughter, or starting them in life, or for some other purpose.

ENDYM'ION, in Greek mythology, a huntsman, a shepherd, or a king of Elis, who is said to have asked of Zeus, or to have received as a punishment, eternal sleep. Others relate that Selēnē or Diana (the moon) conveyed him to Mount Latmos in Caria, and threw him into a perpetual sleep in order that she might enjoy his society whenever she pleased.



Endymion, from British Museum

Endymion is also supposed to be a personification of the sun, or of the plunge of the setting sun into the sea. Cf. Keats, *Endymion*.

ENEMA. Fluid injection into the bowel. Enemata may be cleansing, comprising water with or without soap and purgatives; nutrient, when stomach derangement prevents digestion; sedative, for painful bowel irritation; destructive, for thread-worms; and healing, as for intestinal ulcers. A rubber ball syringe or a funnelled tube passes the fluid through a round-ended nozzle into the rectum.

ENERGY, PHYSICAL, is the capacity which a body or system of bodies has for doing work. Work is done when a force is overcome, and it is measured by the product of the force and the distance through which it is overcome. A quantity of energy is therefore expressed in terms of the same units as work, e.g. the foot-pound and the erg.

Energy exists in two forms. **Potential energy** is that which a body possesses in virtue of its position. For instance, by winding up a clock weight it is given a certain amount of potential energy, which it slowly expends in driving the clock; a bent spring and a mass of compressed air also possess energy in the potential form. This kind may also be noted in the voltaic cell and the charged condenser, and in a chemical form in coal and gunpowder.

Kinetic energy is possessed by bodies in virtue of their motion. Thus a moving bullet and a falling hammer contain kinetic energy; bodies which are in a state of vibration are also sources of this form of energy, which is diffused from the body through the surrounding medium in the form of waves, whether of sound, heat, light, or the ether waves of radio-telegraphy. Energy may thus exist in any of the following forms: mechanical (potential, kinetic), sound, heat, light, magnetic, electrostatic, electro-magnetic, chemical.

Energy may be transformed from one kind into another. When a pendulum is vibrating, there is a continual transformation of potential into kinetic energy, and vice versa. By rubbing the hands together we convert mechanical energy into heat. In an electric tramway system we may note a whole series of transformations. The chemical energy of the fuel is turned into heat in the furnace and boiler; this, again, into kinetic energy of the turbine and dynamo; the latter gives out electric current, the energy of which, after suffering slight losses as heat in the overhead wire, and as light and sound in the spark, at the trolley, passes into the motor, to reappear as kinetic energy of the car.

The transformation of energy takes place according to a definite law. The principle of the **conservation of energy** states that the total amount of energy in a self-contained finite system is constant. This implies that energy cannot be destroyed, and that when a certain amount of energy disappears, an equal amount appears in another form. This principle is apparently contradicted in many cases of transformation, since it is impossible to transform energy by natural process, or by the use of mechanism, without doing work in overcoming frictional or resisting forces. In all such cases the energy spent is converted into heat, which is less available as useful energy.

Heat and Energy. The experiments of Rumford, Davy, and Joule were instrumental in establishing the equivalence of mechanical energy and heat. Rumford showed that water could be boiled by means of the heat produced by rotating a blunt boring-tool within a cannon,

and pointed out that the heat liberated was, in another form, the energy spent in driving the blunt drill. Davy caused two pieces of ice to be rubbed together within a vacuum at a temperature below zero, and melted the ice, thus showing that, since ice has to absorb heat in order to melt, the supply of heat could not have come from the ice itself, but must have resulted from the work done in rubbing. It has to be remembered that, in the time of Rumford and Davy, the belief was prevalent that heat or caloric was a material substance, and not a form of motion.

A further and most important step was made by Dr. J. P. Joule, of Manchester, who measured the amount of mechanical work which is spent in producing one unit of heat. This is known as the mechanical equivalent of heat, or Joule's equivalent. Two hanging weights were geared to a set of paddles which could rotate within a cylindrical copper vessel filled with water, and supplied with fixed vanes. The weights were released, and in descending a measured distance caused the paddles to churn the water in the vessel, and thus the water was slightly warmed. This operation was repeated several times, and the rise of temperature of the water was measured by means of a delicate thermometer. When corrections for friction, cooling, and other losses had been applied, Joule calculated that 772 foot-pounds of work were expended in raising 1 lb. of water 1° F. The experiment has been repeated in various forms, and the value now accepted for Joule's equivalent is 777.

Although energy cannot be destroyed, nor, it may be added, created, it may be rendered less available for use. The various forms of energy may be classified according to their availability, and in this respect mechanical energy is one of the most available, and low-temperature heat is one of the least available. The latter is therefore classed as a lower form of energy, and when energy is converted from a more available to a less available form, it is said to be dissipated or degraded. Now, during any transformation of energy, a part of the energy is spent in overcoming friction forces, and is thus degraded.

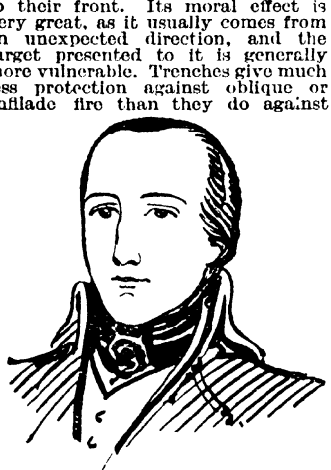
Industrial Application. The problem of economizing our stores of energy is one which is now attracting more attention than it did formerly. With the greater scarcity of coal, and the future prospect of its complete absence, other natural sources of energy are being investigated. Oil has been discovered in this country, but not in large quantities. Waterfalls have long been employed for driving mills wherever this type of power could be obtained cheaply and conveniently; the resources of the Highlands in this respect have not been utilized to any great extent. At Kinlochleven, where the valley has been dammed across to obtain sufficient water-power, an aluminium industry has sprung up. There is a scheme on foot at the present time to make use of the tidal energy of the Severn. Here and there windmills may be seen which drive water-pumps employed for draining purposes. On the Severn, near Ironbridge, a ferry is in use which employs the force of the river current to propel the ferry-boat across the river. In warmer countries batteries of mirrors have been employed to concentrate the sun's heat for use in the absence of fuel. In large towns the presence of unconsumed carbon (soot) in the atmosphere raises the question not only of fuel economy but also of public health.—BIBLIOGRAPHY: Kelvin and Tait, *Natural Philosophy;* Balfour Stewart, *Conservation of Energy;* Deschanel, *Heat, Light,* &c.; E. Buckingham, *Thermodynamics.*

ENFANTIN (án-fán-tan), **Barthélemy Prosper,** one of the chief founders of St. Simonism; born at Paris, 1796, died in 1864. In 1825 he became acquainted with St. Simon, who in dying confided to him the task of continuing the work. This he did with success until after the Revolution of 1830, when, as the representative of the social and religious theories of the school, he quarrelled with Bazard, the representative of its political ideas. Enfantin organized model communities, which quickly fell to pieces; the new organ of the sect, *Le Globe,* was a failure; their convent at Ménilmontant, of which Enfantin was 'supreme father,' was broken up by the Government (1832). He himself was imprisoned as an offender against public morality (being an advocate of free love), and on his release attempted to found a model colony in Egypt, which was broken up in the second year. He then retired to Tain (Drôme), where he lived for some time as a farmer.

In 1841 he was sent as member of a commission to explore the industrial resources of Algiers, and on his return published a work on the *Colonization of Algiers* (1843). On the Revolution of 1848 he started a new journal, *Le Crédit Public,* but after two years withdrew from public notice. He afterwards held a post on the Paris, Lyons and Mediterranean Railway until his death. Among his works are: *Doctrine de St. Simon, La Religion St. Simonienne.*

EN'FIELD, a town, England, county Middlesex, 10¼ miles N. by E. London. It is the seat of the Government manufactory of rifles and small-arms. It gives its name to the British rifle (Lee-Enfield), which helped to win the European War. Pop. (1931), 67,869.

ENFILADE FIRE, fire directed down the length of a trench or a line of troops from a point at right angles to their front. Its moral effect is very great, as it usually comes from an unexpected direction, and the target presented to it is generally more vulnerable. Trenches give much less protection against oblique or enfilade fire than they do against



Duc D'Enghien

frontal fire, although the main purpose of 'bays' is to lessen the effect of enfilading.

ENFRANCHISEMENT, liberation or the admission to political privileges. Persons are enfranchised by being given the right to vote, as was done in 1918 and 1928 in Great Britain when women were made voters. Another kind of enfranchisement is turning a leasehold tenure into a freehold one.

EN'GADINE, a beautiful valley in Switzerland in the Grisons, on the banks of the Inn, bordering on the Tyrol, about 60 miles long, but in some parts very narrow, divided into Upper and Lower. The pop. of the whole valley amounts to about 11,712. The language generally spoken is the Ladin, a branch of the Romanic tongue. The cold, dry climate and mineral springs have made the valley a favourite resort for invalids.

ENGAGED COLUMN, in architecture, a column attached to a wall so that part of it (usually less than half) is concealed.

ENGELS, Friedrich, German Socialist, born at Barmen in 1820, died 1895. He was the son of a rich cotton-spinner, and although destined for a commercial career, he began to collaborate on the *Deutsch-Franzosische Jahrbucher* issued in Paris by Karl Marx and Arnold Ruge. He helped Marx to organize the Communist League in 1846, and took part in the Revolution of 1848 at Baden. From 1850 to 1869 he lived at Manchester as manufacturer. An intimate friend of Marx, he helped the latter to spread social democratic ideas, and was part author of the *Communist Manifesto.* After the death of Marx he edited the second and third volumes of *Das Kapital.* Engel's own works include: *The Condition of the Working Classes in England in* 1844; *The Origin of the Family; Private Property and the State;* and *Socialism, Utopian and Scientific.*—Cf. Karl Kautsky, *Friedrich Engels: his Life, his Work, and his Writings.*

ENGHIEN (àn-gi-àn), or **ENGUIEN,** a town in Hainault, Belgium, between Brussels and Tournai. It has a superb castle, and gave the title of duke to a prince of the house of Bourbon Condé in memory of the victory gained here by the great Condé. Pop. 4,510.

ENGHIEN (àn-gi-àn), **Louis Antoine Henri de Bourbon,** Duke of, born at Chantilly in 1772; son of Louis Henry Joseph Condé, Duke of Bourbon. On the outbreak of the Revolution he quitted France, travelled through various parts of Europe, and went in 1792 to Flanders to join his grandfather, the Prince of Condé, in the campaign against France. From 1796 to 1799 he commanded with distinguished merit the vanguard of Condé's army, which was disbanded at the Peace of Lunéville (1801). He then took up residence as a private citizen at Ettenheim in Baden, where he married the Princess Charlotte de Rohan Rochefort. He was generally looked upon as the leader of the *émigrés* (q.v.), and was suspected by the Bonapartists of complicity in the attempt of Cadoudal to assassinate the first consul. An armed force was sent to seize him in Baden in violation of all territorial rights, and he was brought to Vincennes on the 20th March, 1804. A trial, which was a mere form, was held the same night; and on the following morning he was shot in the ditch outside the walls. It was this event which drew from Fouché the comment, since become proverbial: "C'est plus qu'un crime, c'est une faute" ("It is worse than a crime, it is a blunder").

EN'GINE. *See* INTERNAL COMBUSTION ENGINES; STEAM-ENGINES.

ENGINEERING, the profession concerned in applying the forces of nature to the service of man. It is divided into two groups, civil engineering and military engineering. This grouping of the profession of engineering is adopted in the Charter of the Institution of Civil Engineers. Army engineers are organized as Royal Engineers. Candidates intending to become Royal Engineer officers have to pass the Army Entrance Examination to gain admission to Woolwich. At Woolwich they receive a course of technical instruction, and then proceed to military engineering duties in the Royal Engineers. Naval engineers enter the service as naval cadets. The education of all naval cadets is the same, no matter in what branch of the service they may ultimately specialize, up to the rank of sub-lieutenant, when specialization begins. The engineering lieutenants undergo a special course of engineering training at the Royal Naval College, Greenwich, and then go to sea. Naval engineers are called upon to undergo a severe medical examination, as the conditions of service call for robust men.

In the ordinary way the term *civil engineering* is not used in the technical sense explained above, but is the name given to one of the sections into which the whole group is divided. The 'civil' engineer undertakes the design and erection of constructional works, such as harbours, docks, railways, buildings, bridges, &c. A person entering the profession of civil engineering usually receives a technical education at a technical school, or at a university, and then enters the office of a practising civil engineer. He will spend a part of his time at the drawing-board, learning the details of design, and a part of his time actually in the field or on works, assisting in the supervision of the work.

The other departments of the group of 'civil engineers'—as distinct from military engineers—are mechanical engineers, electrical engineers, motor engineers, telegraph engineers, radio engineers, mining engineers, aeronautical engineers, &c. With the exception of mining, the courses of training in these sections are very much the same, and consist of a technical course in a college or a university, followed by a practical training as a pupil in a works. The prior technical education is now being insisted upon by most of the large engineering firms, and, in many of the best works, special courses of instruction are given to apprentices as part of their training by the most experienced engineers of the company.

In mining, the orthodox training consists of a technical course in one of the mining schools, followed by practical work in a mine. In this country every mining engineer who intends to take a position of responsibility must qualify by passing a Board of Trade examination. Sea-going marine engineering officers have, in addition to undergoing the usual training, to pass the sea-going engineers' examination of the Board of Trade.

It will be seen from the above remarks that the courses of training for engineers depend entirely upon the particular branch of engineering which is to be entered. As this point is often not finally settled till fairly late in a young man's career, it is possibly unwise for him to take his initial training in too narrow a groove. A sound, general technical education, combined with three or four years' experience in a general engineering works, will fit him for specializing in very many sections of engineering, whereas if he intends to enter the mining or the civil engineering professions, a sound technical course, followed by a few years' experience in civil or mining engineering work abroad will usually fit him for a specialized post later on.

ENGINEERS, ROYAL. Military engineers in one form or another, and under various names, have existed in England since the eleventh century. In those early days men of some education—often monks—were appointed as Ingeniatores Regis to undertake the manufacture of the king's engines of war, and to build his castles. In later years they became known as Attilators, and when, with the gradual introduction of gunpowder for military purposes, a combined train was formed, are considered to have given their name to what we now call artillery. In the early seventeenth century this train, composed of engineers and artillery, was merely a temporary corps raised for a particular war and disbanded on its conclusion; but in 1698, when the expediency of maintaining a standing army had been to some extent recognized, the first permanent train was raised. In 1716 a separate body of engineers was formed, but without military rank, and it was not till 1782 that military titles were conferred on the officers of engineers. In 1787 the Corps of Engineers became by Royal Warrant the Corps of Royal Engineers, with the mottoes *Ubique* and *Quo fas et gloria ducunt*, which are also borne by

the Royal Regiment of Artillery. For a considerable period the rank and file of the corps were known as the 'Royal Sappers and Pioneers,' and the term 'Sapper' is still used to denote a private of the corps.

Among the present-day peace-time duties of the Royal Engineers are the construction and maintenance of barracks and military works generally, while for war purposes the corps is organized into mobile units known as field squadrons and companies for general field-work, and into more highly specialized units for mining, heavy bridging, and railway work. The corps is recruited almost entirely from among artisans and tradesmen, and a field company of a total strength of 184 all ranks has representatives of no fewer than nineteen trades in it.

ENGLAND, including *Wales*, the southern and larger portion of the Island of Great Britain, is situated between 50° and 55° 46′ N. lat., and 1° 46′ E. and 5° 42′ W. long. On the north it is bounded by Scotland; on all other sides it is washed by the sea: on the east by the North Sea, on the south by the English Channel; and on the west by St. George's Channel and the Irish Sea. Its figure is, roughly speaking, triangular, but with many windings and indentations, the coast-line measuring not less than 2,765 miles. The length of the country, measured on a meridian from Berwick nearly to St. Alban's Head, is 365 miles. The maximum breadth is 280 miles.

The subdivision of England into shires or counties does not appear to have assumed a definite form till the time of Alfred. The existing division was first completed unde Henry VIII. There are now 'administrative counties' and 'registration counties,' differing in area from the old counties. The figures in the tables (pp. 159, 160) refer to the old counties.

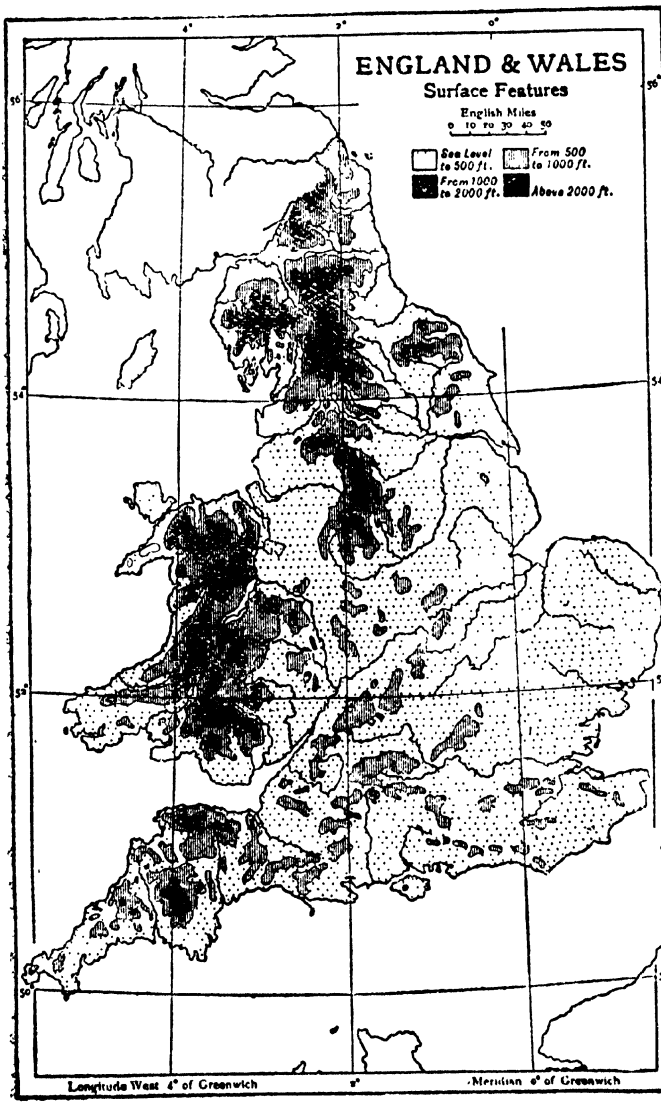
The capital of England and of the British Empire is London. The cities next in size (in order of population at 1931 census) are: Birmingham, Liverpool, Manchester, Sheffield, Leeds, Bristol, Hull, Bradford, and West Ham.

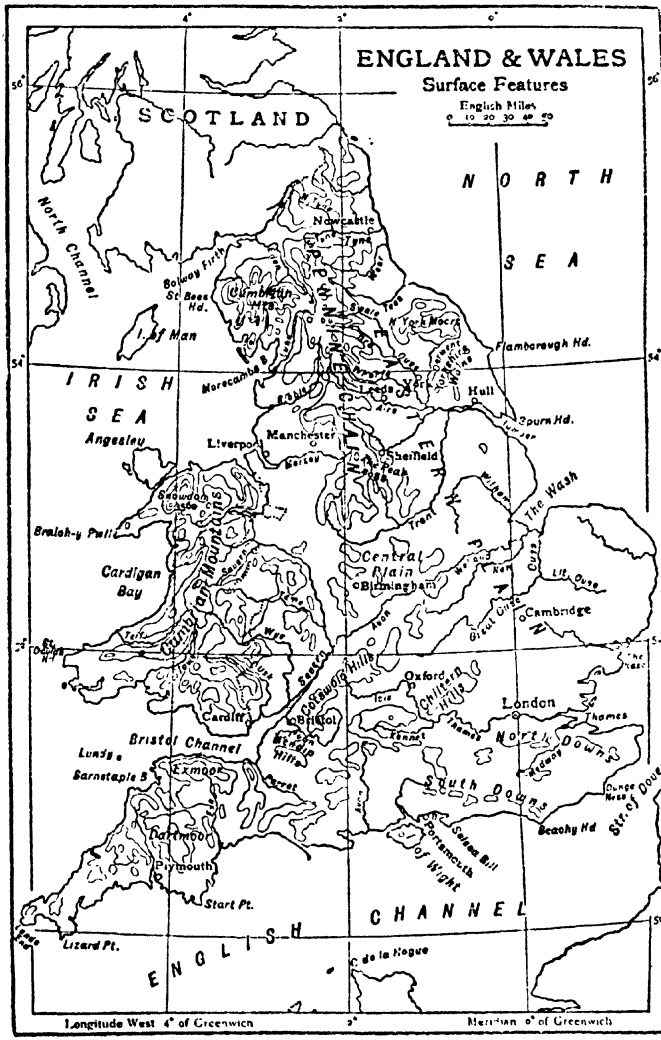
Physical Features. The chief indentations are: on the east, the Humber, the Wash, and the Thames estuary; on the west, the Solway Firth, Morecambe Bay, Cardigan Bay, and the Bristol Channel, those on the south are less prominent, though including some useful harbours. The greater part of the coast consists of cliffs, in some places clayey, in others rocky, and sometimes jutting out, as at Whitby and Flamborough Head on the east, Beachy Head, the Isle of Portland, the Lizard, and Land's End on the south and south-west, St. David's Head and St. Bees Head on the west, into bold, lofty, and precipitous headlands. The most extensive stretches of flat coast are on the east, in the county of Lincoln, and from the southern part of Suffolk to the South Foreland in Kent, and in Sussex and Hants on the south coast. The chief islands are: Holy Island, the Farne Islands, Sheppey, and Thanet on the east coast; the Isle of Wight on the south; the Scilly Isles at the south-west extremity; and Lundy, Anglesey, Holy Island, and Walney on the west.

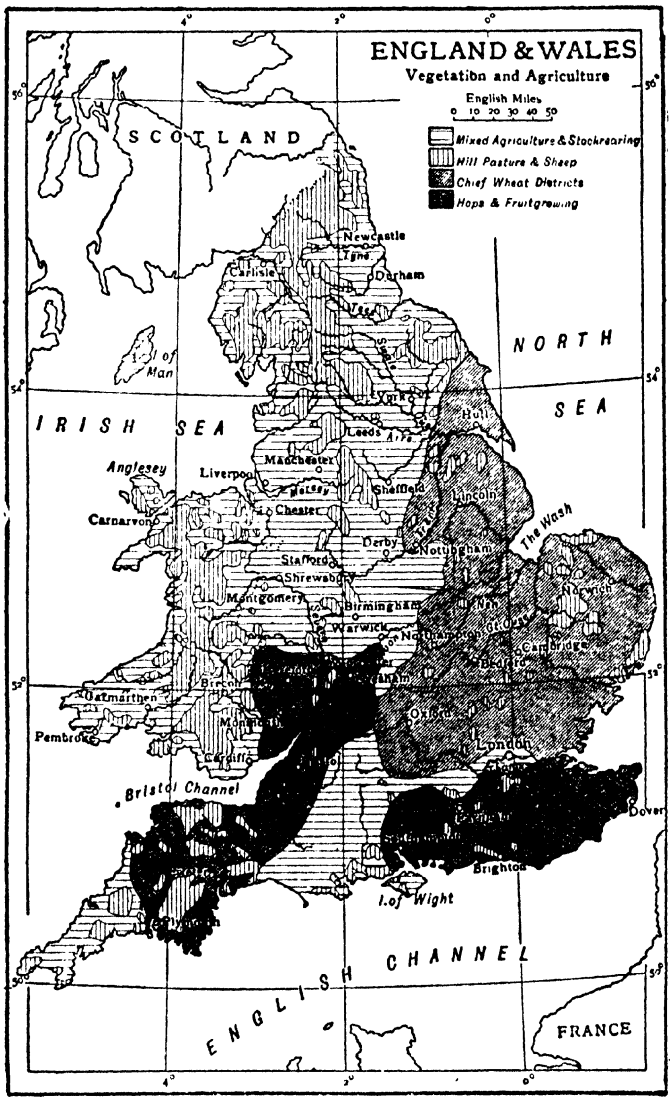
The loftiest heights of England and Wales are situated at no great distance from its western shores, and consist not so much of a continuous chain as of a succession of mountains and hills stretching, with some interruptions, from north to south, and throwing out numerous branches on both sides, but particularly to the west, where all the culminating summits are found. The northern portion of this range has received the name of the Pennine chain. It is properly a continuation of the Cheviot Hills, and, commencing at the Scottish border, proceeds south for about 270 miles till, in the counties of Derby and Stafford, it assumes the form of an elevated moorland plateau.

In Derbyshire The Peak rises to the height of 2,088 feet. By far the most important of its offsets are those of the west, more especially if we include in them the lofty mountain masses in North-Western England sometimes classed separately as the Cumbrian range. Amidst these mountains lie the celebrated English lakes, of which the most important are Windermere, Derwent Water, Coniston Lake, and Ullswater. Here also is the highest

Divisio ns	Area in Sq. Miles	Males	Females	Population 1931
England	50,874	18,067,188	19,722,550	37,789,738
Wales	7,466	1,071,656	1,086,537	2,158,193
Isle of Man	221	22,489	26,849	49,338
Channel Isles ..	75	43,958	49,103	93,061
	58,636	19,205,291	20,885,039	40,090,330


ENGLAND & WALES
Surface Features
English Miles
0 10 20 30 40 50
Sea Level to 500 ft.
From 500 to 1000 ft.
From 1000 to 2000 ft.
Above 2000 ft.
Longitude West 4° of Greenwich
Meridian 0° of Greenwich


ENGLAND & WALES
Surface Features
English Miles
0 10 20 30 40 50
SCOTLAND
NORTH SEA
IRISH SEA
ENGLISH CHANNEL
North Channel
I. of Man
Newcastle
Cumberland Mts.
Pennines
Manchester
Liverpool
Sheffield
Hull
Flamborough Hd.
Bourn Hd.
Angelsey
Snowdon
Cambrian Mts.
Cardigan Bay
Central Plain
Birmingham
The Wash
Cambridge
Oxford
Chiltern Hills
London
Cardiff
Bristol
Bristol Channel
Exmoor
Dartmoor
Plymouth
Start Pt.
Lizard Pt.
North Downs
South Downs
Beachy Hd
Portsmouth
Isle of Wight
Longitude West 4° of Greenwich
Meridian 0° of Greenwich


ENGLAND & WALES
Vegetation and Agriculture
English Miles
0 10 20 30 40 50
Mixed Agriculture & Stockrearing
Hill Pasture & Sheep
Chief Wheat Districts
Hops & Fruitgrowing
SCOTLAND
NORTH SEA
IRISH SEA
ENGLISH CHANNEL
FRANCE
Newcastle
Carlisle
Durham
I. of Man
Hull
Leeds
Manchester
Liverpool
Anglesey
Sheffield
Lincoln
Chester
Carnarvon
Derby
Nottingham
The Wash
Stafford
Shrewsbury
Norwich
Montgomery
Birmingham
Warwick
Cambridge
Oxford
Carmarthen
Brecon
Monmouth
Pembroke
London
Cardiff
Bristol Channel
Dover
Brighton
I. of Wight

Counties.	Area in Statute Acres, 1931 (Land and Inland Water). Counties, including County Boroughs.	*Census Population.* Counties, including County Boroughs, 1921.	1931.
ENGLAND.			
Bedfordshire	302,942	206,162	220,474
Berkshire	463,830	294,821	311,334
Buckinghamshire ..	479,360	236,171	271,565
Cambridgeshire	315,168	129,602	140,004
Isle of Ely	238,073	73,817	77,705
Cheshire	652,383	1,020,257	1,087,544
Cornwall	868,167	320,705	317,951
Cumberland	973,086	273,173	262,897
Derbyshire	647,824	714,634	757,332
Devonshire	1,671,364	709,614	732,869
Dorsetshire	622,843	228,160	239,347
Durham	649,420	1,479,033	1,485,175
Essex	979,532	1,470,257	1,755,459
Gloucestershire	804,638	756,574	785,656
Herefordshire	538,924	113,189	111,755
Hertfordshire	404,520	333,195	401,206
Huntingdonshire	233,985	54,741	56,204
Kent	975,965	1,141,666	1,219,273
Lancashire	1,200,122	4,932,951	5,039,455
Leicestershire	532,779	494,469	541,794
Lincolnshire			
The parts of Holland	268,992	85,870	92,313
The parts of Kesteven	463,505	107,643	110,059
The parts of Lindsey	972,796	408,698	422,181
London	74,850	4,484,523	4,397,003
Middlesex	148,691	1,253,002	1,638,728
Monmouthshire	349,569	450,794	434,821
Norfolk	1,315,064	504,293	504,846
Northamptonshire ..	585,148	302,404	309,428
The Soke of Peterborough	53,464	46,959	51,845
Northumberland ..	1,291,978	746,096	756,723
Nottinghamshire ..	540,015	641,119	712,681
Oxfordshire	479,224	189,615	209,599
Rutlandshire	97,273	18,376	17,397
Shropshire	861,800	243,062	244,162
Somersetshire	1,036,818	465,691	475,120
Southampton	961,665	913,681	1,014,115
Isle of Wight ..	94,116	91,666	88,400
Staffordshire	737,886	1,353,511	1,431,175
Suffolk, East	557,353	291,073	294,977
Suffolk, West	390,916	108,985	106,137
Surrey	461,833	930,086	1,180,878
Sussex, East	530,555	532,187	546,942
Sussex, West	401,916	195,810	223,136
Warwickshire	624,676	1,394,741	1,535,007
Westmorland	504,917	65,746	65,398
Wiltshire	860,829	291,838	303,258
Worcestershire	447,678	397,910	420,156
York, City of	3,730	84,039	84,813
Yorkshire, East Riding ..	750,115	460,880	483,058
,, North Riding	1,362,058	456,436	469,389
,, West Riding	1,776,064	3,181,202	3,352,555
Totals	32,559,868	35,681,019	37,789,738

Counties.	Area in Statute Acres, 1931 (Land and Inland Water). Counties including County Boroughs.	*Census Population.* Counties, including County Boroughs, 1921.	1931.
WALES.			
Anglesey	176,630	51,744	49,025
Brecknockshire	469,281	61,222	57,771
Caernarvonshire	364,108	128,183	120,810
Cardiganshire	443,189	60,881	55,164
Carmarthenshire ..	588,472	175,073	179,063
Denbighshire	427,977	157,634	157,645
Flintshire	163,707	106,617	112,849
Glamorganshire	520,456	1,252,481	1,225,717
Merionethshire	422,372	45,087	43,198
Montgomeryshire ..	510,110	51,263	48,462
Pembrokeshire	393,003	91,978	87,179
Radnorshire	301,165	23,517	21,314
Totals, Wales ..	4,780,470	2,205,680	2,158,193
Totals, England and Wales	37,339,215	37,886,699	39,917,931

summit of Northern England, Scawfell (3,210 feet).

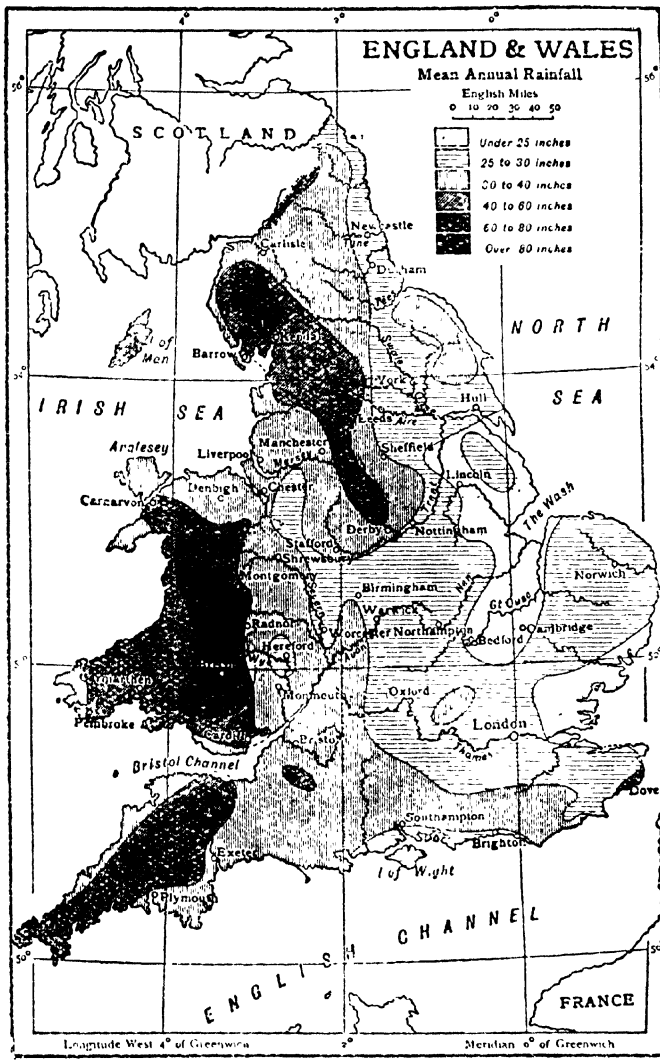
The Pennine chain, with its appended Cumbrian range, is succeeded by one which surpasses both these in loftiness and extent, but has its great nucleus much farther to the west, where it covers the greater part of Wales, deriving from this its name, the Cambrian range. Its principal ridge stretches through Caernarvonshire from N.N.E. to S.S.W., with Snowden (3,560 feet) as the culminating point of South Britain.

Across the Bristol Channel from Wales is the Devonian range. It may be considered as commencing in the Mendip Hills of Somerset, and then pursuing a south-westerly direction through that county and the counties of Devon and Cornwall to the Land's End, the wild and desolate tract of Dartmoor forming one of its most remarkable features (highest summit, Yes Tor, 2,028 feet). Other ranges are the Cotswold Hills, proceeding in a north-easterly direction from near the Mendip Hills; the Chiltern Hills taking a similar direction farther to the east: and the North and South Downs running eastward, the latter reaching the south coast near Beachy Head, the former reaching the south-east coast at Folkestone.

A large part of the surface of England consists of wide valleys and plains. Beginning in the north, the first valleys on the east side are those of the Coquet, Tyne, and Tees; on the west the beautiful valley of the Eden, which, at first hemmed in between the Cumbrian range and Pennine chain, gradually widens out into a plain of about 470 sq. miles, with the town of Carlisle in its centre. The most important of the northern plains is the Vale of York, which has an area of nearly 1,000 sq. miles. Properly speaking it is still the same plain which stretches, with scarcely a single interruption, across the counties of Lincoln, Suffolk, and Essex, to the mouth of the Thames, and to a considerable distance inland, comprising the Central Plain and the region of the Fens. On the west side of the island, in South Lancashire and Cheshire, is the fertile Cheshire Plain.

In Wales there are no extensive plains, the valleys generally have a narrow rugged form favourable to romantic beauty, but not compatible with great fertility. Wales, however, by giving rise to the Severn, can justly claim part in the vale, or series of almost unrivalled vales, along which it pursues its romantic course through the counties of Montgomery, Salop, Worcester, and Gloucester. South-east of the Cotswold Hills is Salisbury Plain, but it is only in name that it can be classed with the other plains and level lands of England, being a large elevated plateau, of an oval shape, with a thin chalky soil only suitable for pasture. In the south-west the only vales deserving of notice are those of Taunton in Somerset and Exeter in Devon.

A large portion of the south-east may be regarded as a continuous plain, consisting of what are called


ENGLAND & WALES
Mean Annual Rainfall
English Miles
0 10 20 30 40 50
Under 25 inches
25 to 30 inches
30 to 40 inches
40 to 60 inches
60 to 80 inches
Over 80 inches
SCOTLAND
NORTH SEA
IRISH SEA
ENGLISH CHANNEL
FRANCE
Isle of Man
Barrow
Liverpool
Manchester
Sheffield
Hull
Leeds
York
Lincoln
Anglesey
Llanbigh
Carnarvon
Chester
Derby
Nottingham
Stafford
Shrewsbury
Montgomery
Birmingham
Warwick
Norwich
The Wash
Radnor
Worcester
Northampton
Bedford
Cambridge
Hereford
Monmouth
Oxford
London
Pembroke
Bristol Channel
Bristol
Dover
Southampton
Brighton
Isle of Wight
Exeter
Plymouth
Longitude West 4° of Greenwich
Meridian 0° of Greenwich

the Wealds of Sussex, Surrey, and Kent, between the North and South Downs, and containing an area of about 1,000 sq. miles. The south-east angle of this district is occupied by the Romney Marsh, an extensive level tract composed for the most part of a rich marine deposit.

Extensive tracts of a similar nature are situated on the east coast, in Yorkshire and Lincoln, where they are washed by the Humber; and in the counties which either border the Wash, or, like Northampton, Bedford, Huntingdon, and Cambridge, send their drainage into it by the Nene and the Ouse. Many of these lands are naturally the richest in the kingdom, but have been utilized only by means of drainage.

England is well supplied with rivers, many of them of great importance to industry and commerce. Most of them carry their waters to the North Sea. If we consider the drainage as a whole, four principal river basins may be distinguished, those of the Thames, Wash, and Humber belonging to the North Sea; and the Severn belonging to the Atlantic.

The basin of the Thames has its greatest length from east to west, 130 miles, and its average breadth about 50 miles, area 6,160 sq. miles. The river itself, which is the chief of English rivers, has a length of 210 miles. The basin of the Wash consists of the subordinate basins of the Great Ouse, Nene, Welland, and Witham, which all empty themselves into that estuary, and has an area computed at 5,850 sq. miles.

The basin of the Severn consists of two distinct portions, that on the right bank of an irregularly oval shape, and having for its principal tributaries the Teme and the Wye; and that on the left of which the Upper Avon is the principal tributary stream. The area of the whole basin is 8,580 sq. miles.

The next basin, that of the Humber, the largest of all, consists of the three basins of the Humber proper, the Ouse, and the Trent, and its area is 9,550 sq. miles, being about one-sixth of the whole area of England and Wales.

Other rivers unconnected with these systems are the Tyne, Wear, and Tees in the north-east; the Eden, Ribble, Mersey, and Dee in the north-west. The south-coast streams are very unimportant except for their estuaries.

For the minerals, climate, agriculture, manufactures, &c., of England, *see the article* BRITAIN.

Civil History. The history of England proper begins when it ceased to be a Roman possession. (*See* BRITAIN.) On the withdrawal of the Roman forces, about the beginning of the fifth century A.D., the South Britons, or inhabitants of what is now called England, were no longer able to withstand the attacks of their ferocious northern neighbours, the Scots and Picts. They applied for assistance to Aëtius, but the Roman general was too much occupied in the struggle with Attila to attend to their petition. In their distress they appear to have sought the aid of the Saxons; and according to the Anglo-Saxon narratives three ships, containing 1600 men, were dispatched to their help under the command of the brothers Hengist and Horsa. Vortigern, a duke or prince of the Britons, assigned them the Isle of Thanet for habitation, and, marching against the northern foe, they obtained a complete victory. The date assigned to these events by the later Anglo-Saxon chronicles is A.D. 449, the narratives asserting further that the Saxons, finding the land desirable, turned their arms against the Britons, and, reinforced by new bands, conquered first Kent and ultimately the larger part of the island.

Whatever the credibility of the story of Vortigern, it is certain that in the middle of the fifth century the occasional Teutonic incursions gave place to persistent invasion with a view to settlement. These Teutonic invaders were Low German tribes from the country about the mouths of the Elbe and the Weser, the three most prominent being the Angles, the Saxons, and the Jutes. Of these the Jutes were the first to form a settlement, taking possession of part of Kent and the Isle of Wight; but the larger conquests of the Saxons in the south and the Angles in the north gave to these tribes the leading place in the kingdom.

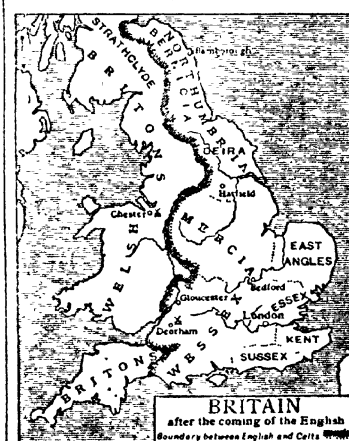
The struggle continued 150 years, and at the end of that period the whole southern part of Britain, with the exception of Strathclyde, Wales, and West Wales (Cornwall), was in the hands of the Teutonic tribes. This conquered territory was divided among a number of small states or petty chieftaincies, seven of the most conspicuous of which are often spoken of as the *Heptarchy*. These were: 1 The Kingdom of Kent; founded by Hengist in 455; ended in 823. 2 Kingdom of South Saxons, containing Sussex and Surrey, founded by Ella in 477, ended in 689. 3 Kingdom of East Angles, containing Norfolk, Suffolk, Cambridge, Ely (Isle of), founded by Uffa in 571 or 575, ended in 792. 4 Kingdom of West Saxons, containing Devon,

Dorset, Somerset, Wilts, Hants, Berks, and part of Cornwall, founded by Cedric 519, swallowed up the rest in 827. 5 Kingdom of Northumbria, containing York, Durham, Cumberland, Westmorland, Northumberland, and the east coast of Scotland to the Firth of Forth, founded by Ida 547, absorbed by Wessex in 827. 6 Kingdom of East Saxons, containing Essex, Middlesex, Hertford (part), founded by Erchew in 527, ended in 823. 7 Kingdom of Mercia, containing Gloucester, Hereford, Worcester, Warwick, Leicester, Rutland, Northampton, Lincoln, Huntingdon, Bedford, Buckingham, Oxford, Stafford, Derby, Salop, Nottingham, Chester, Hertford (part), founded by Cridda about 584; absorbed by Wessex in 827. Each state was, in its turn, annexed to more powerful neighbours, and at length, in 827, Egbert, by his valour and superior capacity, united in his own person the sovereignty of what had formerly been seven kingdoms, and the whole came to be called England, that is Angle-land.

While this work of conquest and of intertribal strife had been in progress towards the establishment of a united kingdom, certain important changes had occurred. The conquest had been the slow expulsion of a Christian race by a purely heathen race, and the country had returned to something of its old isolation with regard to the rest of Europe. But before the close of the sixth century Christianity had secured a footing in the south-east of the island. Ethelberht, King of Kent and suzerain over the kingdoms south of the Humber, married a Christian wife, Bertha, daughter of Charibert of Soissons, and this event indirectly led to the coming of St. Augustine. The conversion of Kent, Essex, and East Anglia was followed by that of Northumberland and then by that of Mercia, of Wessex, of Sussex, and lastly of Wight, the contest between the two religions being at its height in the seventh century.

The legal and political changes immediately consequent upon the adoption of Christianity were not great, but there resulted a more intimate relation with Europe and the older civilizations, the introduction of new learning and culture, the formation of a written literature, and the fusion of the tribes and petty kingdoms into a closer and more lasting unity than that which could have been otherwise secured.

The kingdom, however, was still kept in a state of disturbance by the attacks of the Danes, who had made repeated incursions during the whole of the Saxon period, and about half a century after the unification of the kingdom became for the moment masters of nearly the whole of England. But the genius of Alfred the Great, who had ascended the throne in 871, speedily reversed matters by the defeat of the Danes at Ethandune (878). Guthrum, their king, embraced Christianity, became the vassal of the Saxon king, and retired to a strip of land on the east coast including Northumbria and called the Danelagh. The two immediate successors of Alfred, Edward (901–925) and Athelstan (925–940), the son and the grandson of Alfred, both vigorous and able rulers, had each in turn to direct his arms against these settlers



of the Danelagh. The reigns of the next five kings, Edmund, Edred, Edwy, Edgar, and Edward the Martyr, are chiefly remarkable on account of the conspicuous place occupied in them by Dunstan, who was counsellor to Edmund, minister of Edred, treasurer under Edwy, and supreme during the reigns of Edgar and his successor. It was possibly due to his policy that from the time of Athelstan till after the death of Edward the Martyr (978 or 979) the country had comparative rest from the Danes.

During the tenth century many changes had taken place in the Teutonic constitution. Feudalism was already taking root; the king's authority had increased; the folkland was being taken over as the king's personal property; the nobles by birth, or ealdormen, were becoming of less importance in administration than the nobility of thegns, the officers of the king's court.


Map of
ENGLAND
to illustrate the
Story of Alfred the Great.
English Miles
0 10 20 40 60 80 100
SCOTS
IRELAND
STRATHCLYDE
CUMBRIA
NORTHUMBRIA
Jarrow
Wearmouth
I. of Man
DEIRA
York
The Humber
Manchester
Chester
Lincoln
Derby
Nottingham
Stamford
Leicester
East Anglia
Thetford
ENGLISH
Warwick
MERCIA
Bedford
Hertford
Gloucester
Oxford
Watham
Isle of Mersey
London
Aston
Reading
Isle of Thanet
Ethandun
Farnham
Surrey
Milton
Canterbury
Wedmore
Athelney
Wiltshire
Hampshire
Appledore
Wilton
Winchester
Sussex
Wareham
Exeter
FRANCE

Ethelred (978–1016), who succeeded Edward, was a minor, the government was feebly conducted, and no united action being taken against the Danes, their incursions became more frequent and destructive. Animosities between the English and the Danes who had settled among them became daily more violent, and a general massacre of the latter took place in 1002. The following year Sweyn invaded the kingdom with a powerful army and assumed the crown of England. Ethelred was compelled to take refuge in Normandy; and though he afterwards returned, he found in Canute an adversary no less formidable than Sweyn. Ethelred left his kingdom in 1016 to his son Edmund, who displayed great valour, but was compelled to divide his kingdom with Canute; and when he was assassinated in 1017 the Danes succeeded to the sovereignty of the whole.

Canute (Knut), who espoused the widow of Ethelred, that he might reconcile his new subjects, obtained the name of Great, not only on account of his personal qualities, but from the extent of his dominions, being master of Denmark and Norway as well as England. In 1035 he died, and was followed in England by two other Danish kings, Harold and Hardicanute, whose joint reigns lasted till 1042, after which the English line was again restored in the person of Edward the Confessor. Edward was a weak prince, and in the latter years of his reign had far less real power than his brother-in-law Harold, son of the great Earl Godwin. On Edward's death in 1066 Harold accordingly obtained the crown. He found, however, a formidable opponent in the second-cousin of Edward, William of Normandy, who instigated the Danes to invade the northern counties, while he, with 60,000 men, landed in the south. Harold vanquished the Danes, and hastening southwards met the Normans near Hastings, at Senlac, afterwards called Battle. Harold and his two brothers fell (14th Oct., 1066), and William (1066–87) immediately claimed the government as lawful King of England, being subsequently known as William I, the Conqueror. For some time he conducted the government with great moderation; but being obliged to reward those who had assisted him, he bestowed the chief offices of government upon Normans, and divided among them a great part of the country. The revolts of the native English which followed were quickly crushed, Continental feudalism in a modified form was established, and the English Church reorganized under Lanfranc as Archbishop of Canterbury.

At his death, in 1087, William II, commonly known by the name of Rufus, the Conqueror's second son, obtained the crown, Robert, the eldest son, receiving the duchy of Normandy. In 1100, when William II was accidentally killed in the New Forest, Robert was again cheated of his throne by his younger brother Henry (Henry I), who in 1106 even wrested from him the duchy of Normandy. Henry's power being secured, he entered into a dispute with Anselm the Primate, and with the Pope, concerning the right of granting investiture to the clergy. He supported his quarrel with firmness, and brought it to a not unfavourable issue. His reign was also marked by the suppression of the greater Norman nobles in England, whose power (like that of many Continental feudatories) threatened to overshadow that of the king, and by the substitution of a class of lesser nobles. In 1135 he died in Normandy, leaving behind him only a daughter, Matilda.

By the will of Henry I his daughter Maud or Matilda, wife of Geoffrey Plantagenet, Count of Anjou, and frequently styled the Empress Matilda, because she had first been married to Henry V, Emperor of Germany, was declared his successor. But Stephen, son of the Count of Blois, and of Adela, daughter of William the Conqueror, raised an army in Normandy, landed in England, and declared himself king. After years of civil war and bloodshed an amicable arrangement was brought about, by which it was agreed that Stephen should continue to reign during the remainder of his life, but that he should be succeeded by Henry, son of Matilda and the Count of Anjou. Stephen died in 1154, and Henry Plantagenet ascended the throne with the title of Henry II, being the first of the Plantagenet or Angevin kings. A larger dominion was united under his sway than had been held by any previous sovereign of England, for at the time when he became King of England he was already in the possession of Anjou, Normandy, and Aquitaine.

Henry II found far less difficulty in restraining the licence of his barons than in abridging the exorbitant privileges of the clergy, who claimed exemption not only from the taxes of the State, but also from its penal enactments, and who were supported in their demands by the Primate Becket. The king's wishes were formulated in the Constitutions of Clarendon (1164), which were at first accepted and then repudiated by the

Primate. The assassination of Becket, however, placed the king at a disadvantage in the struggle, and after his conquest of Ireland (1171) he submitted to the Church, and did penance at Becket's tomb. Henry was the first who placed the common people of England in a situation which led to their having a share in the Government. The system of frank-pledge was revived, trial by jury was instituted by the Assize of Clarendon, and the Eyre courts were made permanent by the Assize of Nottingham. To curb the power of the nobles he granted charters to towns, freeing them from all subjection to any but himself, thus laying the foundation of a new order in society.

Richard I, called Cœur de Lion, who in 1189 succeeded to his father, Henry II, spent most of his reign away from England. Having gone to Palestine to join in the third crusade, he proved himself an intrepid soldier. Returning homewards in disguise through Germany, he was made prisoner by Leopold, Duke of Austria, but was ransomed by his subjects. In the meantime John, his brother, had aspired to the crown, and hoped, by the assistance of the French, to exclude Richard from his right. Richard's presence for a time restored matters to some appearance of order; but having undertaken an expedition against France, he received a mortal wound at the siege of Châlons, in 1199.

John was at once recognized as King of England, and secured possession of Normandy; but Anjou, Maine, and Touraine acknowledged the claim of Arthur, son of Geoffrey, second son of Henry II. On the death of Arthur, while in John's power, these four French provinces were at once lost to England. John's opposition to the Pope in electing a successor to the see of Canterbury in 1205 led to the kingdom being placed under an *Interdict*; and, the nation being in a disturbed condition, he was at last compelled to receive Stephen Langton as archbishop, and to accept his kingdom as a fief of the papacy (1213). His exactions and misgovernment had equally embroiled him with the nobles. In 1213 they refused to follow him to France, and, on his return defeated, they at once took measures to secure their own privileges and abridge the prerogatives of the Crown. King and barons met at Runnymede, and on 15th June, 1215, the Great Charter (Magna Charta) was signed. It was speedily declared null and void by the Pope, and war broke out between John and the barons, who were aided by the French king. In 1216, however, John died, and his turbulent reign was succeeded by the almost equally turbulent reign of his son Henry III.

During the first years of the reign of Henry III the abilities of the Earl of Pembroke, who was regent until 1219, retained the kingdom in tranquillity; but when, in 1227, Henry assumed the reins of government he showed himself incapable of managing them. The Charter was three times reissued in a modified form, and new privileges were added to it, but the king took no pains to observe its provisions. The struggle, long maintained in the Great Council (henceforward called Parliament) over money grants and other grievances, reached an acute stage in 1263, when civil war broke out. Simon de Montfort, who had laid the foundations of the House of Commons by summoning representatives of the shire communities to the Mad Parliament of 1258, had by this time engrossed the sole power. He defeated the king and his son Edward at Lewes in 1264, and in his famous Parliament of 1265 still further widened the privileges of the people by summoning to it burgesses as well as knights of the shire. The escape of Prince Edward, however, was followed by the battle of Evesham (1265), at which Earl Simon was defeated and slain, and the rest of the reign was undisturbed.

On the death of Henry III, in 1272, Edward I succeeded without opposition. From 1276 to 1284 he was largely occupied in the conquest and annexation of Wales, which had become practically independent during the barons' wars. In 1292 Baliol, whom Edward had decided to be rightful heir to the Scottish throne, did homage for the fief to the English king; but when, in 1294, war broke out with France, Scotland also declared war. The Scots were defeated at Dunbar (1296), and the country placed under an English regent; but the revolt under Wallace (1297) was followed by that of Bruce (1306), and the Scots remained unsubdued. The reign of Edward was distinguished by many legal and legislative reforms, such as the separation of the old king's court into the Court of Exchequer, Court of King's Bench, and Court of Common Pleas, and the passage of the Statute of Mortmain. In 1295 the first perfect Parliament was summoned, the clergy and barons by special writ, the commons by writ to the sheriffs directing the election of two knights from each shire, two citizens from each city, two burghers from each borough. Two years later the im-

position of taxation without consent of Parliament was forbidden by a special Act (De Tallagio non Concedendo). The great aim of Edward, however, to include England, Scotland, and Wales in one kingdom proved a failure, and he died in 1307 marching against Robert Bruce.

The reign of his son Edward II was unfortunate to himself and to his kingdom. He made a feeble attempt to carry out his father's last and earnest request to prosecute the war with Scotland, but the English were almost constantly unfortunate: and at length, at Bannockburn (1314), they were defeated by Robert Bruce, which ensured the independence of Scotland. The king soon proved incapable of regulating the lawless conduct of his barons; and his wife, a woman of a bold, intriguing disposition, joined in the confederacy against him, which resulted in his imprisonment and death in 1327.

The reign of Edward III was as brilliant as that of his father had been the reverse. The main projects of the third Edward were directed against France, the crown of which he claimed in 1328 in virtue of his mother, the daughter of King Philip. The victory won by the Black Prince at Crécy (1346), the capture of Calais (1347), and the victory of Poitiers (1356), ultimately led to the Peace of Brétigny in 1360, by which Edward III received all the west of France on condition of renouncing his claim to the French throne. (*See* BRÉTIGNY.) Before the close of his reign, however, these advantages were all lost again, save a few principal towns on the coast.

Edward III was succeeded in 1377 by his grandson Richard II, son of Edward the Black Prince. The people of England now began to show, though in a turbulent manner, that they had acquired just notions of government. In 1380 an unjust and oppressive poll-tax brought their grievances to a head, and 100,000 men, under Wat Tyler, marched towards London (1381). Wat Tyler was killed while conferring with the king, and the prudence and courage of Richard appeased the insurgents. Despite his conduct on this occasion, Richard was deficient in the vigour necessary to curb the lawlessness of the nobles. In 1398 he banished his cousin, Henry Bolingbroke; and on the death of the latter's father, the Duke of Lancaster, unjustly appropriated his cousin's patrimony. To avenge the injustice Bolingbroke landed in England during the king's absence in Ireland, and at the head of 60,000 malcontents compelled Richard to surrender. He was confined in the Tower, and despite the superior claims of Edmund Mortimer, Earl of March, Henry was appointed king (1399), the first of the House of Lancaster. Richard was, in all probability, murdered early in 1400.

The manner in which the Duke of Lancaster, now Henry IV, acquired the crown rendered his reign extremely turbulent, but the vigour of his administration quelled every insurrection. The most important—that of the Percies of Northumberland, Owen Glendower, and Douglas of Scotland—was crushed by the battle of Shrewsbury (1403). During the reign of Henry IV the clergy of England first began the practice of burning heretics under the Act *de haeretico comburendo*, passed in the second year of his reign. The Act was chiefly directed against the Lollards, as the followers of Wycliffe now came to be called. Henry died in 1413, leaving his crown to his son, Henry V, who revived the claim of Edward III to the throne of France in 1415, and invaded that country at the head of 30,000 men. The disjointed councils of the French rendered their country an easy prey; the victory of Agincourt was gained in 1415; and after a second campaign a peace was concluded at Troyes in 1420, by which Henry received the hand of Katherine, daughter of Charles VI, was appointed regent of France during the reign of his father-in-law, and declared heir to the throne on his death. The two kings, however, died within a few weeks of each other in 1422, and the infant son of Henry thus became King of England (as Henry VI) and France at the age of nine months.

England, during the reign of Henry VI, was subjected, in the first place, to all the confusion incident to a long minority, and afterwards to all the misery of a civil war. Henry allowed himself to be managed by anyone who had the courage to assume the conduct of his affairs, and the influence of his wife, Margaret of Anjou, a woman of uncommon capacity, was of no advantage either to himself or the realm. In France (1422–53) the English forces lost ground, and were finally expelled by the celebrated Joan of Arc, Calais alone being retained. The rebellion of Jack Cade in 1450 was suppressed, only to be succeeded by more serious trouble. In that year Richard, Duke of York, the father of Edward, afterwards Edward IV, began to advance his pretensions to the throne, which had been so long usurped by the House of Lancaster. His claim was founded on his descent from the third son of Edward III, Lionel, Duke of Clarence, who was his

great - great - grandfather on the mother's side, while Henry was the great-grandson on the father's side of John of Gaunt, Duke of Lancaster, the fourth son of Edward III. Richard of York was also grandson on the father's side of Edmund, fifth son of Edward III. The wars which resulted, called the Wars of the Roses, from the fact that a red rose was the badge of the House of Lancaster and a white one that of the House of York, lasted for thirty years, from the first battle of St. Albans, 22nd May, 1455, to the Battle of Bosworth, 22nd Aug., 1485. Henry VI was twice driven from the throne (in 1461 and 1471) by Edward of York, whose father had previously been killed in battle in 1460. Edward of York reigned as Edward IV from 1461 till his death in 1483, with a brief interval in 1471; and was succeeded by two other sovereigns of the House of York, first his son Edward V, who reigned for eleven weeks in 1483; and then by his brother Richard III, who reigned from 1483 till 1485, when he was defeated and slain on Bosworth field by Henry Tudor, of the House of Lancaster, who then became Henry VII.

Henry VII was at this time the representative of the House of Lancaster, and in order at once to strengthen his own title and to put an end to the rivalry between the Houses of York and Lancaster, he married, in 1486, Elizabeth, the sister of Edward V and heiress of the House of York. His reign was disturbed by insurrections attending the impostures of Lambert Simnel (1487), who pretended to be a son of the Duke of Clarence, brother of Edward IV, and of Perkin Warbeck (1488), who affirmed that he was the Duke of York, younger brother of Edward V; but neither of these attained any magnitude. The king's worst fault was the avarice which led him to employ in schemes of extortion such instruments as Empson and Dudley. His administration throughout did much to increase the royal power and to establish order and prosperity. He died in 1509.

The authority of the English Crown, which had been so much extended by Henry VII, was by his son Henry VIII exerted in a tyrannical and capricious manner. The most important event of the reign was undoubtedly the Reformation; though it had its origin rather in Henry's caprice and in the casual situation of his private affairs than in his conviction of the necessity of a reformation in religion, or in the solidity of reasoning employed by the reformers. Henry had been espoused to Catherine of Spain, who was first married to his elder brother Arthur, a prince who died young. Henry became disgusted with his queen, and enamoured of one of her maids of honour, Anne Boleyn. He had recourse, therefore, to the Pope to dissolve a marriage which had at first been rendered legal only by a dispensation from the Pontiff; but, failing in his desires, he broke away entirely from the Holy See, and in 1534 got himself recognized by Act of Parliament as the head of the English Church. He died in 1547. He was married six times, and left three children, each of whom reigned in turn. These were: Mary, by his first wife, Catherine of Aragon; Elizabeth, by his second wife, Anne Boleyn; and Edward, by his third wife, Jane Seymour.

Edward, who reigned first, with the title of Edward VI, was nine years of age at the time of his succession, and died in 1553, when he was only sixteen. His short reign, or rather the reign of the Earl of Hertford, afterwards Duke of Somerset, who was appointed regent, was distinguished chiefly by the success which attended the measures of the reformers, who acquired great part of the power formerly engrossed by the Catholics. The intrigues of Dudley, Duke of Northumberland, during the reign of Edward, caused Lady Jane Grey to be declared his successor; but her reign, if it could be called such, lasted only a few days. Mary, daughter of Henry VIII, was placed upon the throne, and Lady Jane Grey and her husband were both executed. Mary, a bigoted Catholic, seems to have wished for the crown only for the purpose of re-establishing the Roman Catholic faith. Political motives had induced Philip of Spain to accept of her as a spouse; but she could never prevail on her subjects to allow him any share of power. She died in 1558.

Elizabeth, who succeeded her sister Mary, was attached to the Protestant faith, and found little difficulty in establishing it in England. Having concluded peace with France (1559), Elizabeth set herself to promote the confusion which prevailed in Scotland, to which her cousin Mary had returned from France as queen in 1561. In this she was so far successful that Mary placed herself in her power (1568), and after many years imprisonment was sent to the scaffold (1587).

As the most powerful Protestant nation, and as a rival to Spain in the New World, it was natural that England should become involved in difficulties with that country. The dispersion of the Armada by the

English fleet under Howard, Drake, and Hawkins was the most brilliant event of a struggle which abounded in minor feats of valour. In Elizabeth's reign London became the centre of the world's trade, the extension of British commercial enterprise being coincident with the ruin of Antwerp in 1585. The Parliament was increased by the creation of sixty-two new boroughs, and its members were exempted from arrest. In literature not less than in politics and in commerce the same full life displayed itself, and England began definitely to assume the characteristics which distinguish her from the other European nations of to-day.

To Elizabeth succeeded (in 1603) James VI of Scotland and I of England, son of Mary Queen of Scots and Darnley. His accession to the crown of England in addition to that of Scotland did much to unite the two nations, though a certain smouldering animosity still lingered. His dissimulation, however, ended in his satisfying neither of the contending ecclesiastical parties—the Puritans or the Catholics: and his absurd insistence on his divine right made his reign a continuous struggle between the prerogative of the Crown and the freedom of the people. His extravagance kept him in constant disputes with the Parliament, who would not grant him the sums he demanded, and compelled him to resort to monopolies, loans, benevolences, and other illegal methods. The nation at large, however, continued to prosper through the whole of his reign. His son Charles I, who succeeded him in 1625, inherited the same exalted ideas of royal prerogative, and his marriage with a Catholic, his arbitrary rule, and illegal methods of raising money provoked bitter hostility. Under the guidance of Laud and Strafford things went from bad to worse. Civil war broke out in 1642 between the king's party and that of the Parliament, and the latter proving victorious, in 1649 the king was beheaded.

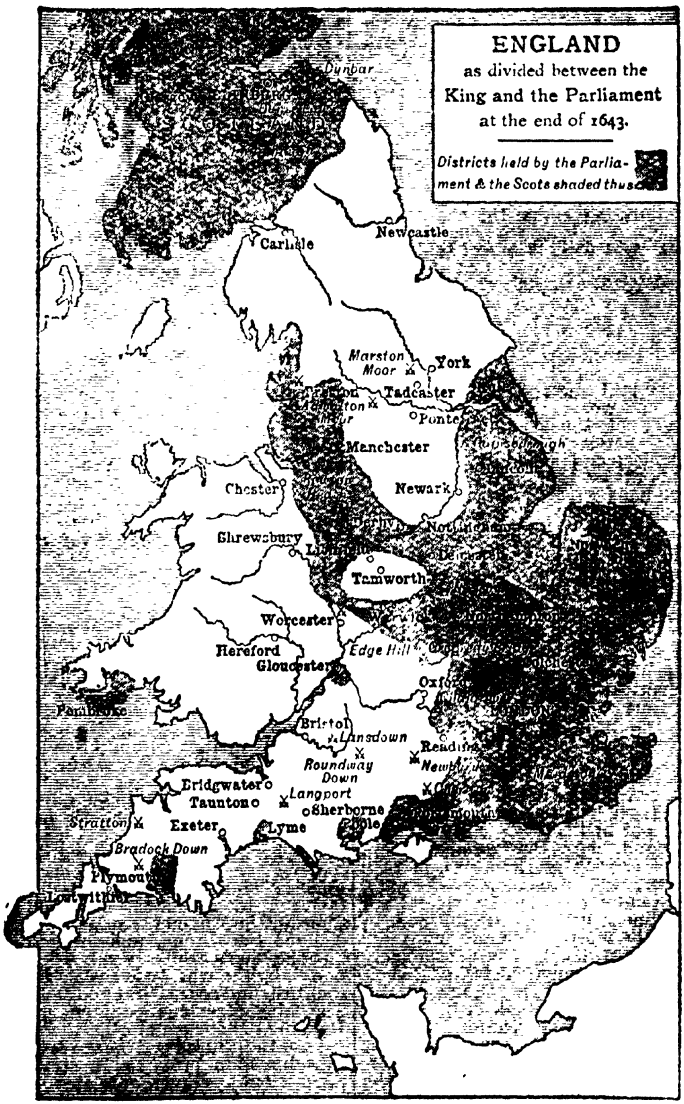
A Commonwealth or republican government was now established, in which the most prominent figure was Oliver Cromwell. Mutinies in the army among Fifth-monarchists and Levellers were subdued by Cromwell and Fairfax, and Cromwell, in a series of masterly movements, subjugated Ireland and gained the important victories of Dunbar and Worcester. At sea Blake had destroyed the Royalist fleet under Rupert, and was engaged in an honourable struggle with the Dutch under van Tromp.

But within the governing body matters had come to a deadlock. A dissolution was necessary, yet Parliament shrank from dissolving itself, and in the meantime the reform of the law, a settlement with regard to the Church, and other important matters remained untouched. In April, 1653, Cromwell cut the knot by forcibly ejecting the members and putting the keys of the House in his pocket. From this time he was practically head of the Government, which was vested in a council of thirteen. A Parliament—the Little or Barebones Parliament—was summoned, and in the December of the same year Cromwell was installed Lord Protector of the Commonwealth of England, Scotland, and Ireland. With more than the power of a king, he succeeded in dominating the confusion at home, and made the country feared throughout the whole of Europe. Cromwell died in 1658, and the brief and feeble protectorate of his son Richard followed.

There was now a widespread feeling that the country would be better under the old form of government, and Charles II, son of Charles I, was called to the throne by the Restoration of 1660. He took complete advantage of the popular reaction from the narrowness and intolerance of Puritanism, and even endeavoured to carry it to the extreme of establishing the Catholic religion. The promises of religious freedom made by him before the Restoration in the Declaration of Breda were broken by the Test and Corporation Acts, and by the Act of Uniformity, which drove two thousand clergymen from the Church and created the great dissenting movement of modern times. The Conventicle and Five-mile Acts followed, and the "Drunken Parliament" restored Episcopacy in Scotland. At one time even civil war seemed again imminent. The abolition of the censorship of the press (1679) and the reaffirmation of the Habeas Corpus principle are the most praiseworthy incidents of the reign.

As Charles II left no legitimate issue, his brother the Duke of York succeeded him as James II (1685–8). An invasion by an illegitimate son of Charles, the Duke of Monmouth, who claimed the throne, was suppressed, and the king's arbitrary rule was supported by the wholesale butcheries of such instruments as Kirke and Jeffreys. The king's zealous countenance of Roman Catholicism and his attempts to force the Church and the universities to submission provoked a storm of opposition. Seven prelates were brought to trial for seditious libel, but were acquitted amidst general rejoicings.

The whole nation was prepared to welcome any deliverance, and in 1688 William of Orange, husband of James's


ENGLAND
as divided between the
King and the Parliament
at the end of 1643.
Districts held by the Parliament & the Scots shaded thus
Dunbar
Carlisle
Newcastle
Marston Moor
York
Tadcaster
Pontefract
Manchester
Chester
Newark
Shrewsbury
Tamworth
Worcester
Hereford
Gloucester
Edge Hill
Pembroke
Bristol
Lansdown
Roundway Down
Bridgwater
Taunton
Langport
Sherborne
Stratton
Exeter
Lyme
Bradock Down
Plymouth

daughter Mary, landed in Torbay. James fled to France, and a convention summoned by William settled the crown upon him, he thus becoming William III. Annexed to this settlement was a Declaration of Rights circumscribing the royal prerogative by depriving him of the right to exercise dispensing power, or to exact money, or maintain an army without the assent of Parliament. This placed henceforward the right of the British sovereign to the throne upon a purely statutory basis. The Toleration Act, passed in 1689, released dissent from many penalties.

An armed opposition to William lasted for a short time in Scotland, but ceased with the fall of Viscount Dundee, the leader of James's adherents; and though the struggle was prolonged in Ireland, it was brought to a close before the end of 1691. The following year saw the origination of the national debt, the exchequer having been drained by the heavy military expenditure. A Bill for triennial Parliaments was passed in 1694, the year in which Queen Mary died. For a moment after her death William's popularity was in danger, but his successes at Namur and elsewhere, and the obvious exhaustion of France, once more confirmed his power. The Treaty of Ryswick followed in 1697, and the death of James II in exile in 1701 removed a not unimportant source of danger. Early in the following year William also died, and by the Act of Settlement Anne succeeded him.

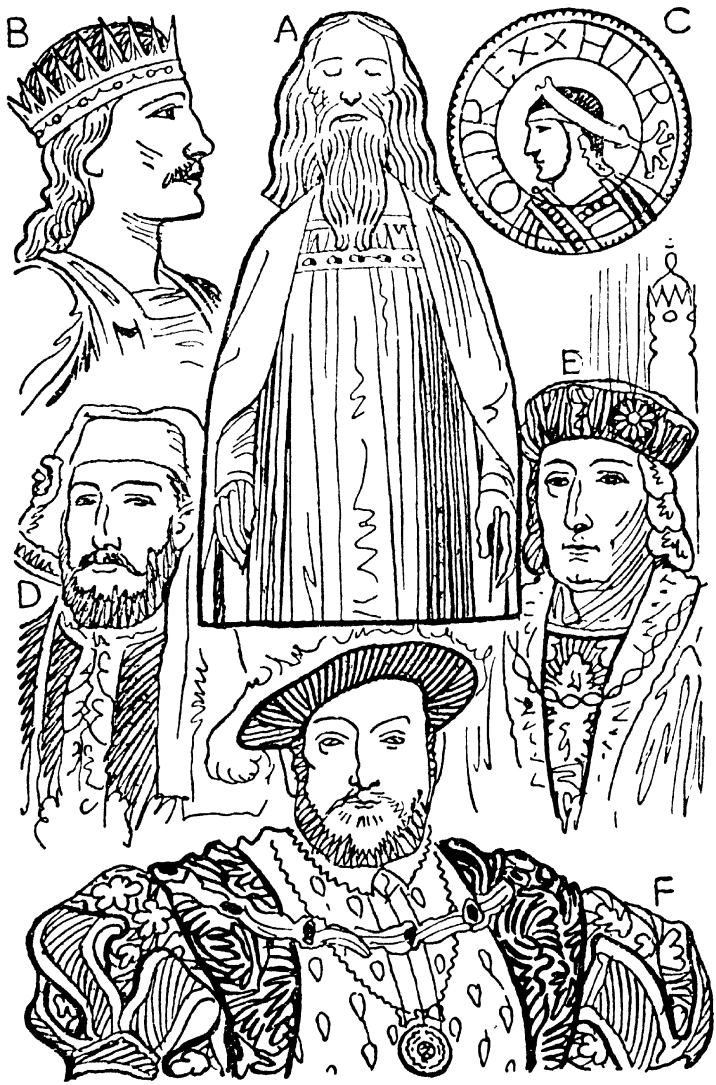
The closing act of William's reign had been the formation of the grand alliance between England, Holland, and the German Empire, and the new queen's rule opened with the brilliant successes of Marlborough at Blenheim (1704) and Ramilies (1706). Throughout the earlier part of her reign the Marlboroughs practically ruled the kingdom, the duke's wife, Sarah Jennings, being the queen's most intimate friend and adviser. In 1707 the history of England becomes the history of Britain, the Act of Union passed in that year binding the Parliaments and Realms of England and Scotland into a single and more powerful whole. (*See* BRITAIN).

Ecclesiastical History. The first religion of the Celts of England was Druidism. It has been conjectured that Christianity may have reached Britain by way of France (Gaul) before the conclusion of the first, or not long after the commencement of the second century, but the period and manner of its introduction are uncertain. It had, however, made considerable progress in the island previous to the time of Constantine the Great (306–337). Several bishops from Britain sat in the Councils of Nice (325), Sardica (347), and Ariminum, in Italy (359); and in 519 an ecclesiastical synod of all the British clergy was held by St. David, Archbishop of Caerleon, for extirpating the remains of the Pelagian heresy.

A period of almost total eclipse followed the inroad of the pagan Saxons, and it was not till A.D. 570 that signs of change showed themselves in the new nationality. On the coming of Austin, or St. Augustine, sent over in 596 by Gregory the Great, a residence at Canterbury was assigned to him, and Ethelbert, King of Kent, and most of his subjects, adopted Christianity. Other missionaries followed; East Saxons were soon after converted by Mellitus; and a bishop's see was established at London, their capital, early in the seventh century. The Northumbrians were next converted, an event accelerated by the marriage of their king, Edwin, with a daughter of Ethelberht, and by the labours of the missionary Paulinus. The influence of Edwin and Paulinus also secured the conversion of Carpwald, King of the East Angles; and, as a reward to Paulinus, Edwin erected a see at York, and obtained an archbishop's pall for him from Pope Honorius I, who sent one at the same time to Canterbury. The conversion of the other kingdoms followed in the course of the seventh century.

As Kent and Wessex received Christianity from Roman and Frankish missionaries, and Mercia and Northumberland through the Scottish St. Aidan (for Northumbria had apostatized after the death of its first Christian king, and received Christianity anew from a Scottish source), there were certain differences between the Churches, especially concerning the time of keeping Easter. To promote the union of the Churches thus founded in England with the Church of Rome, a grand council was summoned by Theodore of Tarsus, Archbishop of Canterbury, at Hertford, A.D. 673, when uniformity was secured among all the English Churches, and the see of Canterbury made supreme.

The clergy in course of time attained, particularly after the Norman Conquest, to such a height of domination as to form an *imperium in imperio*. Under Anselm (1093–1109) the Church was practically emancipated from the control of the State, and the power of the Pope became supreme. The result was a considerable increase of monasticism in England, and the prevalence of the greatest abuses under the cloak of Church privilege. Several monarchs showed themselves restive under the



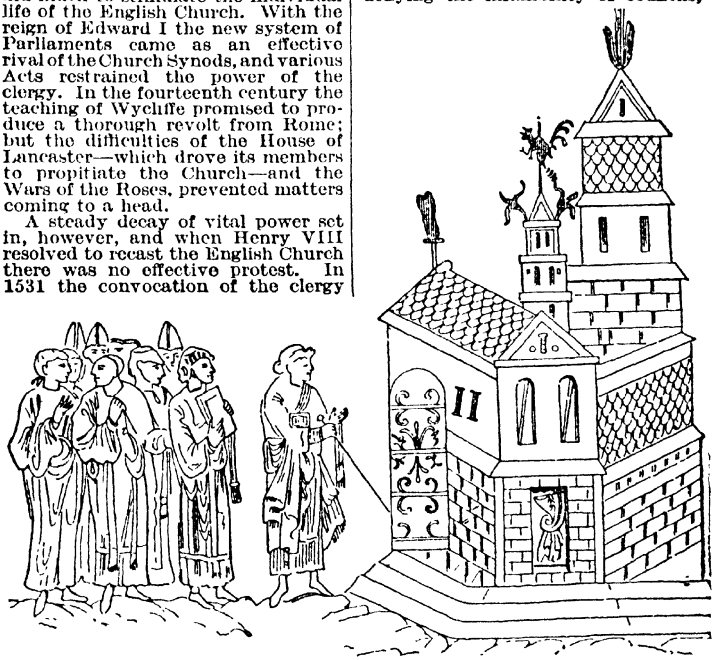
ENGLISH KINGS

A. Edward III, from Westminster Abbey B. Egbert C. Harold II, from his coin D. Henry IV
E. Henry VII F. Henry VIII

Papal control, but without shaking off the yoke; and though Henry II succeeded in abating some evils, yet the severity of the penance exacted from him for the murder of Becket is a striking proof of the power that the Church then had in punishing offences committed against itself.

The reaction set in during the reign of Henry III, when the vigorous independence of Robert Grosseteste did much to stimulate the individual life of the English Church. With the reign of Edward I the new system of Parliaments came as an effective rival of the Church Synods, and various Acts restrained the power of the clergy. In the fourteenth century the teaching of Wycliffe promised to produce a thorough revolt from Rome; but the difficulties of the House of Lancaster—which drove its members to propitiate the Church—and the Wars of the Roses, prevented matters coming to a head.

A steady decay of vital power set in, however, and when Henry VIII resolved to recast the English Church there was no effective protest. In 1531 the convocation of the clergy addressed a petition to Henry VIII as the chief protector and only and supreme lord of the English Church. Not very long after, the Parliament abolished appeals to the see of Rome, dispensations, licences, bulls of institution for bishoprics and archbishoprics, the payment of Peter's-pence, and the annates. In 1534 the Papal authority was set aside by Act of Parliament, and by another Act of Parliament, passed in 1535, Henry assumed the title of supreme head of the Church of England. These Acts, although they severed the connection between the English Church and the Holy See, did not alter the religious faith of the Church. But under Edward VI the Duke of Somerset, the protector of the realm during the minority of the king, caused a more thorough reform of the doctrines and ceremonies of the Church to be made. At his instigation Parliament in 1547 repealed the statute of the six articles promulgated by Henry VIII, and in 1551 a new confession of faith was embodied in forty-two articles, denying the infallibility of councils,



Consecration of a Saxon Church. From an ancient manuscript of Cædmon's poems

keeping only two sacraments, baptism and the Lord's Supper, and rejecting the real presence, the invocation of saints, prayers for the dead, purgatory and the celibacy of the clergy. At the same time a new liturgy was composed, in which English was substituted for Latin.

With the reign of Mary the old religion was re-established; and it was not till that of Elizabeth that the Church of England was finally instituted in its present form. The doctrines of the Church were again modified, and the Forty-two Articles were reduced to thirty-nine by the convocation of the clergy in 1563. As

no change was made in the episcopal form of government, and some rites and ceremonies were retained which many of the reformed considered as superstitious, this circumstance gave rise to many future dissensions. In 1559, before the close of the first year of Elizabeth's reign, the Acts of Supremacy and Uniformity were passed with the object of bringing about the entire subjection of the Church and the people in religious matters to the royal authority.

From James I some relief was anticipated by Puritans and Nonconformists, but they were disappointed. Under Charles I the attempt was made, through the instrumentality of Laud, to place all the Churches of Great Britain under the jurisdiction of bishops. But after the death of Laud the Parliament abolished the episcopal government, and condemned everything contrary to the doctrine, worship, and discipline of the Church of Geneva. As soon as Charles II was restored, the ancient forms of ecclesiastical government and public worship were re-established, and three severe measures were passed against nonconformity, namely, the Corporation Act of 1661, the Act of Uniformity, passed in 1662, and the Test Act, passed in 1673 (*see* ACT OF UNIFORMITY; CORPORATION AND TEST ACTS).

In the reign of William III, and particularly in 1689, the divisions among the friends of Episcopacy gave rise to the two parties called the *high-churchmen* or *non-jurors*, and *low-churchmen*. The former maintained the doctrine of passive obedience to the sovereign; that the hereditary succession to the throne is of divine institution; and that the Church is subject to the jurisdiction of God alone. The gradual progress of civil and religious liberty since that time has settled practically all such controversies. The measures of relief granted to those outside the Established Church include the repeal of the Corporation and Test Acts (1828), Catholic emancipation (1829), and the opening of the old universities to Dissenters (1871).

The Established Church of England has always adhered to Episcopacy. Under the sovereign as supreme head, the Church is governed by three archbishops and forty bishops, of Canterbury, York, and Wales. The Archbishop of Canterbury is styled the *Primate of all England*, and to him belongs the privilege of crowning the kings and queens of England. The province of Canterbury comprehends 30 bishoprics; in the province of the Archbishop of York, who is styled *Primate of England*, there are 12 bishoprics, the province comprising Cheshire, Lancashire, Yorkshire, and the other northern counties. Wales has now been formed into a separate archbishopric. An Act was passed in 1914 disestablishing and disendowing the Church in Wales and Monmouthshire. The Act, suspended during the European War, came into force on 31st March, 1920. Archbishops and bishops are appointed by the sovereign by what is called a *congé d'Aire*, or leave to elect, naming the person to be chosen and sent to the Dean and Chapter. The National Assembly of the Church of England (Powers) Act of 1919 instituted a National Assembly in England consisting of the House of Bishops, a House of Clergy, and a House of Laymen, which has power to legislate in Church matters. The archbishops and bishops, to the number of 24, have seats in the House of Lords, and are styled Lords Spiritual.

The following are the bishops' sees: London, Winchester, Bangor, Bath and Wells, Birmingham, Bradford, Bristol, Chelmsford, Chichester, Coventry, Ely, Exeter, Gloucester, Hereford, Ipswich, Lichfield, Lincoln, Llandaff, Norwich, Oxford, Peterborough, Rochester, St. Albans, St. Asaph, St. David's, Salisbury, Southwark, Southwell, Truro, Worcester, Durham, Carlisle, Chester, Liverpool, Manchester, Newcastle, Ripon, Sheffield, Wakefield, Sodor and Man. To every cathedral belong several prebendaries and a dean; these together, spoken of as "the Dean and Chapter," form the council of the bishop. The bishops are aided in their work by 36 suffragan and assistant bishops in England and Wales. The ordinary clergy are the *priests*, whether curates, vicars, or rectors. A *parson* is a priest in full possession of all the rights of a parish church; if the great tithes are *impropriated*, the priest is called a vicar; if not, a rector; a *curate* (in popular speech) is one who exercises the spiritual office under a rector or vicar. The *deacons* form the third order of ordained clergy.

The doctrines of the Church are contained in the Thirty-nine Articles: the form of worship is directed by the *Book of Common Prayer*. The revenue of the Church from endowments is over £6,000,000 annually. The clergy number about 27,000.—BIBLIOGRAPHY: Wakeman, *Introduction to the History of the Church of England*; Newbolt and Stone, *Church of England*.

English Art. As regards *architecture* little can be said with regard to the style prevalent between the invasion of the Anglo-Saxons and the Norman Conquest, from the fact that

the remains of buildings erected in England before the Conquest are few and insignificant. The Norman style was introduced in the reign of Edward the Confessor, though the workmen, both then and after the Conquest, being English, the earlier work preserved many native characteristics. The Norman period proper extends from about 1090 to 1150, some of the best examples being parts of the cathedrals of Rochester, Winchester, Durham, and Canterbury.

In the brief period 1160 to 1195 a marked change took place in the adoption of the pointed arch and what is known as the *Early English style*. Improved methods of construction led to the use of lighter walls and pillars instead of the heavy masses employed in the Norman style. Narrow lancet-shaped windows took the place of the round arch; bold projecting buttresses were introduced; and the roofs and spires became more lofty and more pointed, while in the interiors pointed arches rested on lofty clustered pillars. The best Early English type is Salisbury Cathedral. The Early English style has been regarded as lasting from 1190 to 1270, when the *Decorated style* of Gothic began to prevail.

The transition to the Decorated style was gradual, but it may be considered as lasting to 1377. Exeter Cathedral is an excellent example of the earliest Decorated style. Between 1360 and 1399 the Decorated style gave place to the *Perpendicular*, which prevailed from 1377 to 1547, and was an exclusively English style. Gothic architecture, though it lingered on in many districts, practically came to an end in England in the reign of Henry VIII.

The *Elizabethan* and *Jacobean styles*, which followed, were transitions from the Gothic to the Italian, with which these styles were more or less freely mixed. Many palatial mansions were built in these styles. In the reign of Charles I Inigo Jones designed, among other buildings, Whitehall Palace and Greenwich Hospital in a purely classic style.

After the great fire in London (1666) Sir Christopher Wren designed an immense number of churches and other buildings in Classic style, particularly St. Paul's Cathedral, the Sheldonian Theatre of Oxford, and Chelsea Hospital. Various phases of Classic or Renaissance continued to prevail during the eighteenth and earlier part of the nineteenth century.

About 1836 the Gothic revival commenced, and that style was employed with considerable success in churches erected in recent times. The Houses of Parliament, erected between 1840 and 1860 in the Tudor style, the Law Courts of Salford, St. Pancras railway station, and the Law Courts of London (opened 1882) in the Gothic served to sustain an impetus that had been given to the use of that style. In more modern times Gothic was much employed for ecclesiastical and collegiate buildings, and a modified type of Renaissance for civil buildings. Later a style that has received the name of "Queen Ann" was much in vogue for private residences. It was very mixed, but withal highly picturesque. The most striking novelties in the nineteenth century were induced by the extensive use of iron and glass, as exemplified in the Exhibition building of 1851, the Crystal Palace, Sydenham, and the great railway stations.

A fresh development occurred in the twentieth century governed largely by the new constructional methods which then came into use. Stone-faced steel was the basis of the new building. Use rather than beauty was its primary objective, and at first it seemed that the architect must give place to the engineer. However, as fresh essays were made a new and characteristic type of architectural beauty was evolved, classical in the æsthetic though not in the historic sense. Cubic effects and an appearance of solidity were its distinguishing features, with smooth surfaces, clean, soft outline and an almost complete absence of ornament.

The best aspects of modern English architecture are exemplified in Liverpool Cathedral, by Sir Giles Gilbert Scott, a "new Gothic" structure sublimated in the modern school. Other distinctly modern buildings are the County Hall, Westminster, and the Shakespeare Memorial Theatre at Stratford-on-Avon. Work was begun on an English skyscraper, the Sun Ray Hotel, Blackpool, in 1933.

Painting. Very little is known of the state of the art of *painting* among the Anglo-Saxons; but in the ninth century Alfred the Great caused numerous MSS. to be adorned with miniatures, and about the end of the tenth century Archbishop Dunstan won reputation as a miniature painter. Under William the Conqueror and his two sons the painting of large pictures began to be studied, and Lanfranc, Archbishop of Canterbury, adorned the vault of his church with paintings. Numerous miniatures of the thirteenth and fourteenth centuries have come down to us, rude in execution, but not without originality. From this period down to the eighteenth century a succession of foreign painters resided in England, of whom the chief were Mabuse, Hans Holbein, Federigo Zuc-

chero, Cornelius Jansen, Van Dyck, Lely, and Kneller. Of native artists few are of importance prior to that original genius William Hogarth (1697–1764).

Throughout the eighteenth century English artists attained higher eminence in portrait painting than in other departments, and it culminated in Sir Joshua Reynolds (1723–92), Thomas Gainsborough (1727–88), and Romney (1734–1802). These were followed by Raeburn (1756–1823) and Lawrence (1769–1830). Barry (1741–1806), West (1738–1820), and Copley (1737–1815) gained distinction in historical compositions, especially in pictures of battles. Landscape painting was represented by Richard Wilson (1714–82), who painted classical scenes with figures from heathen mythology, and by Gainsborough, already mentioned, who painted scenes of English nature and humble life. The Royal Academy of Arts, of which Reynolds was the first president, was established in London in 1769. Sir David Wilkie (1785–1841), in what is known abroad as genre painting, gained a European reputation that is unsurpassed. In the same class of art C. R. Leslie (1794–1859), Newton (1795–1835), Collins (1788–1847), and Mulready (1786–1863) gained great distinction.

In landscape the reputation of Turner (1775–1857) stands alone. Other distinguished landscape painters are Clarkson Stanfield (1798–1867); David Roberts (1796–1864), who greatly excelled in picturesque architecture; Wm. Muller (1812–45); and John Constable (1776–1837), whose works exercised great influence in France; and Calcott (1799–1844). In historical painting Hilton (1786–1839), Eastlake (1793–1865), Etty (1787–1849), E. M. Ward (1816–79), C. W. Cope (1811–90), and D. Maclise (1811–70) attained celebrity. John Philip (1817–67) greatly distinguished himself by his scenes from Spanish life and by his mastery in colour. Landseer (1802–73) stands by himself as a painter of animals.

In 1824 the nucleus of the National Gallery was formed by the purchase of the Angerstein collection, and in 1832 the vote was passed for the erection of the National Gallery building. The competitions held in Westminster Hall in 1843, 1844 and 1847, with a view to the decoration of the Houses of Parliament, exercised great influence on art. Up to this time English pictures were rather distinguished for colour and effect of light and shade than for carefulness of modelling and exactness of drawing. In aiding to bring about a more accurate and careful style of work, the Pre-Raphaelites (1840–60), while seeking to restore in their practice an early phase of Italian art, exercised a beneficial influence, while they themselves ultimately abandoned the style to which at the first they had been devoted.

The modern group of British painters may be held to date from about 1850. Prominent among these the following may be named: in historical painting Leighton, Alma-Tadema, Watts, Poynter, Long, Goodall, Holman Hunt, Noel Paton, Burne-Jones, and Madox Brown, as also W. P. Frith, whose *Derby Day* and *Railway Station*, so descriptive of modern life, may well be classed as historical. In figure painting or genre, T. Faed, Erskine Nicol, Fildes, Orchardson, Herkomer, Millais, and Pettie. In portraiture, Millais, Frank Holl, Ouless, and Richmond. In landscape, Linnell, Hook, W. J. Müller, Peter Graham, John Brett, Vicat Cole, H. Moore, Keeley Halswelle. In water-colours the most eminent artists have been Girtin (1773–1802), Cotman (1782–1842), Liverseege (1803-32), Stothard (1755–1834), Turner, David Cox (1788–1859), De Wint (1784–1849), Copley Fielding (1787–1855), Samuel Prout (1783–1852), W. H. Hunt (1790–1864), Louis Haghe (1806–85), W. L. Leitch (1804–83), Sam Bough (1822–78), John Gilbert (1817–97). Present-day artists of note are Augustus John, Sir William Orpen, Sir John Lavery; Harrington Mann, Charles Shannon, H. G. Riviere and Sir George Clausen. —BIBLIOGRAPHY: R. Muther, *History of Modern Painting*; S. Reinach, *Apollo*.

English **sculpture** was long merely an accessory to architecture, and few English sculptors are known by name till comparatively modern times. During the Renaissance period Torregiano came from Italy and executed two masterpieces in England, the tomb of the mother of Henry VII, and that of Henry himself at Westminster. The troubles of the reign of Charles I and the Commonwealth produced a stagnation in the art, and were the cause of the destruction of many valuable works. After the Restoration two sculptors of some note appeared, Grinling Gibbons, a wood-carver, and Caius Gabriel Cibber.

During the eighteenth century there was no English sculptor of great eminence till John Flaxman (1755–1826). He had for rival and successor Sir Francis Chantrey (1781–1841), who acquired renown by the busts and statues which he made of many of the eminent men of his time. John Carew, Sir Richard Westmacott (1775–1856), E. H. Baily (1788–1867), John Gibson (1790–1866), P. Mac-

Dowell (1799–1870), H. Weekes (1807–77), J. H. Foley (1818–74), J. Edgar Boehm (1834–90), and Thomas Woolner (1825–92) are a few of the eminent sculptors of the nineteenth century. W. H. Thorneycroft, E. Onslow Ford, C. B. Birch, Alfred Gilbert, G. F. Watts, Henry H. Armstead, G. Simons, Sir Thomas Brock, Harry Bates, and Sir George Frampton are among the foremost sculptors of the early twentieth century. Their works in general are characterized by a sort of romantic grace which is their distinguishing mark, and by extraordinary delicacy and finish in detail; but they frequently exhibit weaknesses in their treatment of the nude.

One of the best known exponents of the modern English school is Jacob Epstein, whose "Day" and "Night" (on the Underground Headquarters, London) and "Genesis" have aroused much controversy by their departure from accepted standards of beauty. Frank Dobson and Eric Rowland Gill have also done notable work in recent years.—BIBLIOGRAPHY: Wilhelm Lubke, *History of Sculpture*; E. H. Short, *History of Sculpture*.

English Language. The language spoken in England from the settlement of the Anglo-Saxons to the Norman Conquest (say 500–1066) is popularly known as Anglo-Saxon, though simply the earliest form of English (*see* ANGLO-SAXONS.) It was a highly inflected and purely Teutonic tongue presenting several dialects. The Conquest introduced the Norman-French, and from 1066 to about 1250 two languages were spoken, the native English speaking their own language, the intruders speaking French. During this period the grammatical structure of the native language was greatly broken up, inflexions fell away, or were assimilated to each other; and towards the end of the period we find a few words written in a language resembling the English of our own day in grammar, but differing from it by being purely Saxon or Teutonic in vocabulary. Finally, the two languages began to mingle, and form one intelligible to the whole population, Normans as well as English, this change being marked by a great infusion of Norman-French words, and English proper being the result.

English is thus, in its vocabulary, a composite language, deriving part of its stock of words from a Teutonic source and part from a Latin source, Norman-French being in the main merely a modified form of Latin. In its grammatical structure and general character, however, English is entirely Teutonic, and is classed with Dutch and Gothic among the Low German tongues. If we divide the history of the English language into periods, we shall find three most distinctly marked: first, the Old English or Anglo-Saxon, extending down to about 1100: second, the Middle English, 1100–1400 (to this period belong Chaucer, Wycliffe, Langland); third, Modern English. A more detailed subdivision would give transition periods connecting the main ones. The chief change which the language has experienced during the modern period consists in its absorbing new words from all quarters in obedience to the requirements of advancing science, more complicated social relations, and increased subtlety of thought. At the present time the rapid growth of the sciences already existing, and the creation of new ones, have caused whole groups of words to be introduced, chiefly from the Greek, though unfortunately not a few are hybrid words, coined by some scientist who had small Latin and less Greek. —Cf. H. Sweet, *New English Grammar, Logical and Historical*.

English Literature. Before any English literature, in the strict sense of the term, existed, four literatures had arisen in England—the Celtic, Latin, Anglo-Saxon, and Anglo-Norman. The first includes such names as those of Taliesin, Llywarch Hen, Aneurin, and Merlin or Merddhin. The Latin literature prior to the Conquest presents those of Aldhelm, Bede, Alcuin, Asser, Ethelwerd, and Nennius. For Anglo-Saxon literature, *see* the article ANGLO-SAXONS. With the coming of the Normans, although the *Anglo-Saxon Chronicle* was continued until 1154, the native language practically ceased for a time to be employed in literature, Latin being used in law, history, and philosophy, French in the lighter forms of literature. The Norman *trouvère* displaced the Saxon *scop*, or gleeman, introducing the *Fabliau* and the Romance. By the *Fabliau* the literature was not greatly influenced until the time of Chaucer: but the Romance attained an early and striking development in the Arthurian cycle, founded upon the legends of Geoffrey of Monmouth's Latin *History of the Britons* (1147), by Geoffrey Gaimar, Wace, Walter Map, and other writers of the twelfth century.

The Latin literature included important contributions to the Scholastic philosophy by Alexander Hales (died 1245), Duns Scotus (died 1308) and William of Occam (died 1347): the philosophic works of Roger Bacon (1214–92); the Golias poems of Walter Map; and a long list of chronicles or histories, either in prose or

verse, by Eadmer (died 1124); Ordericus Vitalis (died 1142), William of Malmesbury (died 1143), Geoffrey of Monmouth (died 1154), Henry of Huntingdon (died after 1154), Joseph of Exeter (died 1195), Gervase of Tilbury (twelfth century), Roger of Wendover (died 1237), Roger de Hoveden (twelfth and thirteenth centuries), Giraldus Cambrensis (died 1222), Joscelin de Brakelonde (twelfth and thirteenth centuries), and Matthew Paris (died 1259).

Apart from a few brief fragments, the first English writings after the Conquest are the *Brut* of Layamon (about 1200), based on the *Brut* of Wace; and the *Ormulum*, a collection of metrical homilies attributed to Orm or Ormin, an Augustine monk. Next in importance come the rhyming chroniclers Robert of Gloucester (time of Henry III, Edward I) and Robert of Brunne or Mannyng (died 1340), other writers being Dan Michel of Northgate (*Ayenbite of Inwyt*, 1340); Richard Rolle of Hampole (*Pricke of Conscience*, 1340); Laurence Minot (author of eleven military ballads; died 1352); and several works of uncertain authorship, including the *Ancren Riwle* (?Richard Poor, died 1237), *The Owl and the Nightingale* (? Nicholas of Guildford), *The Land of Cockayne* (? Michael of Kildare), the song against the King of Almaigne, and a dialogue between the Body and the Soul. To this pre-Chaucerian period belong also several English translations of French romances—*Horn, Tristrem, Alisaunder, Havelok*, and others.

Between the beginning and middle of the fourteenth century the English speech had entered upon a new phase of development in the absorption of Norman-French words. A rapid expansion of the literature followed, having as the foremost figure that of Chaucer (1340–1400), who, writing at first under French influences, and then under Italian, became in the end the most representative English writer of the time. Contemporary with him was the satirist William Langland or Langley (1332–1400), the indefatigable John Gower (1325–1408), and the Scot John Barbour (1316–95). In prose the name of John Wycliffe (1324–84) is pre-eminent, the English version of Mandeville's *Travels* being apparently of later date.

The period from the time of Chaucer to the appearance of Spenser, that is, from the end of the fourteenth to near the end of the sixteenth century, is a very barren one in English literature, in part probably owing to foreign and domestic wars, the struggle of the people towards political power, and the religious controversies preceding and attending the Reformation. The immediate successors of Chaucer, Occleve (1370–1454) and Lydgate (died 1460), were neither men of genius, and the centre of poetic creation was for the time transferred to Scotland, where James I (1394–1437) headed the list which comprises Andrew de Wyntoun (fifteenth century), Henry the Minstrel or Blind Harry (died after 1492), Robert Henryson (died before 1508), William Dunbar (1460–1520), Gavin Douglas (1474–1522), and Sir David Lyndsay (1490–1557). In England the literature was chiefly polemical, the only noteworthy prose prior to that of More being that of Reginald Pecock (1390–1460); Sir John Fortescue (1395–1485); the *Paston Letters* (1422–1505), which are, however, much more interesting for their subject matter than their style; and Malory's *Morte d'Arthur* (completed 1469–70); the only noteworthy verse, that of John Skelton (1460–1529).

It was now that several events of European importance combined to stimulate life and enlarge the mental horizon—the invention of printing, or rather of movable types, the promulgation of the Copernican system of astronomy, the discovery of America, the Renaissance, and the Reformation. The Renaissance spread from Florence to England by means of such men as Colet, Linacre, Erasmus, and Sir Thomas More (1480–1535), the last noteworthy as at the head of a new race of historians. Important contributions to the prose of the time were the Tyndale *New Testament*, printed in 1525, and the Coverdale *Bible* (1535).

The first signs of an artistic advance in poetic literature are to be found in Wyatt (1503–42) and Surrey (1516–47), who nationalized the sonnet; Surrey was also a pioneer in the use of blank verse. The drama, too, had by this time reached a fairly high stage of development. The mystery and miracle plays, after the adoption of the vernacular in the fourteenth century, passed from the hands of the clergy into those of the laity, and both stage and drama underwent a rapid secularization. The morality began to embody matters of religious and political controversy, historical characters mingled with the personification of abstract qualities, real characters from contemporary life were introduced, and at length farces on the French model were constructed, the *Interludes* of John Heywood (died 1565) being the most important examples.

To Nicholas Udall (1504–56) the first genuine comedy, *Ralph Roister*

Doister, was due, this being shortly afterwards followed by John Still's *Gammer Gurton's Needle* (1566). The first tragedy, the *Ferrex and Porrex*, or *Gorbodue* of Sackville (died 1608) and Norton (died 1600), was performed in 1561, and the first prose play, the *Supposes* of Gascoigne (died 1577) in 1566. Gascoigne and Sackville were noteworthy amongst the earlier Elizabethans apart from their plays; but the figures which bulk most largely are those of Sidney (1554–86) and Spenser (1552–99). In drama Lyly, Peele, Greene, Nash, and Marlowe (1564–93) are the chief immediate precursors of Shakespeare (1564–1616), Marlowe alone, however, being at all comparable with the great master. Contemporary and later dramatic writers were Ben Jonson (1573–1637), the second great Elizabethan dramatist, Middleton (died 1627), Marston (better known as a satirist), Chapman (1557–1634), Thomas Heywood, Dekker (died 1639), Webster (seventeenth century), Ford (1586–1639), Beaumont (1586–1616) and Fletcher (1576–1625), and Massinger (1584–1640). The minor poets include Michael Drayton (1563–1631), Samuel Daniel (1562–1619), John Davies (1570–1626), John Donne (1573–1631), Giles Fletcher (1580–1623), and Phineas Fletcher (1584–1650), Drummond of Hawthornden (1585–1649). In Elizabethan prose the prominent names are those of Roger Ascham (1515–68), John Lyly (1553–1606), Hooker (1554–1600), Raleigh (1552–1618), Bacon (1561–1626), the founder in some regards of modern scientific method, Burton (1576–1640), Herbert of Cherbury (1581–1648), and Selden (1584–1654), with Overbury, Knolles, Holinshed, Stowe, Camden, Florio, and North. The issue of the Authorized Version of the Bible in 1611 may be said to close the prose list of the period, as it represents the finest flower of English prose.

After the death of James I the course of literature breaks up into three stages, the first from 1625 to 1640, in which the survivals from the Elizabethan Age slowly die away. The "metaphysical poets," Cowley, Wither, Herbert, Crashaw, Habbington, and Quarles, and the cavalier poets, Suckling, Carew, Denham, all published poems before the close of this period, in which also Milton's early poems were composed, and the *Comus* and *Lycidas* published.

The second stage (1640–60) was almost wholly given up to controversial prose, the Puritan revolution checking the production of pure literature. In this controversial prose of the time Milton was easily chief.

With the Restoration a third stage was begun. Milton turned his new leisure to the composition of his great poems; the drama was revived, and Davenant and Dryden, with Otway, Southerne, Etherege, Wycherley, Congreve, Vanbrugh, and Farquhar in their first plays, and minor playwrights, are the most representative writers of the period. Butler established a genre in satire, and Marvell as a satirist in some respects anticipated Swift; Roscommon, Rochester, and Dorset contributed to the little poetry; while in prose we have Hobbes, Clarendon, Fuller, Sir Thomas Browne, Walton, Cotton, Pepys and Evelyn, John Bunyan, Locke, Sir William Temple, Owen Feltham, Sir Henry Wotton, James Harrington, and a crowd of theological writers, of whom the best known are Jeremy Taylor, Richard Baxter, Robert Barclay, William Penn, George Fox, Isaac Barrow, John Tillotson, Stillingfleet, Bishop Pearson, Sherlock, South, Sprat, Cudworth, and Burnet. Other features of the last part of the seventeenth century were the immense advance in physical science under Boyle, Isaac Newton, Harvey, and others, and the rise of the newspaper press.

Dryden's death in 1700 marks the commencement of the so-called Augustan Age in English literature. During it, however, no greater poet appeared than Pope (1688–1744), in whom sagacity, wit, and fancy take the place of the highest poetic faculty, but who was a supreme artist within the formal limits of his conception of the art of poetry. Against these formal limits signs of reaction are apparent in the verse of Thomson (1700–48), Gray (1716–71), Collins (1720–59), Goldsmith (1728–74), and in the productions of Macpherson and Chatterton. The poets Prior (1664–1721), Gay (1688–1732), and Ambrose Phillips (1671–1749) inherit from the later seventeenth century, Gay being memorable in connection with English opera; and there are many minor poets—Garth, John Philips, Blackmore, Parnell, Dyer, Somerville, Green, Shenstone, Blair, Akenside, Falconer, Anstey, Beattie, Allan Ramsay, and Robert Fergusson.

It is in prose that the chief development of the eighteenth century is to be found. Defoe (1661–1731) and Swift (1667–1745) led the way in fiction and prose satire; Steele (1672–1729) and Addison (1672–1719), working on a suggestion of Defoe, established the periodical essay; Richardson (1689–1761), Fielding (1707–54), Smollet (1721–71), and Sterne raised the novel to sudden

perfection. Goldsmith also falls into the fictional group as well as into that of the poets and of the essayists. Johnson (1709–84) exercised during the latter part of his life the power of a literary dictator, with Boswell (1740–95) as his "Secretary of State." The other chief prose writers were Bishop Berkeley (1685–1753), Arbuthnot (1675–1735), Shaftesbury (1671–1713), Bolingbroke (1678–1751), Burke, the historians David Hume (1711–76), William Robertson (1721–93), Edward Gibbon (1737–94); the political writers Wilkes and "Junius," the economist and moral philosopher Adam Smith (1723–90); the philosophical writers Hume, Bentham (1749–1832), and Dugald Stewart (1753–1828); the scholars Bentley (1662–1742), Sir William Jones (1746–94), and Richard Porson (1759–1808); the theologians Atterbury, Butler (1692–1752), Warburton, and Paley; and some playwrights, of whom the most important was Sheridan, but who also included Rowe, John Home, Colley Cibber, Colman the elder, and Foote.

With the French Revolution, or a few years earlier, the modern movement in literature may be said to have commenced. The departure from the old traditions, traceable in Gray and Collins, was more clearly exhibited in the last years of the century in Cowper (1731–1800) and Burns (1759–96), and was developed and perfected in the hands of Blake (1757–1828), Bowles (1762–1850), and the "Lake poets" Wordsworth (1770–1850), Coleridge (1772–1834), and Southey (1774–1843); but there were at first many survivals from the poetic manner of the seventeenth century, such as Erasmus Darwin (1731–1802), Dr. John Wolcot (1738–1819), and Samuel Rogers (1763–1855). Amongst the earlier poets of the nineteenth century, also, were George Crabbe (1754–1832), Sir Walter Scott (1771–1832), Hogg (1772–1835), Campbell (1777–1844), James Montgomery, Mrs. Hemans, Bryan Waller Procter ("Barry Cornwall"), Joanna Baillie, Robert Montgomery. A more important group was that of Byron (1788–1824), Shelley (1792–1822), and Keats (1796–1821), with which may be associated the names of Leigh Hunt (1784–1859), Thomas Moore (1779–1852), and Landor (1775–1864).

Among the earlier writers of fiction there were several women of note, such as Maria Edgeworth (1767–1849) and Jane Austen (1775–1817). The greatest name in fiction is unquestionably that of Scott. Other prose writers were Malthus, Hallam, James Mill, Southey, Hannah More, Cobbett, William Hazlitt, Sydney Smith, Francis Jeffrey, Lord Brougham.

In the literature since 1830 poetry has included as its chief names those of Praed, Hood, Sidney Dobell, Gerald Massey, Charles Mackay, Philip James Bailey, William Allingham, Elizabeth Barrett Browning, Coventry Patmore, the second Lord Lytton ("Owen Meredith"), Arthur Hugh Clough, Matthew Arnold, Dante G. Rossetti, Robert Buchanan, Wm. Morris, Lewis Morris, Jean Ingelow, Swinburne, and last and greatest, Tennyson and Browning. Among more modern English poets are Stephen Phillips (1868–1915), Francis Thompson (1860–1907), Sir William Watson (born 1858), John Davidson (1857–1909), and R. Kipling (born 1865). Early twentieth century poets include John Masefield, W. H. Davies, Rupert Brooke, J. E. Flecker, J. C. Squire, Lascelles Abercrombie, Margaret Sackville, and Edmund Blunden. Essentially war poets are Siegfried Sassoon and Robert Nichols. In post-war poetry the Sitwells, Edith, Osbert and Sacheverell, T. S. Eliot, Humbert Wolfe, W. J. Turner, and Harold Monro are prominent.

A brilliant list of nineteenth-century novelists includes Marryat, Michael Scott, the first Lord Lytton, Ainsworth, Benjamin Disraeli (Earl of Beaconsfield), Dickens, Thackeray, Charles Kingsley, Charlotte Brontë, Lover, Lever, Wilkie Collins, Mayne Reid, Charles Reade, George Eliot, Anthony Trollope, William Black, Thomas Hardy, R. D. Blackmore, George Meredith, R. L. Stevenson, Miss Braddon, Mrs. Craik (Miss Mulock), Mrs. Oliphant, Miss Yonge, and others.

Towards the end of the nineteenth and at the beginning of the twentieth century there was a deepening interest in the drama, and the list of brilliant dramatists includes the names of Barrie, H. A. Jones, G. B. Shaw, Pinero, Granville Barker, and others. More recent dramatists are Somerset Maugham, John Drinkwater, St. John Ervine, and R. C. Sherriff.

The tendency in the fiction of the twentieth century is a concrete and imaginative presentation of the social, ethical, and sentimental problems of the day. This tendency is clearly seen in the novels of John Galsworthy (*The Forsyte Saga*, etc.) and H. G. Wells (*Kipps*, *The World of William Clissold*, etc.).

Other pre-eminent names in this sphere are D. H. Lawrence, whose realistic novels include *Lady Chatterley's Lover* and *Sons and Lovers*, Arnold Bennett, the novelist of the five towns of the Potteries (*The Old Wives'*

Talc, etc.), and Joseph Conrad, who wrote novels of the sea. Post-war novelists include James Joyce, Hugh Walpole, Virginia Woolf, and Aldous Huxley.

To the historical and biographical list of the nineteenth century belong Macaulay, Buckle, Carlyle, Thirlwall, Grote, Milman, Froude, Lecky, S. R. Gardiner, Kinglake, John Richard Green, E. A. Freeman, Stubbs, Dean Stanley, John Morley, Leslie Stephen. In twentieth century biography the names of Lytton Strachey and Philip Guedalla are prominent. In science and philosophy among the chief writers of the nineteenth century have been Whewell, Sir W. Hamilton, Mansel, John Stuart Mill, Alexander Bain, Hugh Miller, Charles Darwin, Huxley, Tyndall, Max Muller, Herbert Spencer, T. H. Green. Twentieth century philosophers and scientists include J. S. Haldane, Bertrand Russell, C. E. M. Joad, Julian Huxley, Bernard Bosanquet, Sir A. S. Eddington, Sir James Jeans, and Sir Oliver Lodge. — BIBLIOGRAPHY: *Cambridge History of English Literature*; Taine, *History of English Literature*; Saintsbury, *Short History of English Literature*; Chambers, *Cyclopædia of English Literature*.

ENGLEFIELD GREEN, village of Surrey. It is 1¼ miles from Egham and near Windsor Park. The village is the scene of Mrs. Oliphant's *Neighbours on the Green*. Another Englefield is a village in Berkshire, about 6 miles from Reading.

ENGLISH ARCHITECTURE, ART, CHURCH, LANGUAGE, LITERATURE, &c. *See* ENGLAND.

ENGLISH CHANNEL (Fr. *La Manche*, the sleeve), the arm of the sea which separates England from France, extending, on the English side, from Dover to Land's End; and on the French, from Calais to the Island of Ushant. On the east it communicates with the North Sea by the Straits of Dover, 21 miles wide; and on the west it opens into the Atlantic by an entrance about 100 miles wide. At its greatest breadth it is about 150 miles. The pilchard and mackerel fisheries are very important. The advantages of a railway tunnel under the Channel at or near its narrowest part have been frequently urged; and an English company, formed in 1887 for constructing a tunnel from Dover, to meet a similar tunnel starting from near Calais, pushed an excavation under the sea for over 2,000 yards. The plan has been much discussed, but whether it will ever come to anything is a matter of great uncertainty. Plans have also been put forward for a railway bridge across the Straits of Dover.

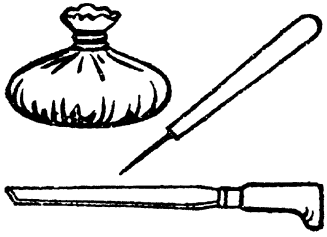
ENGRAVING, the art of drawing or writing on metal, wood, precious stones, &c., by means of incisions made with instruments variously adapted to the substances operated upon and the description of work intended. The term is also applied to the work so performed, and to impressions taken on paper or similar material from the engraved work. Impressions from metal plates are called engravings, prints, or plates; those printed from wood being termed indifferently wood engravings or wood-cuts. While, however, these impressions are not altogether dissimilar in appearance, the processes are distinct. As a rule, in prints from metal the lines intended to print are incised, and in order to take an impression the plate is daubed over with a thick ink which fills all the lines. The surface is then wiped perfectly clean, leaving only the incised lines filled with ink. A piece of damp paper is then laid on the face of the plate, and both are passed through the press, which causes the ink to pass from the plate to the paper. This operation needs to be repeated for every impression. In the wood block, on the contrary, the spaces between the lines of the drawing are cut out, leaving the lines standing up like type, the printing being from the inked surface of the raised lines, and effected much more rapidly than plate printing. This process has also been used to a certain extent with metal.

Engraving on wood, intended for printing or impressing from, long preceded engraving on metals. The art is of Eastern origin, and at least as early as the tenth century engraving and printing from wood blocks was common in China. We first hear of wood engraving being cultivated in Europe by the Italians and Germans for impressing patterns on textiles, but no paper impressions earlier than the fourteenth century are known. For a hundred years there is small indication of the practice of the art, which was at first confined to the production of block-books, playing-cards, and religious prints.

According to Vasari, the art of printing from engraved plates was discovered in Florence by Maso Finiguerra about 1460, but engravings of earlier date are known to exist. Engraving had long been used as a means of decorating armour, metal vessels, &c., the engravers generally securing duplicates of their works before laying in the niello (a species of metallic enamel) by taking casts of them in sulphur, and rubbing the

lines with black. The discovery of the practicability of taking impressions upon paper helped the development of engraving upon copper plates for the purpose of printing from. The date of the earliest known niello proof upon paper is 1452. The work of the Florentine engravers, however, was almost at once surpassed in Venice and elsewhere in North Italy by Andrea Mantegna (1431–1506), Girolamo Mocetto, Jacopo de' Barbari, and others. In Marc Antonio Raimondi (1475–1534), who wrought under the guidance of Raphael, and reproduced many of his works, the art reached its highest point of the earlier period, and Rome became the centre of a new school, which included Marco da Ravenna (died 1527), Giulio Bonasone (1531–72), and Agostino de Musis (flourished 1536).

In the meantime, in Germany the progress of the art had been not less rapid. Of the oldest school the most



Engraving tools, showing Dabber, Burin and Etching Needle

important engraver is Martin Schongauer (1420–88). He was, however, surpassed a generation later by Albert Dürer (1471–1528), who excelled both in copper and wood engraving, especially in the latter, and also etched a few plates. Among his most famous contemporaries and successors were Burgkmair and Lucas Cranach.

The Dutch and Flemish schools, of which Dürer's contemporary Lucas van Leyden was the head, did much to enlarge the scope of the art, either by paying increased attention to the rendering of light and shade, and the expression of tone and surface quality, as in the case of Cornelius Cort and Bloemart; or by developing freedom and expression of line, as in the case of Glotzius and his pupils. Rubens (1577–1640) influenced engraving through the two Bolswerts, Vostermann, Pontius, and P. de Jode, who engraved many of his works on a large size.

Towards the end of the seventeenth century etching, which had before been rarely used, became more common, and was practised with supreme mastery by Rembrandt (1607–69) and other painters of that period. In France, Noel Garnier founded a school of engraving about the middle of the sixteenth century; but it produced no work of any high distinction until the reign of Louis XIV, when Robert Nanteuil, his follower Gerard Edelinck, and Antoine Masson produced many fine portraits, and Gerard Audran engraved works by Nicolas Poussin and Le Brun. Jacques Callot also produced some admirable etchings. These were followed about the middle of the eighteenth century by Wille (1717–1807), a German resident in Paris, who gave new vitality to a waning art, and by the school of French illustrators.

Before the middle of the seventeenth century England produced little noteworthy work, availing herself principally of the work of foreign engravers such as Wenzel Hollar, of whom many took up temporary and even permanent residence. The first English engraver of marked importance was William Hogarth (1697–1764), whose works are distinguished for a power of vivid characterization. Vivares (1712–82), a Frenchman by birth, laid the foundation of the English school of landscape engraving, which was still further developed by William Woollet (1735–85), who was also an excellent engraver of the human figure. In historical engraving a not less remarkable advance was made by Sir Robert Strange (1721–92); and Richard Earlom (1743–1822), Valentine Green, and J. R. Smith produced some admirable works in mezzotint. In succession to these came William Sharp (1746–1824), James Bazire (1730–1892), Bartolozzi (1727–1815), who practised stipple engraving, James Heath, Bromley, Raimbach, and others.

The substitution of steel for copper plates (1820–30) gave the power of producing a much larger number of fine impressions, and opened new possibilities for highly finished work. During the closing years of the eighteenth century, line engraving attained a depth of colour and fullness of tone in which earlier works are often deficient, and during the following century it reached a perfectness of finish which it had not previously attained. A picture, whether figure or landscape, came to be translated by line engraving with all its depth of colour, delicacy of tone, and effect of light and shade; the various textures, whether of naked flesh, silk, satin, woollen, or

velvet, were all successfully rendered by ingenious modes of laying the lines and combinations of lines of varying strength, width, and depth. At the same time, original work by engravers declined in quality. Among engravers who have produced historical works of large size and in the line manner the names of Raphael Morghen (1758–1833), Longhi (1766–1831), Anderloni (1784–1849), Garavaglia (1790–1835), and Toschi, in Italy; of Forster (1790–1872), Henriquel-Dupont (born 1797), Bridoux (born 1812), and Blanchard (born 1819), in France; of John Burnet (1784–1868), J. H. Robinson (1796–1871), Geo. T. Doo (1800–86), J. H. Watt (1799–1867), and Lumb Stocks (1812–92), in England, stand pre-eminent. Among historical and portrait engravers in the stipple or dotted manner the names of H. T. Ryall, Henry Robinson, William Holl (1807–71), and Francis Holl may be mentioned.

In the period 1820–60 landscape engraving attained a perfection in Great Britain which it had not attained in any other country, or at any other time. In fact, most of the work was done by etching, details being sharpened by the graver. Among landscape engravers the names of Geo. Cooke (1781–1834), William Miller (1796–1882), E. Goodall (1795–1870), J. Cousen (1804–80), R. Brandard (1805–62), and Wm. Forrest (born 1805) hold the foremost places. Most of these were associated with the reproduction of Turner's pictures, and owed much to his control and direction. In mezzotint engraving Samuel Cousins (1801–87) and David Lucas, who was associated with John Constable in the "English Landscape" series, achieved considerable success.

In the period 1830–45 various publications called Annuals, composed of light literature in prose and verse, and illustrated by highly finished engravings in steel, were very popular. The engravings were necessarily of small size, and are generally of great excellence. A number of them, both figure and landscape, are executed with such finish and completeness as to be esteemed perfect works. The illustrations of Rogers's *Poems* and Rogers's *Italy* after Turner and Stothard belong to this period. Many of the originals of the engravings in the Annuals were finished pictures of large size. A great part of the difficulty in engraving on a small scale from a large picture consists in determining what details can be left out, and still preserve the full effect and character of the original. The most noted engravers for work of this kind are Charles Heath, Charles Rolls, W. Finden, E. Finden, E. Portbury, J. Goodyear, F. Engleheart, Henry le Keux, E. Goodall, and W. Miller.

Since 1870 many reproductions of paintings have been produced by means of etching, a comparatively cheap and rapid process. Such works have been fashionable and very popular with collectors. But while some of them have been excellent of their kind, the process is of limited resource, and the best works in this manner do not compare with the masterpieces of line engraving. In original work, however, etching and dry-point (q.v.) have produced some excellent work, notably in the hands of Charles Meryon, J. M. Whistler, Sir Seymour Haden, and Anders Zorn. A revival of mezzotint owes much to Sir Frank Short. Through lack of encouragement, change of fashion, and the adoption of other methods of reproduction, line engraving on metal has become almost a lost art in Great Britain, though a revival in wood engraving has taken place of recent years.

Line Engraving, as implied by the term, is executed entirely in lines. The tools are few and simple. They consist of the graver or *burin*, the scraper, to remove the burr left by the graver, and the burnisher; an oil-stone or hone, dividers, a parallel square, a magnifying lens; a bridge on which to rest the hand; a blind or shade of tissue paper, to make the light fall equally on the plate, callipers for levelling important erasures, a small steel anvil, a small pointed hammer, and punches. In etching, the following articles are required: a resinous mixture called etching-ground, capable, when spread very thinly over the plate, of resisting the action of the acids used; a dabber for laying the ground equally; an etching needle; a hand-vice; some brushes of different sizes; and bordering wax, made of burgundy-pitch, bees'-wax, and a little oil.

In *etching*, the plate, which is highly polished and must be free from all scratches, is first prepared by spreading over it a thin layer of *ground*. The surface is then smoked, and the outline of the picture transferred to it by pressure from the paper on which it has been drawn in fine outlines by a black-lead pencil. The picture is then drawn on the ground with the etching-needle, which removes the ground in every form produced by it, and leaves the bright metal exposed. Sometimes, however, the drawing is made direct, without the use of tracing. A bank of wax is then put round the plate and diluted acid poured on it, which eats out the metal from the lines from

which the ground has been removed, but leaves the rest of the plate untouched, (*see also* DRY-POINT). In landscape engraving, as practised in England in the early nineteenth century, the plate is then gone over with the graver, the etched lines clearly defined, broken lines connected, new lines added, &c. Sometimes the plate is *rebitten* more than once, those parts which are sufficiently bitten in the first treatment being *stopped* with varnish, and only the selected parts exposed to after-biting. Finally the burnisher is brought into play alternately with the graver and point to give perfectness and finish.

In engraving proper, the lines are first drawn on the metal with a fine point and then cut in by the graver, first making a fine line, and afterwards entering and re-entering till the desired width and depth of lines is attained. Much of the excellence of such engravings depends on the mode in which the lines are laid, their relative thickness, and the manner in which they cross each other. In this method of engraving etching is but little used, if at all, and then only for accessories and the less important parts.

Soft-ground Etching. The ground, made by mixing lard with common etching-ground, is laid on the plate and smoked as before, but its extreme softness renders it very liable to injury. The outline of the subject is drawn on a piece of paper larger than the plate. The paper is then damped, and laid gently over the ground, face upwards, and the margins folded over and pasted down on the back of the plate. When the paper is dry and lightly stretched, a bridge is laid across, and with a hardish pencil and firm pressure the drawing is completed in the usual manner. The pressure makes the ground adhere to the back of the paper at all parts touched by the pencil, and on the paper being lifted carefully off, these parts of the ground are lifted with it, and the corresponding parts of the plate thus left bare are exposed to the subsequent action of the acid. The granulated surface of the paper, causing similar granulations in the touches on the ground, gives the character of a chalk drawing. The biting-in is effected in the same manner as already described, and the subject may be finished by rebiting and dotting with the graver. (*See* ETCHING.)

Stipple, or Chalk Engraving, in its pure state, is exclusively composed of dots, made with a special form of graver, varying in size and form as the nature of the subject demands, but few stipple plates are now produced without a large admixture of line in all parts, flesh excepted. Etching is often used to put in the more important lines and tone masses.

The processes of *Aquatint* and *Mezzotint* will be found under their respective heads, the latter differing from all other styles of engraving in that the lights and gradations are scraped or burnished out of a plate prepared so that it would print quite dark all over, instead of the forms being corroded or cut into a plain surface.

The *Mixed Style* is based on mezzotint, which, still forming the great mass of shading, is in this method combined with etching in the darker, and stipple in the more delicate parts. By this combination a plate will produce a larger number of good impressions than it would if it were done entirely in mezzotint.

Engraving on Wood. The wood best adapted for engraving is box. it is cut across the grain in thickness equal to the height of type, these slices being subjected to a lengthened process of seasoning, and then smoothed for use. Every wood engraving is the representative of a finished drawing previously made on the block, the unshaded parts being cut away, and the lines giving form, shading, texture, &c., left standing in relief by excavations of varied size and character, made between them by gravers of different forms. Drawings on wood are made either with blacklead pencil alone or with pencil and indian ink, the latter being employed for the broader and darker masses. It is now much the practice to photograph drawings made in black and white upon the wood instead of making the drawing on the wood block. When the drawing is put on the wood by washes or by photography, instead of being entirely done by pencil lines, the engraver has to devise the width and style of lines to be employed instead of cutting in facsimile, as is the case when the drawing is made entirely in lines. The tools required for wood engraving are similar but more numerous than those of the engraver on copper or steel. *See also* DIE-SINKING; GEMS.—BIBLIOGRAPHY: W. Y. Ottley, *Early History of Engraving*; G. Duplessis, *History of Engraving in France*; P. G. Hamerton, *Graphic Arts*; F. Wedmore, *Fine Prints*; A. M. Hind, *A Short History of Engraving and Etching*; J. H. Slater, *Engravings and their Value*; H. C. Levis, *Engraving and Collecting of Prints: Bibliography.*

ENGROSSING, FORESTALLING, and **REGRATING,** terms formerly in use for the purchase of corn or other commodities in order to sell again at a higher price, or in order to raise

the market price of the same. The modern equivalent is "making a corner." These practices were once regarded as criminal, and positive statutes against them were passed in England in 1266–7, in 1350–2, in 1552, in 1562, and in 1570. The offence of *engrossing* was described by the statute of Edward III as the "getting into one's possession, or buying up, large quantities of corn, or other dead victuals, with intent to sell them again"; *forestalling*, as the "buying or contracting for any cattle, merchandise, or victual, coming in the way to the market, or dissuading persons from bringing their goods or provisions there, or persuading them to enhance the price when there"; and *regrating*, "the buying of corn or other dead victual in any market and selling it again in the same market, or within 4 miles of the place."

By the statute of Edward VI the engrossing of corn, which included the buying of it in one market to sell it in another, was made punishable by imprisonment and pillory; and no one could carry corn from one part of the kingdom to another without a licence. All the positive statutes against these offences were repealed in 1772, but they were still found to be punishable by common law, and it was not till 1844 that they entirely ceased to rank among offences.

ENHAM. Village of Hampshire. It is 2 miles from Andover. After the Great War it became a centre for the treatment and training of disabled soldiers. The full name is Knight's Enham.

ENHARMON'IC, in music, is an epithet applied to intervals smaller than the regular divisions of the scale, i.e. less than semitones.

ENKELDOORN, a town, Southern Rhodesia, 170 miles N.E. of Bulawayo, is the centre of a district mainly colonized by Dutch farmers. Tobacco is grown, and there are several ostrich farms.

ENKHUIZEN (engk'hoi-zn), a seaport of Holland, on a projection in the Zuider Zee, 29 miles north-east of Amsterdam. It had formerly a pop. of 40,000, but the silting up of the harbour has caused its decay, and its inhabitants number now about 7,110.

ENLIST'MENT, the act of engaging oneself or another to perform any service. In general, the use of the word is confined to engagements for the public service, and more especially in the armed forces of the Crown. In earlier days enlistment of soldiers was either for an indefinite period, as, for instance, for a particular war or campaign, or for life. Up to the middle of the seventeenth century enlistments were made to serve the officer raising the force under a contract from the Crown; after this period all enlistments were to serve the king. In both cases they were for a particular regiment only. For the next hundred years troops continued to be raised both in peace and war on the contract system, which by now implied that the officer accepting the contract, in addition to having a considerable say in the matter of allotting commissions to his friends, received a lump sum to cover all expenses of recruiting, pay, and clothing, out of which he and his officers made what they could. The objections to such a system are palpable, and it was abolished in 1783, after which year all duties with regard to the enlistment of troops were placed in the hands of a Director of Recruiting and Organization. The contract system was last used in war as late as the fifties of the last century during the Crimean War.

For some eighty years prior to 1847 the term of enlistment was ordinarily for life, but from that year onward to 1870 various systems of limited enlistment were in force. In 1870, with the idea of forming a reserve, the principle of short service was introduced by the Army Enlistment Act, and this principle has been continued by all succeeding legislation. The existing law as to enlistment is to be found in Part II of the Army Act, Sections 78 to 101; more detailed instructions are in the Recruiting Regulations. The Army Act, brought into force annually by the Army (Annual) Act, specifies the term of original enlistment to be twelve years, which may be either entirely in army (colour) service, or partly in colour service and partly in the reserve. In practice the normal terms are seven years' colour service and five years' reserve service for the infantry, with certain modifications in the case of other arms.

Enlistment may be made for general service or for a particular corps, and in the latter case the recruit will be posted to that corps only, and will ordinarily spend his whole service in it. A man desiring to enlist should present himself at a recruiting office, where he will be given a notice setting forth the terms of service. If, after reading the conditions, he still desires to enlist, he will be directed to appear before a justice of the peace (a recruiting officer is ex officio a justice of the peace for this purpose) for attestation. Attestation consists in giving signed answers to certain questions contained in the Form of Attestation, and in taking the oath of allegiance. The completed form is then signed by the justice, and the man becomes *a*

properly enlisted and attested soldier. The former practice of giving a shilling to every prospective recruit, and thereafter considering him for some purposes a soldier, is no longer recognized, and, at any time before signing the attestation paper, the man may decline to complete his bargain without rendering himself liable to any penalty. Should he, however, make a false answer to certain of the questions contained in his attestation paper, he is liable to punishment on conviction by court-martial.

ENNIS, a town (formerly a parliamentary borough), Irish Free State, County Clare, on the Fergus, 25 miles by rail from Limerick. It is irregularly built, the streets being narrow and crooked. There are remains of a Franciscan abbey founded in 1240. Some linen and flannel are manufactured, and there is a trade in agricultural produce. Pop. (1926), 5,517.

ENNISCOR'THY, a town, Irish Free State, County Wexford, on the Slaney, 77 miles south of Dublin. An old castle erected by one of the early Norman conquerors is in the centre of the town. Vinegar Hill in the immediate vicinity was the scene of a skirmish in 1798, when the town was stormed and burned by the rebels. Pop. (1926), 5,545.

ENNISKIL'LEN, a town (formerly a parliamentary borough), Irish Free State, County Fermanagh, 34 miles north-east of Sligo, on an island in the river which connects the upper and lower sections of Lough Erne, with suburbs on both sides of the adjoining mainland, with which it communicates by two bridges; a well-built, clean, thriving town. Pop. (1926), 4,883.

EN'NIUS, Quintus, the father of Latin poetry, was born at Rudiæ, in Calabria, in 239 B.C., and died in 170 B.C. Like our own early poet Gower, he was trilingual, speaking Greek, Oscan, and Latin. He was of good family, and claimed descent from the legendary kings of Calabria. Little is known of his life; he served in the Second Punic War, and held the rank of centurion in 204 B.C.; at a later date he went to Rome, supported himself by teaching, and was friendly with the greatest of his contemporaries. He died of gout in his seventieth year.

Ennius was a man of great versatility. He held perhaps the foremost place among writers of tragedies at Rome. He wrote good comedies. He wrote satires, and prepared the way for Lucilius. He wrote didactic poetry, and prepared the way for Lucretius. Most important of all, he wrote epic poetry—the *Annales*—and prepared the way for Virgil. He was the first to transplant the hexameter into Italy. His predecessors wrote in a rough kind of verse scanned by accent rather than quantity, and known as "Saturnian verse". Ennius contemptuously called this "the verse of fauns and soothsayers", and introduced the strong-winged music of Homer into his verse. He also brought in the elegiac couplet, which was to attain perfection at the hands of Propertius and Ovid. He left a permanent impress on the language. He made a systematic study of orthography, and invented a system of shorthand. He was fond of philosophical speculations, and made the Romans acquainted with the rationalism of Euripides and Euhemerus. He was, therefore, a remarkably versatile and prolific writer. His translations from the Greek tragedians were of the greatest importance in the history of Roman drama.

His chief fame, however, rests upon his *Annales*, a great epic in eighteen books. Like all of the works of Ennius, it only survives in fragments quoted by later writers. It was a great national epic, recording the history of the Roman state from the landing of Æneas down to the poet's own time. The city itself—*urbs quam dicunt Romam*—may be said to have been the central figure of his poem, a nobler figure than the pious Æneas. The verse of Ennius is sometimes crude and harsh, but it contains many fine lines and grand passages. Some of these lines are world-famous, like those on Fabius Maximus beginning with

> Unus homo nobis cunctando restituit rem,

or the great line

> Moribus antiquis res stat Romana virisque,

which sums up some of the qualities which placed Rome at the head of the civilized world. In a famous simile Quintilian (*Inst. Or.* x, 1, 88) compares Ennius to a sacred grove of ancient oaks, whose massive immemorial trunks are awe-inspiring rather than beautiful. In his own epitaph Ennius boasted that he still lived as he passed to and fro through the mouths of men (*volito vivu' per ora virum*). Though his works are lost, this is still true, for he inspired Virgil and influenced all Latin literature.—BIBLIOGRAPHY: W. Y. Sellar, *Roman Poets of the Republic*; L. Müller, *Quintus Ennius*; J. W. Duff, *A Literary History of Rome.*

ENNS, a river in Austria, which rises in the Alps of Salzburg, flows N., then E.N.E., then N.N.W., entering Upper Austria (Ober der Enns), which for 15 miles it separates from Lower Austria (Unter der Enns), and finally enters the Danube a little below the

town of Enns (4,438 inhabitants). Total course about 150 miles.

ENOCH (ē'nok), (1) the eldest son of Cain, who called the city which he built after his name (*Gen.* iv, 17). (2) One of the patriarchs, the father of Methuselah. He "walked with God: and he was not; for God took him" (*Gen.* v, 24) at the age of 365 years. The words quoted are generally understood to mean that Enoch did not die a natural death, but was removed as Elijah was.

ENOCH, BOOK OF, an apocryphal book of an assumedly prophetical character, to which considerable importance has been attached, particularly on account of St. Jude quoting it in the 14th and 15th verses of his *Epistle*. It is referred to by many of the early Fathers; is of unknown authorship, but was probably written by a Palestinian Jew in Hebrew or Aramaic, was translated into Greek, and from the Greek the existing Ethiopic version was made in the first or second century B.C. Till the end of the eighteenth century it was known in Europe only by the references of early writers. On his return, Bruce, the African traveller, brought with him from Abyssinia two manuscripts containing the Ethiopic translation of it. In 1821 Archbishop Laurence published a translation of the work, and in 1838 the Ethiopic text followed. *The Book of Enoch* has since been repeatedly published, translated, and criticized.

E'NOS, a seaport of Turkey, 38 miles N.W. of Gallipoli, on the Ægean Sea, in the Gulf of Enos. Pop. 8,000. —The Gulf of Enos is 14 miles in length by about 5 miles in breadth.

ENSCHEDE (ens'*he*-dā), a town of Holland, province of Overyssel, near the Prussian frontier, the chief seat of cotton manufacture in Holland. It has increased rapidly in recent years. Pop. 51,795.

ENSENA'DA (in Sp., a creek or natural harbour), a seaport of the Argentine Republic, province of Buenos Aires, the port of the town of La Plata, with which it is connected by rail and tramway, with recently constructed harbour works.—Another place of the same name is a rising port of Mexico, in the northern part of the peninsula of California on the Pacific, in the Bay of Todos los Santos, with gold- and copper-mines adjacent.

EN'SIGN, formerly, in the British army, the officer who carried the flag or colours of an infantry regiment; for this title, second lieutenant has been substituted since 1871. In naval language the ensign is the flag over the poop or stern which distinguishes the ships of different nations. In the Royal Navy of Britain it is a flag with a white field divided into quarters by the red cross of St. George, and having the union (or Union Jack, as it is commonly called) in the upper corner next the staff. A similar ensign with a red field is flown by the merchant service.

EN'SILAGE, in agriculture, a mode of storing green fodder or vegetables in receptacles called 'silos.' These are usually pits of quadrangular form, lined with wood, brick, concrete, or stone. The fodder is cut and mixed, placed in the silo, pressed down, and kept compressed by heavy weights placed on a movable wooden covering. It undergoes a slight fermentation, and attains a slightly acid taste and smell, which is particularly grateful to cattle. The modern system of ensilage dates from about 1875, but the practice was known to the ancient Romans, and the system has been common in Mexico for centuries. Such advantages are claimed for it, as that in a wet season grass can be made into ensilage instead of hay, and that there is little loss of nutritive elements, while it has great feeding powers. Successful experiments have shown that green fodder may be converted into ensilage without a pit by simply piling up and consolidating by pressure.

ENTAB'LATURE (Lat. *in,* and *tabula,* a tablet), in architecture, the horizontal, continuous work which rests upon a row of columns, and belongs especially to classical architecture. It consists of three principal divisions—the *architrave* immediately above the abacus of the column, next the *frieze,* and then the *cornice.* In large buildings projections similar to and known also as entablatures are often carried round the whole edifice, or along one front of it.

ENTADA, a genus of leguminous plants, sub-ord. Mimoseæ, containing about a dozen species of climbing tropical shrubs, remarkable for the great size of their pods. *E. scandens* has pods which measure from 6 to 8 feet in length. They are sometimes carried from America to the coasts of Europe by the Gulf Stream. The seeds have a hard, woody, and beautifully polished shell, and are often made into snuff-boxes, scent-bottles, and other small articles.

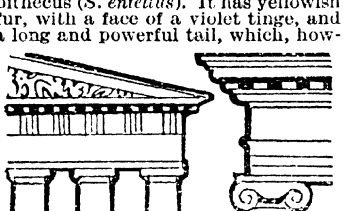
ENTAIL', in law, the settlement of an estate by which a freehold is limited to a person and the heirs of his body, with such particular restrictions as the donor may specify. Entailed estates are divided into *general* and *special,* the former when the estate is given to the donee and the

heirs of his body without exception, the latter when the estate is limited to certain heirs to the exclusion of others. Entail in lands can now freely be dealt with by following the procedure provided by the Law of Property Act, 1925.

EN'TASIS, in architecture, the delicate and almost imperceptible swelling of the lower part of the shaft of a column, to be found in almost all the Grecian examples.

ENTEBBE, the administrative capital of Uganda Protectorate, situated on Lake Victoria.

ENTEL'LUS, an East India species of monkey, of the genus Semnopithecus (*S. entellus*). It has yellowish fur, with a face of a violet tinge, and a long and powerful tail, which, however, is not prehensile. It receives divine honours from the natives of India, by whom it is termed *Hanuman*. Costly temples are dedicated to these animals; hospitals are built for their reception, and large fortunes are bequeathed for their support. The entellus abounds in India; enters houses and gardens, plunders them of fruit and eatables, and the visit is even considered an honour.



Entablature

ENTENTE CORDIALE, a term applied in international politics to friendly relations existing between different countries and statesmen. It is not a formal alliance, but denotes the existing community of interests and friendly sentiments between two countries. The term has been especially applied to the friendly relations which existed between France and England ever since the reign of Edward VII down to the formal alliance concluded at the outbreak of the European War.

ENTERIC FEVER, or **TYPHOID FEVER,** is an acute infectious fever, characterized by much general disturbance, and giving rise to ulceration in the small intestine. The distinction between this fever and typhus fever was only established in the middle of last century. It is due to a bacillus difficult to detect, but during an attack found in many of the internal organs as well as in the stools, urine, and blood of the affected person. Enteric fever occurs in all parts of the world, and in most countries it is endemic, with occasional outbursts of epidemic prevalence. In Great Britain it is most common in the autumn, but epidemics may appear at any season. The great majority of cases occur between ten and twenty-five years of age; less common in middle life, it is rare after sixty.

The most common source of infection is from the fæces and urine of infected persons, hence the channels of infection are contaminated water, milk, and food-stuffs. Much public interest has been roused by the infection, through contaminated sewage-water, of watercress, celery, oysters, and other shell-fish, and various outbreaks have arisen through these agents. A further danger is the "enteric carrier," a person who has once had enteric fever, and who is harbouring the bacillus for many years in his gall-bladder or elsewhere, and whose stools and urine may be infectious for an indefinite period.

The incubation period is very variable, ranging from one to three weeks, while the onset of the disease itself is usually insidious. The patient complains of feeling out of sorts and of headache, soon followed by the signs of chill, due to the rising temperature, and associated with sleeplessness, occasionally severe head symptoms, and much digestive disturbance.

Attacks vary much in intensity, but during the first three weeks so-called mild cases may suddenly develop more severe symptoms. Convalescence is slow and protracted, as in severe cases emaciation and debility are marked. The chief complications during the acute stage of the illness are perforation of an ulcer through the bowel, demanding immediate surgical interference, and intestinal bleeding resulting from hæmorrhage from an ulcer. During convalescence relapses are frequent, brought on by indiscretions of diet, chill, and undue exposure, or some unknown cause. The most common *sequelæ* arising from the disease are thrombosis of a vein, usually in the thigh; bronchitis; one-sided parotitis; outbreaks of boils and superficial abscesses; and more occasionally heart weakness and disease of bone.

In its early stages enteric fever is difficult to diagnose, and confusion may arise between it and lobar- and broncho-pneumonia, influenza, diarrhœa associated with septic infection, typhus fever, appendicitis, or septicæmia.

In treatment, good nursing is of first importance. The patient must have suitable nourishment and stimulation, and requires to have the greatest care, whatever special form of treatment is being carried out, while constant watch must be kept for the appearance of any complication. Great differences in the treatment are observed in different countries and by different schools of medicine.

ENTERI'TIS (Gr. *enteron*, intestine) is inflammation of the intestines. It varies from a mild intestinal catarrh, causing slight symptoms, and yielding to treatment in a few days, to cases of severe vomiting and diarrhœa with extreme prostration. These severe forms are most frequently seen in infants and young children during the summer months, and frequently prove fatal. Removal of the cause of irritation and complete rest to the intestines are to be aimed at, as far as possible, in the treatment of the condition.

ENTEROMORPHA, a genus of Green Algæ, similar to Ulva, but with a tubular thallus. *E. intestinalis* is common in fresh and brackish waters.

ENTERTAINMENTS TAX, first imposed by the Finance (New Duties) Act, 1916, is an *ad valorem* duty on payments for admission of persons as spectators or members of an audience to any entertainment. Entertainment is defined as including any exhibition, performance, amusement, game, or sport to which persons are admitted for payment. The tax is collected by means of stamped tickets of admission, or (in respect of places of regular entertainment, and in other cases on special cause shown) on the basis of returns furnished to the Board of Customs and Excise by arrangement previously made with the Board. Admission by complimentary ticket is not taxable if no indirect payment is a condition of such admission.

Exemption from the tax may be claimed in respect of any entertainment (1) where the gross receipts are entirely devoted to philanthropic or charitable purposes; or (2) where the purpose is the amusement of children, and the charge for admission does not exceed one penny per head; or (3) which is provided by or on behalf of a school or other educational institution for the furtherance of an object connected therewith, and at which the performers are children under sixteen years of age who have been or are in attendance thereat; or (4) which is wholly educational, or, being partly educational and partly scientific, is conducted by an association not established or carried on for profit, or, having for its aim the revival of national pastimes, is provided by such an association founded for that purpose.

Repayment of the tax may be claimed when the net proceeds of an entertainment are devoted to philanthropic or charitable purposes, and the total expenses met from the receipts do not exceed one-fifth of the receipts.

When admission to an entertainment is dependent upon payment of a contribution or subscription to a club, society, or association, tax is payable thereon, and where such payment carries with it the right of admission, the tax is due whether the right is exercised or not. If, however, the payment confers the right to other privileges besides admission to an entertainment, e.g. to the use of library, reading-room, &c., only such proportion thereof as the Board determines to represent the right of admission is taxable.

The amount yielded by the tax for the fiscal years 1929, 1930, 1931, and 1932 were £6,003,587, £6,695,847, £6,952,088, and £7,868,908 respectively, as at the end of March of each year.

ENTOMOL'OGY, the branch of *zoology* which treats of insects, the name being from Gr. *entoma*, animals 'cut in,' the transverse division or segmentation of the body being their most conspicuous feature. The true insects are those animals of the phylum Arthropoda distinguished from the other classes of the phylum by the fact that the three divisions of the body—the head, thorax, and abdomen—are always distinct from one another. There are never more than three pairs of legs in the perfect insect, and these are all borne upon the thorax.

Each leg consists of from six to nine joints. The first of these is called the 'coxa,' and is succeeded by a short joint called the 'trochanter.' This is followed by a joint, often of large size, called the 'femur,' succeeded by the 'tibia,' and this has articulated to it the 'tarsus,' which may be composed of from one to five joints.

Normally two pairs of wings are present, but one or other, or both, may be wanting. The wings are expansions of the sides of the second and third sections of the thorax, and are strengthened by narrow thickenings called 'nervures.' In the beetles the anterior pair of wings becomes hardened so as to form protective cases for the posterior membranous wings, and are called in this condition 'elytra' or 'wing-cases.' The fore-wings are similarly transformed in the Orthoptera, while in many of the Hemiptera they are horny except at the tip.

Respiration is effected by means of air-tubes or tracheæ, which open on the surface of the body by lateral apertures called 'stigmata' or 'spiracles,' and ramify through every part of the body. The head is composed of several segments amalgamated together, and carries a pair of feelers, or 'antennæ'; a pair of eyes, usually compound (and often simple eyes in addition), and the appendages of the mouth. These last include an upper lip (labrum), and three pairs of jaws (mandibles, first maxillæ, second maxillæ), the third pair being more or less fused into a lower lip (labium). The thorax is composed of three segments, also amalgamated but generally pretty easily recognized. The abdominal segments are usually more or less freely movable upon one another, and never carry locomotive limbs; but the extremity is frequently furnished with appendages connected with generation, which in some cases serve as offensive and defensive weapons (stings).

The organs of the mouth take collectively two typical forms, the masticatory and the suctorial, the former exemplified by the beetles, the latter by the butterflies, in which the mouth is purely for suction. The alimentary canal consists of the œsophagus or gullet, a crop, a gizzard, a stomach, and an intestine, terminating in a cloaca. There is no regular system of blood-vessels; the most important organ of the circulation is a contractile vessel situated dorsally and called the 'dorsal vessel.' The nervous system consists of a pair of cerebral ganglia (brain) in the head, these being the thickened upper part of a nerve-ring which encircles the gullet and passes below into a double ventral nerve-cord dilated into ganglia at intervals. The sexes are in different individuals, and most insects are oviparous. Reproduction is generally sexual, but non-sexual reproduction also occurs, (*see* PARTHENOGENESIS.)

Generally the young are very different from the full-grown insect, and pass through a 'metamorphosis' before attaining the mature stage. When this metamorphosis is complete, it exhibits three stages—that of the larva, caterpillar, or grub, that of the pupa or chrysalis, and that of the imago or perfect winged insect.

Insects have been divided into three sections—Ametabŏla, Hemimetabŏla, and Holometabŏla, according as they undergo no metamorphosis, an incomplete one, or a complete one. The young of the Ametabŏla differ from the adult only in size. They are all destitute of wings; the eyes are simple and sometimes wanting. The Hemimetabŏla undergo an incomplete metamorphosis, the larva differing from the imago chiefly in the absence of wings and in size. The pupa, here termed a nymph, is usually active, or, if quiescent, capable of movement. In the Holometabŏla the metamorphosis is complete, the larva, pupa, and imago differing greatly from one another in external appearance and habits. The larva is worm-like and the pupa quiescent.

The section Ametabŏla includes the order Aptĕra (tassel-tails and spring-tails). The section Hemimetabŏla comprises the orders Hemiptĕra (cicadas, bugs, plant-lice, &c.), Orthoptĕra (cock-roaches, crickets, grasshoppers, locusts, earwigs, &c.), and Neuroptĕra (dragon-flies, may-flies, white-ants, &c.). The Holometabŏla comprises the orders Diptĕra (gnats, bot-flies, gad-flies, mosquitoes, house-flies, fleas, &c.), Lepidoptĕra (butterflies and moths), Hymenoptĕra (bees, wasps, and ants), and Coleoptĕra (lady-birds, glow-worms, cockchafers, weevils, and all of the beetle tribe).

A division is sometimes made into Mandibulate and Haustellate groups, the oral apparatus of the former being adapted for mastication, the latter for imbibition of liquid food. Both types are, however, sometimes modified, and occasionally combined.

Economic entomology considers insects in relation to mankind's interests. The Entomological Society of London 41 Queen's Gate, S.W.7, founded in 1834, and various foreign societies specialize in this study. There is an Imperial Institute of Entomology with headquarters at the Natural History Museum, London, S.W.7.

ENTOMOPH'AGA ('insect eaters'), a term applied to (1) a group of hymenopterous insects whose larvæ feed upon living insects; (2) a tribe of marsupials, as the opossums, bandicoots, &c., which are insectivorous, though not exclusively so; (3) a section of the edentates, as the ant-eater and pangolin.

ENTOMOPHTHORINEÆ, a curious family of Fungi, group Zygomycetes, all parasites on insects. The best known is *Empusa Muscæ*, which attacks the common house-fly. After thoroughly permeating and finally killing the infected fly, the fungus sends numerous hyphæ to the surface, from the ends of which conidia are shot forth by an 'explosive' process, to spread the infection if they alight on living flies. In autumn, flies killed by this parasite may often be found adhering to window-panes, surrounded by a halo of ejected conidia. It has been proposed to utilize this fungus in combating the fly nuisance.

ENTOMOS'TRACA, a sub-class of

crustacea, including forms which are mostly small, and comprising four orders; (1) Branchiopoda, brine-shrimps and water-fleas; (2) Copepoda, including the freshwater Cyclops, and numerous marine species contributing to the floating surface population (plankton); (3) Cirripedia, barnacles; (4) Ostracoda, types such as Cypris enclosed in a bivalve shell.

ENTOZO'A, a general name for the various parasitic worms that infest the bodies of other animals. Some are found in the intestines, others in the liver, brain, muscles, and other tissues. They pass through different stages in their development, and at each stage may occupy a different organ (or tissue), and usually a different animal. Thus the cystic or bladder-worm, whose presence in the brain of sheep causes staggers, is the immature form of a tape-worm of the dog, &c. The number of species is being reduced as the relations of the different forms are studied. They belong to the two phyla Platyhelminthes (flat-worms) and Nemathelminthes (thread-worms, &c.). The former embraces flukes (Trematoda) and tapeworms (Cestoda); while the latter includes threadworms and round-worms (Nematoda), and spiny-headed worms (Acanthocephala).

ENTRENCHMENTS. The employment of entrenchments, or earthworks, in connection with military operations dates from the earliest times. Entrenched camps, made by the Romans, are still to be seen in many parts of the country. The primary object, in early designs, was to offer a material obstacle to the assaulting enemy; the defenders manned a high parapet overlooking a formidable ditch, and a hand-to-hand conflict decided the issue.

The development of fire-arms, and especially of artillery, depreciated the value of entrenchments as affording material obstacles, but gave them a gradually increasing value as a means of protecting the defenders from missiles. The provision of cover, that is to say, concealment from view or protection from fire, ultimately became the dominant factor in the design of earthworks. Obstacles were still necessary, but they had to be provided by other means.

Successive improvements in fire-arms altered the nature of the cover which it was necessary and practicable to provide. A bullet-proof parapet has always been an essential feature, but whereas a few inches of earth sufficed to stop a musket-ball, the modern rifle-bullet will penetrate a thickness of nearly four feet.

The introduction, during last century, of shrapnel shell, the bullets from which descend at a steep angle, was followed by the adoption of overhead cover as a standard feature in trench design. This persisted for several years, until the great increase in the power of high-explosive shell made it impossible to construct any form of roof which would withstand bombardment, even by the lighter artillery accompanying an army in the field, and still permit of the defenders using their rifles from below it. Modern fire-positions are made open, i.e. without overhead cover.

All past wars have proved that victory can only be won as the result of offensive action. Nevertheless, in any campaign it will not be possible to attack at all times and in all places. The provision of the strongest possible force at the vital point necessitates a defensive attitude on other parts of the front. Although entrenchments presuppose a defensive attitude locally, they play an important part in offensive operations. The ultimate aim is that, by a skilful use of entrenchments, a commander may be able to reduce to a minimum the strength of his force in actual combat with the enemy, and thus to retain at his disposal a reserve of troops for offensive action.

Construction of Defences. Entrenchments may be either hasty or deliberate. *Hasty entrenchments* are those made on the actual field of battle: by the attackers, to secure the ground won prior to another bound forward; by the defenders, to hold up the attack pending fresh dispositions of troops in rear. The amount of digging that can be done is necessarily small; existing cover must be utilized to the utmost. This may consist of ditches, hedges, sunken roads, railway embankments and cuttings, buildings, woods, shell-holes, &c. All of these are readily convertible into strong defences. The test of battle has proved, over and over again, that troops well trained in adapting natural cover to defence are very difficult to dislodge, once they have dug themselves in.

Deliberate entrenchments are employed in the gradual building up of a trench system when once the opportunity of manœuvre has ceased to exist; or in the preparation of a defensive position somewhat remote from the scene of active operations.

The following are the salient features in the design of modern entrenchments: (1) A parapet 18 inches high, and upwards of 5 feet thick, in front of every fire-trench. (2) Longitudinal division of every trench, either by projecting buttresses of earth or by bends, so that no straight portion exceeds 10 yards in length. The effect of this is to give protection against flanking or enfilade rifle-fire, and to localize the

burst of shell. (3) A parapet on the rear side (parados), to shield the defenders from the backblast of shell which burst beyond the trench. (4) Wide trenches (6 feet at the top), to minimize the risk of men getting buried during bombardment. (5) Accommodation, in dug-outs and other refuges, for a proportion of the troops.

Principles of Camouflage. Arms of precision have, during the past twenty years, compelled careful attention to the concealment of entrenchments. Although systems of trenches cannot now be hidden from the eye of the aeroplane-camera, yet the enemy can be kept in doubt, by correct design and careful siting of trenches, as to the strength in which the various portions of a position are held. It is for this reason that the deep fire-trench, with a low parapet in front, has been universally adopted, despite the obvious objection that minor undulations restrict the field of fire because the rifle is brought nearer to the ground. Earthworks on a skyline, or those seen by the enemy against a distant background, violate the first principles of siting.

Three Zones of Defence. Modern entrenchments are arranged in depth. The 'lines' of Wellington's time have given place to a broad belt of mutually supporting defences, organized in three zones. These merge imperceptibly into one another, and each zone extends upwards of a mile from front to rear.

The foremost fringe of the outpost zone is in contact with the enemy; it is the high-water mark on which the troops advancing during the last action have come to a standstill and dug themselves in. Very lightly manned, as befits an area where heavy shelling is rife, this zone, nevertheless, plays an important rôle. It harbours the forward artillery observation posts, which control and direct the fire of the guns in rear. It furnishes a 'jumping-off' place for attacks. It takes the first shock of a hostile attack, and, although not strong enough to repulse a serious offensive, contributes to the enemy's ultimate defeat by depriving his onslaught of momentum.

The battle zone is more elaborately organized, and capable of being very heavily manned. Within this area the defence intend to bring to a standstill the most determined offensive. It lies sufficiently far back from the fringe of the outpost zone to be reasonably immune from destructive bombardment. Lying still farther back is the third zone, which serves for the accommodation of reserves of troops, and is also prepared for defence, as a last resort, in case the enemy should penetrate the battle zone.

ENTREPÔT (ân-tr-pō; Fr.), a port where foreign merchandise which cannot enter the interior of a country is deposited in magazines under the surveillance of the custom-house officers till it is re-exported; also, any place where goods are sent to be distributed wherever customers are found.

ENTRE RIOS (en'tre rē'os; 'between rivers'), a province of the Argentine Republic, lying between the Uruguay and the Paraná; area estimated at 30,243 sq. miles; pop. (1932), 628,960. The province is largely pastoral. Capital, Paraná, with a pop. of 66,204 (1931).

ENTRO'PION is the inversion or turning in of the eyelid. It may be congenital, or arise as the result of some inflammatory process or burn of the conjunctiva. Entropion affecting the lower lid appears also as the result of extreme photophobia (intolerance to light).

ENTROPY, a term introduced into physics by Clausius as the name of one of the two important thermodynamical properties of a substance which depend on its 'state.' Suppose we have 1 lb. of water, at atmospheric pressure and 212° F., say, and suppose we apply heat to the water and change it into 1 lb. of steam at 212° F. The temperature does not change during this process, while the heat which must be added is the latent heat of the steam, namely, about 960 British Thermal Units. The increase of entropy from the first state to the second state is got by dividing the heat given to the substance, namely, 960 B.Th.U., by the absolute temperature at which that heat was given to the substance, namely, 461 + 212 = 673 degrees absolute, i.e. the increase of entropy is $\frac{960}{673} = 1{\cdot}43$ units.

If the temperature changes with the addition of heat, as it would usually do, we have to imagine the heat to be supplied in small quantities, and to take the average temperature of the body at which these tiny quantities of heat are supplied. The quotient heat ÷ temperature is taken for each small quantity of heat, and the results are added together. The summation is defined as the increase in entropy between the initial and the final states

In mathematical language the increase in entropy between state A and state B is given by $(\phi_B - \phi_A) = \int_A^B \frac{dQ}{T}$, where ϕ stands for the entropy, Q for the heat received by the body, and T for the absolute temperature at which

the heat is received. The importance of the entropy function, namely, the integral $\int \frac{dQ}{T}$, in thermodynamics is due to the fact that it is, like the internal energy of the substance, a function of the state of the substance only, and consequently in any temperature cyclic change in which the final state of the substance is the same as its initial state A, the total change, either of its internal energy or of its entropy, is zero. The fact that the total change in the internal energy of the substance is zero is practically equivalent to the *First Law of Thermodynamics*, while the fact that the total change of the entropy of the substance is zero is equivalent to the *Second Law of Thermodynamics*.—BIBLIOGRAPHY: J. H. Poynting and J. J. Thomson, *Textbook of Physics* (vol. 3): *Heat*.

EN'VELOPES, the paper covers that enclose letters or notes. They became common shortly after the introduction of the penny postage system; were at first made chiefly by hand, but are now made entirely by machinery.

ENVERPASHA, Turkish soldier and politician, born at Constantinople in 1879. He entered the Turkish army in 1896, and in 1905 took part in the Young Turk movement at Salonica. He joined the revolutionaries in 1908, was for a short time military attaché in Berlin, but in 1909 returned to Salonica, and assisted in the deposition of Sultan Abdul Hamid. He then took part in the Tripoli War and the second Balkan War, and recaptured Adrianople from the Bulgarians in July, 1913.

After being Minister of War, Enver subsequently became one of the leaders of the Committee of Union and Progress. A staunch pro-German, he was to a great extent responsible for Turkey's entry into the European War as an ally of Germany. In 1918 Enver Pasha fled to the Caucasus. In 1920 he worked under the Soviet Government, against whom he turned. On 4th August, 1922, he was killed at Bokhara.

ENVIRONMENT, in biology, the surroundings of an organism, including non-living factors, such as climate and weather; and also other organisms. Plants and animals are more or less adapted to their surroundings, a good example being the mutual adaptations of flowers and insects, but there has been much controversy as to the way in which such adaptations have come about.

Among all but unicellular organisms any individual consists of (1) a general body (*soma*), by which the life of the individual is maintained, and (2) germ cells, capable of becoming fresh individuals, and thus providing for the continuance of the species. According to a school of thought founded by some of the pre-Darwinian evolutionists, notably Buffon, Lamarck, and Treviranus, modifications of the soma (acquired characters) of an individual, brought about by the action of the environment (e.g. thickening of parts of the skin as the result of constant pressure), or by use and disuse (e.g. increased size of muscles; diminished wings of poultry), can be inherited, leading to increasing alteration capable of ending in the production of new species.

Most living biologists, however, hold with Weismann that only *germinal variations*, i.e. variations in the substances of the germ-cells, are heritable. Much further research is necessary before it is possible to pronounce with certainty on many of the complex details involved in these theories. As to the part played by the environment, cases are known where this acts directly on the germ-cells, so as to influence their variation. But these are among some of the lower animals, in which the eggs develop outside the body of the parent, and we know hardly anything about the action of the environment on germs that develop internally.

It has been suggested that modifications of the soma undoubtedly brought about by the influence of the surroundings may react upon the germ-cells and cause these to vary, but of this no proof has so far been forthcoming. Even if we admit that modifications of the soma are not inherited, they may nevertheless play a part in evolution by aiding the development of germinal variations that take the same direction.

The whole subject is one of more than academic interest, especially in regard to the further evolution of human beings. Comparatively rapid advance, either in desirable or undesirable directions, would be possible if modifications acquired by the soma of an individual were capable of being inherited. So far as we know at present, acquired improvements in physique and mentality of individuals are not inherited by their offspring, which seems rather disappointing, but, on the other hand, undesirable modifications, including those due to disease, appear to be in the same case, and there is little reason to think that the children of parents possessing undesirable acquired characters are unduly handicapped from the very start.

We must, of course, exclude cases of antenatal infection by the microbes

of certain infectious or contagious diseases to which one or both parents have fallen victims, and also those of direct poisoning of germ-cells as the result of alcoholism.

EN'VOY, a person deputed by a Government to negotiate a treaty, or transact other business, with a foreign Government. We usually apply the word to a public minister sent for one particular purpose; hence an *envoy* is distinguished from an *ambassador,* and is of inferior rank.

ENZYMES. *See* FERMENTATION, PHYSIOLOGICAL CHEMISTRY.

EOANTHROPOS. Oldest known European race of man. It is one of a number of words, the first part of



Eos: goddess of the dawn

which is *eo* (a form of the Greek ēōs, dawn) used chiefly in palaeontology, in the sense of first beginnings.

E'OCENE, in geology, a term applied to the lower division of the Tertiary strata, from Gr. *ēōs,* dawn, and *kainos,* recent, because remains of existing organic species first occur here. The Eocene beds are arranged in two groups, termed the Lower and Upper Eocene; the strata formerly called Upper Eocene being now known as Oligocene. They consist of marls, limestones, clays, and sandstones, and are found in the Isle of Wight and in the south-east of England and north-west of France, in Central Europe, Western Asia, Northern Africa, and the Atlantic coast of North America.

ÉON DE BEAUMONT. *See* D'ÉON DE BEAUMONT.

E'OS, among the ancient Greeks the goddess of the dawn. *See* AURORA.

EÖTVÖS (eut'veush), **Baron Joseph,** a Hungarian statesman and author, born 1813, died 1871. He completed his studies at the University of Pesth in 1831. He had already, before leaving the university, produced three dramas —*The Critics, The Wedding,* and *Revenge*—the last a tragedy, all of which were well received. He became a friend of Kossuth, and distinguished himself as a journalist and orator of the popular party. In 1848, after the revolution of 15th March, he was appointed Minister of Public Instruction, resigned the same year, but was again appointed Minister of Public Instruction in 1867, and filled this office until his death. Among his works are the novels: *The Carthusian, The Village Notary* (translated into English), and *Hungary in* 1514—giving vivid pictures of Hungarian life in modern and more remote epochs.

EOZO'IC ROCKS, the name given to the pre-Cambrian rocks, from their containing the first or earliest traces of life in the stratified systems.

EOZO'ON, a supposed gigantic fossil foraminifer found in the limestone of the pre-Cambrian rocks of Canada, whence the name *Eozoön canadense.* The structure, however, which is recognized also in Bavaria and in County Galway, has proved to be due to a zonal development of serpentine during metamorphism of the ancient limestones concerned. A similar structure occurs in limestone associated with the volcanic focus of Vesuvius.

EP'ACRIS, a genus of gamopetalous Dicotyledons, the typical genus of the nat. ord. Epacridaceæ, distinguished by having a coloured calyx with many bracts, a tubular corolla with smooth limb, stamens affixed to the corolla, and a five-valved many-seeded capsule. The species are shrubby plants, with axillary, white, red, or purple flowers, generally in leafy spikes. Among those cultivated in Britain we may mention *E. grandiflōra,* which has flowers nearly an inch in length, of a brilliant reddish purple at the base and pure white at the apex. The order Epacridaceæ consists of plants allied to the heaths, chiefly natives of Australia. The fruit of some species is eaten under the name of Australian cranberry, and they are cultivated in greenhouses for their flowers.

EP'ACT (Gr. *epaktos,* added), in chronology, the excess of the solar month above the lunar synodical month, and of the solar year above the lunar year of twelve synodical months. The epacts then are *annual* and *menstrual* or *monthly.* Suppose the new moon to be on the 1st of January: the month of January containing 31 days, and the lunar month only 29 days, 12 hours, 44 minutes, 3 seconds; the difference, 1 day, 11 hours, 15 minutes, 57 seconds, is the *menstrual epact.* The *annual epact* is nearly 11 days; the solar year being 365 days, and the lunar year 354. The epacts

were once of some importance in ecclesiastical chronology, being used for finding when Easter would fall.

EPAMINON'DAS, an ancient Greek statesman and general, who, for a short time, raised his country, Thebes, to the summit of power and prosperity. He was born about 418 B.C., and killed at the battle of Mantinea, 362 B.C. He took the leading part in the struggle during which Spartan supremacy in Greece was destroyed, and the supremacy of Thebes temporarily secured. Four times he successfully invaded the Peloponnesus at the head of the Thebans, but after his death Thebes soon sank to her former secondary condition. Throughout life Epaminondas was distinguished for the friendship subsisting between him and Pelopidas, with whom he served in the Spartan campaign, 385 B.C. His character is one of the finest recorded in Greek history, and his virtues have been praised by both Xenophon and Plutarch.

EPARCH (ep'ark), in Greece, the governor or prefect of a provincial division called an *eparchy*, a subdivision of a nomarchy or province of the kingdom. In Russia, an eparchy is the diocese or arch-diocese of a bishop or archbishop of the Greek Church.

EPAULEMENT (e-pāl'ment; Fr. *épaule*, shoulder), in fortification, a term for the mass of earth or other material which protects the guns in a battery in front and on either flank.

EP'AULET, or **EP'AULETTE** (Fr. *épaulette*, dim. of *épaule*, the shoulder), an ornamental shoulder-piece belonging to a military or other dress. Epaulettes were worn in the British army till 1855, and in the United States as late as 1872, and are still worn in the navy by all officers of and above the rank of lieutenant, and by some civil officers.

ÉPÉE (é-pā), **Charles Michel, Abbé de l',** French philanthropist, born in 1712, died 1789. He had chosen the clerical profession, but had to leave the Church on account of Jansenist opinions. The great object of his life was the instruction of the deaf and dumb, upon whom he spent his whole income, besides what was contributed by benevolent patrons. In 1770 he founded at his own expense an institution for the deaf and dumb. He left several works on his method of instruction, one of these being *Institution des sourds et muets* (1774).

ÉPÉHY, a town of France, department of Somme, about 13 miles S.E. of Cambrai. It was the scene of fierce fighting during the European War, and was captured by the British in Sept., 1918.

EPEIRA (e-pī'ra), a genus of spiders, comprising the largest and best-known British species. *E. diadema*, the common garden spider, is a handsomely marked species, which constructs a beautifully symmetrical wheel-shaped web.

EPERIES (ep'er-yāsh), a town of Czechoslovakia, formerly in Hungary, on the Tarcza, the seat of a Greek Catholic bishop. Pop. 14,590.

ÉPERNAY (ep-er-nā; ancient **SPARNACUM,** and the Roman **AQUÆ PERENNES**), a town of North-Eastern France, department of Marne, on the Marne, the central depôt of the wine trade of Champagne. The vast wine-cellars of the town form a labyrinth of galleries cut in the tufa or calcareous soil of the district. Épernay was occupied for a short time by the Germans at the beginning of the European War, and was one of the enemy's objectives in the second battle of the Marne (July, 1918). Pop. 20,381.

E'PHAH, or **BATH,** a Hebrew measure of capacity, containing, according to one estimate or calculation 8·6696 gallons; according to another, only 4·4286 gallons.

EPHEDRA, the principal genus of the Gnetales family of Gymnosperms. The species are shrubby switch-plants, natives of the warm temperate zone, found especially on sandy soil. The ripe seeding cones have fleshy scales, and those of *E. distachya* are eaten in South Russia.

EPHEM'ERA, the typical genus of the neuropterous insects constituting the family Ephemeridæ, so named from the extreme shortness of their lives in the perfect state. They are known as *may-flies* or *day-flies*, and are characterized by the slenderness of their bodies; the delicacy of their wings, which are erect and unequal, the anterior being much the larger; the rudimentary condition of the mouth; and the termination of the abdomen in three filiform appendages.

In the state of larvæ and pupæ they are aquatic and exist for years. When ready for their final change, they creep out of the water, generally towards sunset of a fine summer evening, beginning to be seen generally in May. They shed their whole skin shortly after leaving the water, propagate their species, and die, taking no food in the perfect state. The may-fly is well known to anglers, who imitate it for bait.

EPHE'SIANS, THE EPISTLE TO THE, a canonical epistle addressed by the Apostle Paul to the Church which he had founded at Ephesus. It was written during his first captivity at Rome, immediately after he had

written the *Epistle to the Colossians* (A.D. 62); and was sent by the hands of Tychicus, who also bore the message to the Church at Colossæ.

EPH'ESUS, an ancient Greek city of Lydia, in Asia Minor, one of the twelve Ionian cities, on the south side of the Caystrus, near its mouth. It was at one time the grand emporium of Western Asia, having a convenient and spacious harbour. The Apostle Paul visited Ephesus and established a Christian Church there, to which he dedicated one of his Epistles.

It was famous for its temple of Artemis (Diana), called *Artemision*, the largest and most perfect model of Ionic architecture, and reckoned one of the seven wonders of the world. The first great temple, begun about 650 B.C. and finished after 120 years, was burnt by the notorious Herostratus in order to perpetuate his name, 356 B.C. (the night of Alexander the Great's birth). A second and more magnificent was then erected, which was burned by the Goths in A.D. 262. Some interesting remains have been discovered by excavation since 1896.

Several Church councils were held here, especially the Third Ecumenical Council of 431, at which Nestorius was condemned. The site of the city is now desolate; near it is a poor village, Aiasoluk.

EPH'OD, a species of vestment worn by the Jewish high-priest over the second tunic. It consisted of two main pieces, one covering the back, the other the breast and upper part of the body, fastened together on the shoulders by two onyx stones set in gold, on each of which were engraved the names of six tribes according to their order. A girdle or band, of one piece with the ephod, fastened it to the body. Just above the girdle, in the middle of the ephod, and joined to it by little gold chains, rested the square breastplate with the Urim and Thummim.

The ephod was originally intended to be worn by the high-priest exclusively, but a similar vestment of an inferior material seems to have been in common use in later times among the ordinary priests.

EPH'ORS, or **EPH'ORI** (Gr. *ephoroi*, overseers), magistrates common to many Dorian communities of ancient Greece, of whom the most celebrated were the Ephori of Sparta. They were five in number, were elected annually, and both the judicial authority and the executive power were almost entirely in their hands. Their power became an intolerable burden, especially to the kings, and in 225 B.C. Cleomenes III murdered the whole college and abolished the office.

E'PHRAEM SYRUS, that is, 'Ephraim the Syrian,' writer of the Syrian Church, born at Nisibis, in Mesopotamia, about A.D. 306, died at Edessa in 373 or 378. He wrote several commentaries on Scripture, numerous homilies, and other works (as well as hymns), which have come down to us partly in Syriac, partly in Greek, Latin, and Armenian translations. They were edited by Assemani at Rome between 1732 and 1746, and by Overbeck at Oxford in 1865.

E'PHRAIM, the younger son of Joseph, and the founder of one of the twelve tribes of Israel. When the Israelites left Egypt, the Ephraimites numbered 40,500, and their possessions in the very centre of Palestine included most of what was afterwards called Samaria. Ephraim is also a town mentioned in *John* xi, 54, and to which Jesus retired after His raising of Lazarus, when the Jewish authorities manifested their hostility against Him.

EP'IC, a poem of the narrative kind, dealing with a series of events or actions of permanent interest. Some authorities restrict the term to narrative poems written in a lofty style and describing the exploits of heroes. Others widen the definition so as to include not only long narrative poems of romantic or supernatural adventure, but also those of an historical, legendary, mock-heroic, or humorous character. Epic poetry is distinguished from drama in so far as the author frequently speaks in his own person as narrator; and from lyrical poetry by making the predominant feature the narration of action rather than the expression of emotion.

Among the more famous epics of the world's literature may be noted: Homer's *Iliad* and *Odyssey*, Virgil's *Æneid*, the German *Nibelungenlied*, the Anglo-Saxon poem of *Beowulf*, the French *Song of Roland*, Dante's *Divina Commedia*, Tasso's *Gerusalemme Liberata*, Ariosto's *Orlando Furioso*, Milton's *Paradise Lost*, Spenser's *Faërie Queene*, Camoens' *Lusiads* (Portuguese), and Firdusi's *Shah Namah* (Persian).

Hesiod's *Theogony*, the *Elder Edda*, the Finnish *Kalevala*, and the Indian *Mahâbhârata* may be described as collections of epic legends. The historical epic has an excellent representative in Barbour's *Bruce*; and specimens of the mock-heroic and humorous epic are found in *The Battle of the Frogs and Mice*, *Reynard the Fox*, Butler's *Hudibras*, and Pope's *Rape of the Lock*.—BIBLIOGRAPHY: Chassang and Marcou, *Les Chefs-d'œuvre épiques de tous les peuples*; W. M. Dixon, *English Epic and Heroic Poetry*; A. Lang, *Homer and the Epic*.

EPICHARMUS (ep-i-kär'mus), a Sicilian comic poet and philosopher of the Pythagorean school, born in the Island of Cos about 540 B.C., died 450 B.C. He removed to Syracuse, where at the court of Hieron he spent the remainder of his life. He is credited with the invention of written comedy, and Plato called him "a master of the comic type."

EPICTE'TUS, a Greek Stoic philosopher, born at Hierapolis, in Phrygia, about A.D. 60. He lived long at Rome, where, in his youth, he was a slave. Though nominally a Stoic, he was not interested in Stoicism as an intellectual system; he adopted its terminology and its moral doctrines, but in his discourses he appeared rather as a moral and religious teacher than as a philosopher.

His doctrines approach more nearly to Christianity than those of any of the earlier Stoics, and although there is no trace in what is recorded of them of his having been directly acquainted with Christianity, it is at least probable that the ideas diffused by Christian teachers may have indirectly influenced them. The excellence of his system was universally acknowledged.

When Domitian banished the philosophers from Rome (A.D. 94), Epictetus retired to Epirus, where he is supposed to have died. His disciple Arrian collected his opinions, which are preserved in two treatises called the *Discourses of Epictetus*, and the *Manual or Enchiridion*.

EPICU'RUS, a Greek philosopher, founder of the Epicurean school, was born in the Island of Samos 342 B.C., died at Athens 270 B.C. He settled at Athens 306 B.C., and purchased a garden in a favourable situation, where he established a philosophical school. Here he spent the remainder of his life, living in a simple manner and taking no part in public affairs. His pupils were numerous and enthusiastically devoted to him. His theory of the universe was based on the atomic theory of Democritus. The fundamental principle of his ethical system was that pleasure and pain are the chief good and evil, the attainment of the one and the avoidance of the other of which are to be regarded as the end of philosophy.

The term 'Epicurean' has come to signify one who is indulging his sensual appetites without measure, but this is really due to a misapprehension of the meaning of the word pleasure as used by the philosopher. Epicurus himself was not an 'Epicurean' in this sense, for he endeavoured to give a moral tendency to this doctrine. He exalted the pure and noble enjoyments derived from virtue, to which he attributed an imperishable existence, as incalculably superior to the passing pleasures which disturb the peace of mind, the highest good, and are therefore detrimental to happiness. Peace of mind, based on meditation, he considered as the origin of all good. It is, however, easy to see that his use of the word 'pleasure' was calculated to produce the mischievous results with which Epicureanism has been charged.

The philosophy of Epicurus has, therefore, been violently opposed and frequently misrepresented; but while it is not open to the charges of gross sensualism which have been brought against it, it cannot be considered as much better than a refinement of sensualism. In ancient times his philosophy appears to have been more popular in Greece than in Rome, although his disciples were numerous in both, and the Latin poem of Lucretius, *De Rerum Natura*, is a poetical exposition of his doctrines. Epicureanism was resuscitated in France by Pierre Gassendi, and its principles have been professed by De la Rochefoucauld, Rousseau, and Voltaire.

Epicurus was a very voluminous writer, but few of his writings are extant, what we possess comprising only some fragments of a *Treatise on Nature*, two letters, and detached passages. Lucretius, Cicero, Pliny, and Diogenes Laertius are our chief authorities for his doctrines. — BIBLIOGRAPHY: Lange, *History of Materialism*; W. Wallace, *Epicureanism*; Guyau, *La Morale d'Epicure*; Taylor, *Epicurus*; W. Pater, *Marius the Epicurean*.

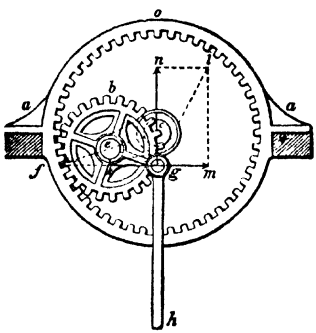
EP'ICYCLE, a conception of the ancient astronomy used to explain the irregular, and at times retrograde, motions of the planets. Corresponding to each planet there was supposed to be a circle called a *deferent*, which had the earth as its centre. Round this circle a point was imagined to revolve with uniform motion. That point formed the centre of a second and smaller circle, called an epicycle, and the actual planet was supposed to revolve with uniform motion round the circumference of the epicycle.

EPICY'CLOID, in geometry, a curve generated by a point on the circumference of a circle which rolls on the convex side of another fixed curve. The curve generated by rolling on the concave side is called a 'hypocycloid.' If the point is not on the circumference, the generated curves are called 'trochoids.'

EPICYCLOI'DAL WHEEL, a wheel or ring fixed to a framework, toothed on its inner side, and having in gear with it another toothed wheel of half

the diameter of the first, fitted so as to revolve about the centre of the latter. It is used for converting circular into alternate motion, or alternate into circular. While the revolution of the smaller wheel is taking place, any point whatever on its circumference will describe a straight line, or will pass and repass through a diameter of the circle, once during each revolution. In practice, a piston-rod or other reciprocating part may be attached to any point on the circumference of the smaller wheel.

EPIDAU'RUS, a town and seaport of ancient Greece, situated in Argolis, in the Peloponnesus, particularly celebrated for its magnificent temple of Æsculapius, which stood on an eminence not far from the town. It



Epicycloidal Wheel

had also temples of Artemis, Dionysus, Aphrodite, and Hera, and a splendid theatre still in fair preservation. The site is now occupied by the village *Epidavro*, where a congress met in 1822 and promulgated the 'Constitution of Epidaurus.'

EPIDEM'IC, or EPIDEMIC DISEASE (Gr. *epi*, upon, and *dēmos*, people), signifies a disease which attacks a people, suddenly spreading from one to the other in all directions, prevailing a certain time and then dying away. It usually travels from place to place in the direction of the most-frequented lines of communication. The reason is that such diseases are commonly due to some infective material capable of being conveyed from one individual to another, and of being transported from place to place. In Britain smallpox and cholera are occasionally epidemic, whilst scarlet fever, measles, chicken-pox, diphtheria, typhoid fever, &c., are almost invariably so. Certain diseases which appear to be more mental than physical sometimes occur so numerously as to assume an epidemic form, such as St. Vitus's dance, convulsionary diseases, or suicidal mania.

EPIDEN'DRUM (Gr. *epi*, upon, and *dendron*, a tree), a large genus of tropical American orchids, most of the species of which are epiphytic, growing on trees. The flowers are very handsome, and a large number of the species are in cultivation.

EPIDER'MIS, in anatomy, the cuticle or scarf-skin of the body; a thin membrane covering the true skin of animals, consisting of two layers, an inner or mucous layer, called the *rete mucosum*, composed of active cells containing granules of colouring matter, and an outer or horny layer, consisting of flattened scale-like cells, dry, inactive, and effete, which are constantly being shed in the form of dust. Both layers are destitute of blood-vessels or nerves.

EPIDERMIS, in botany, the superficial layer of cells covering leaves and young stems. Its principal function is to restrict transpiration, for which purpose its outer wall is more or less cutinized, i.e. chemically modified so as to be very impervious to water and gases, especially the outermost part thereof, the so-called *cuticle*.

Naturally both cuticle and epidermis as a whole are most strongly developed in drought-adapted plants or xerophytes (q.v.); and conversely the epidermis of submerged plants is not cutinized, nor is the superficial layer of ordinary roots. The epidermis frequently bears hairs of various kinds. Stems which undergo secondary growth in thickness soon cast off their epidermis, its rôle being assumed by cork or bark. The water- and gas-proof covering provided by the epidermis is not continuous, but is interrupted by numerous minute pores or *stomata*, capable of opening and closing, through which accordingly a regulated interchange of gases takes place.

EP'IDOTE, a mineral of a green or grey colour, vitreous lustre, and partial transparency, a member of the garnet family. The primary form of the crystals is a right rhomboidal prism. The crystals occur in Norway, Siberia, Tyrol, and the United States.

EPIGÆA (-jē'a), a genus of Ericaceous shrubs. *E. repens*, the trailing arbutus, is the May-flower of North America.

EPIGLOTTIS is a cartilaginous plate behind the tongue, which covers the glottis like a lid during the act of swallowing, and thus prevents foreign bodies from entering the larynx. In its ordinary position during respiration it is pointed upwards, but in the act

of swallowing it is pressed downwards and backwards by the drawing up of the windpipe beneath the base of the tongue, and thus closes the entrance to the air-passages. *See* LARYNX.

EP'IGRAM (Gr. *epi*, upon, *graphein*, to write), in a restricted sense, a short poem or piece in verse, which has only one subject, and finishes by a witty or ingenious turn of thought; in a general sense, a pointed or witty and antithetical saying. The term was originally given by the Greeks to a poetical inscription placed upon a tomb or public monument, and was afterwards extended to every little piece of verse expressing with precision a delicate or ingenious thought, as the pieces in the *Greek Anthology*. In Roman classical poetry the term was somewhat indiscriminately used, but the epigrams of Martial contain a great number with the modern epigrammatic character.

Epigrams flourished in modern times after the Revival of Learning period, and all the Elizabethan versifiers tried their hand at them. Pope was a great master of the epigram, and the art was practised by Clément Marot, Boileau, Voltaire, Schiller, Goethe, Byron, and Moore, and more recently by Sir William Watson. Coleridge's definition of an epigram, which itself is an epigram, may be given as an example:

> What is an epigram? A dwarfish whole,
> Its body brevity, and wit its soul.

—C. Dodd, *Epigrammatists of Mediæval and Modern Times*.

EPIGRAPHY, a term used both for the study of inscriptions as a whole, and for the science which deals with their classification and decipherment. The attention of the epigraphist is given to inscriptions upon stone, brick, metal, and other comparatively permanent material, as compared with writings upon parchment, papyrus, or paper; but he excludes inscriptions upon coins, which are in the department of the numismatist. The science of epigraphy is of immense importance for a knowledge of the past, the subject including inscriptions so far apart in point of time as Egyptian records of the days of Mena (4700 B.C.), and the Greek hexameters that commemorate the death in Westmorland of a young Syrian soldier in the army of Septimius Severus. Of still more recent date are the Runic inscriptions discovered in Greenland, which seem to place beyond a doubt the fact of Icelandic explorers having reached that country in the eleventh or twelfth century.

The most important inscriptions are Egyptian, Cuneiform (Babylonian and Assyrian), Semitic, Greek, Latin, Indian, and Runic. The inscribed writings include epitaphs on the dead, records of important events, dedications of public buildings, with such comparatively private matters as receipts, contracts, and other business transactions.

While inscriptions form a valuable source of knowledge, they cannot be accepted as invariably reliable. Reasons might in some cases exist for making a false or misleading record, as in the case of a eulogistic tombstone, while mistakes in spelling and other details may be due to a careless workman. The literature which deals with the science of epigraphy is very large.

EPIGYNOUS (e-pij'i-nus) **FLOWERS**, those in which the gynæcium is *inferior*, i.e. embedded in, and adherent to, the hollowed-out receptacle, so that the other parts of the flower appear to be inserted on the top of the ovary.

EP'ILEPSY (Gr. *epilēpsia*, literally, a seizure), a nervous disease, the falling-sickness, so called because the patient falls suddenly to the ground. It depends on various causes, often exceedingly complicated and incapable of being removed; hence it is often an incurable periodical disease, appearing in single paroxysms. In its fully developed form, convulsions, attended by complete unconsciousness, are the prominent feature.

Among the different causes may be mentioned intense emotional disturbance in early childhood, injury to the brain or its coverings at birth or subsequently, or some irritation within the skull itself, such as tumours, &c., developing later in life. Epileptiform fits due to the last-mentioned cause differ from those of true epilepsy, and are known as *Jacksonian epilepsy* (cf. Sir W. K. Gowers, *The Borderland of Epilepsy*).

It is, for the most part, preceded by a tingling sensation, creeping up from the foot or hand to the breast and head, or some other premonitory symptom such as spectral illusions, headache, giddiness, confusion of thought, sense of fear, &c.; but sometimes there are no precursive symptoms. During the paroxysm all that is to be attended to is to prevent the patient from injuring himself; and this is to be accomplished by raising the head gently and loosening all tight parts of the dress. It is advisable to protect the tongue from being bitten by introducing a piece of india-rubber, cork, or soft wood between the teeth.

EPILO'BIUM, the willow-herbs, a genus of plants, nat. ord. Onagraceæ. The species are herbs or under-shrubs

with pink or purple, rarely yellow, flowers, solitary in the axils of the leaves or in terminal leafy spikes. The seeds are tipped with a pencil of silky hairs, and are contained in a long four-celled capsule. There are more than fifty species scattered over the arctic and temperate regions of the world, ten of them being natives of Britain.

EPILOGUE. Conclusion of a literary work or peroration of a speech. Specifically it was an independent commentary in verse after a drama, sometimes by another pen, appealing to the hearer's or reader's indulgence or deprecating criticism; it especially characterised 17th-18th century English drama.

EPIMEN'IDES (-dēz), an ancient Greek philosopher and poet, born in



Madame Epinay

Crete in the seventh century before Christ. He was held for an infallible prophet, and by some is reckoned among the seven wise men, instead of Periander. He is supposed to be the prophet referred to by St. Paul in *Titus* i, 12: "One of themselves, even a prophet of their own, said, The Cretians are alway liars, evil beasts, slow bellies."

EPIMETHEUS (ep-i-mē'thūs), in Greek mythology, the son of Iapetus, brother of Prometheus, and husband of Pandora. Epimetheus may be translated 'afterthought,' as Prometheus 'forethought.'

ÉPINAL, a town of Eastern France, capital of the department of the Vosges, on the Moselle. It is well built and has handsome quays, an ancient Gothic church, a communal college, a public library of 30,000 volumes, a museum, and extensive fortifications. The town was occupied by the Germans in the Franco-Prussian War of 1870, and since that time a modern fortress has been constructed. The manufactures consist of articles in metal, cottons, linens, woollens, earthenware, and leather. The famous paper-mills of Archettes are in the vicinity. Pop. 27,350.

ÉPINAY, Louise Florence Petronille, Madame d', French authoress, born in 1726, died 1783. She became the wife of M. Delalive d'Épinay, who was collector-general of taxes. In 1748 she became acquainted with Rousseau, and gave him a cottage in which he passed many of his days. She was the author of *Les Conversations d'Emilie*, a companion-volume to Rousseau's *Emile*; *Lettres à mon Fils*; and *Mes Moments heureux*. She left interesting memoirs and correspondence.

EPIPHA'NIUS, St., was born in Palestine about 310, died 403. About 367 he was consecrated Bishop of Salamis or Constantia, in Cyprus. A zealous denouncer of heresy, he combated the opinions of Arius and Origen. His work *Panarion* gives the history, together with the refutation, of a great number of heresies. His festival is on the 12th of May.

EPIPH'ANY (Gr. *epiphaneia*, a manifestation or showing forth), a festival, otherwise called the *Manifestation of Christ to the Gentiles*, observed on the 6th of January in honour of the adoration of our Saviour by the three Magi, or wise men, who came to adore him and bring him presents, led by the star. As a separate festival it dates from 813.

EP'IPHYTE (Gr. *epi*, on, *phyton*, a plant), a plant which grows and flourishes on the trunks and branches of trees, adhering to the bark, as a moss, lichen, fern, &c., but which does not, like a parasite, derive any nourishment from the plant on which it grows. Most orchids are epiphytes, and so are many Bromeliaceæ and Cactaceæ. Epiphytic Angiosperms are characteristic of humid tropical regions. Depending as they do entirely on atmospheric moisture, they show many curious adaptations, and are nearly always more or less xerophytic in structure.

EPI'RUS (Gr. *Epeiros*), a country of ancient Greece corresponding to Southern Albania and the north-western division of modern Greece. The most interesting locality in it was Dodona. The inhabitants were only in part Greeks. The Molossians at last acquired the ascendancy, and the kings of this tribe took the name of kings of Epirus. The most celebrated King of Epirus was Pyrrhus, who made war upon the Romans. Epirus became a Roman province in 168 B.C., and shared the fortunes of Rome till it was conquered by the Turks.

In Nov., 1914, Greece, with the consent of the Great Powers, occupied North Epirus, and formally took possession of it in March, 1916. By the end of 1920, however, the occupation had not yet been recognized. Epirus is also the name of an administrative province of Greece, formed after the Balkan campaigns (1912–3) out of the territory acquired by the country. The population is about 312,634.

EPISCOPACY. Form of church government of which bishops are the head. It grew up in the 2nd century and has since been the rule in the Roman Catholic Church, which claims for its bishops an unbroken descent from those times. The Anglican and Greek Churches are both episcopal and both regard the "historic episcopate" as essential to their life and work. Bishops can only be ordained by other bishops and in this way the apostolic succession, as it is called, is maintained. Episcopacy also prevails in the Lutheran, Moravian and Methodist Episcopal churches. *See* BISHOP.

EPISTEMOL'OGY (Gr. *epistēmē*, knowledge), that department of metaphysics which investigates and explains the doctrine or theory of knowing. It deals with the validity of knowledge rather than with the analysis of the knowing mind, and is thus distinguished from *psychology*. It is also distinguished from *ontology*, which investigates real existence or the theory of being.

EPISTLE. Writing or letter. It is applied especially to the letters included in the New Testament, sent by S. Paul, S. Peter and other apostles to churches and individuals. Such are the epistles to the Corinthians and to Timothy. Other epistles were those written by Horace and later poets, a fashion copied by English writers in the 18th century.

EPIS'TOLÆ OBSCURO'RUM VIRO'RUM (*Letters of Obscure Men*), the title of a collection of satirical letters which appeared in Germany in 1515, and professed to be the composition of certain ecclesiastics and professors in Cologne and other places. It is considered as one of the most masterly pieces of sarcasm in the history of literature, and its importance is enhanced by the effect it had in promoting the cause of the Reformation. The authorship of this satire has been a fertile subject of controversy, and is yet apparently far from being settled. It was ascribed to Reuchlin, and afterwards to Reuchlin, Erasmus, and Hutten. By a Papal bull the work was placed on the Index of forbidden books.

EP'ITAPH (Gr. *epi*, upon, and *taphos*, tomb), an inscription upon a tomb or monument in honour or memory of the dead. Epitaphs were in use both among the Greeks and Romans. The Greeks distinguished by epitaphs only their illustrious men. Among the Romans they became a family institution, and private names were regularly recorded upon tombstones. The same practice has generally prevailed in Christian countries. On Christian tombstones epitaphs usually give brief facts of the deceased's life, sometimes also the pious hopes of survivors in reference to the resurrection or other doctrines of the Christian faith, &c.,

Many so-called epitaphs are mere witty *jeux d'esprit*, which might be described as epigrams, and which were never intended seriously for monumental inscriptions. Dr. Johnson and William Wordsworth wrote essays on epitaphs. Cf. Andrews, *Curious Epitaphs*.

EPITHALAMIUM (Gr. *epi*, on, and *thalamos*, a chamber), a nuptial song or poem in praise of a bride and bridegroom. Among the Greeks and Romans it was sung by young men and maids at the door of the bridal chamber of a newly-married couple. Epithalamia have been written by Spenser, Ben Jonson, and Donne.

EPITHE'LIUM, in anatomy, the cellular layer which lines the internal cavities and canals of the body, both closed and open, as the mouth, nose, respiratory organs, blood-vessels, &c., and which is analogous to the cuticle of the outer surface. There are several varieties of epithelium. The epithelium lining the blood-vessels is called sometimes *endothelium*.

EPIZO'A, a term applied to those parasitic animals which live upon the bodies of other animals, as lice, the itch-mite, &c.

EPIZOÖT'IC, or **EPIZOÖTIC DISEASE,** a disease that at some particular time and place attacks great numbers of the lower animals just as an epidemic attacks man. Pleuro-pneumonia is often an epizoötic, as is also the rinderpest.

EPOCH, or **ERA,** is a fixed point of time, commonly selected on account of some remarkable event by which it has been distinguished, and which is made the beginning or determining point of a particular year from which all other years, whether preceding or ensuing, are computed.

The creation and the birth of Christ are the most important of the historical epochs. The creation has formed the foundation of various chronologies, the chief of which are: (1) The epoch adopted by Bossuet, Ussher, and other Catholic and Protestant divines,

which places the creation in 4004 B.C. (2) The *Era of Constantinople* (adopted by Russia), which places it in 5508 B.C. (3) The *Era of Antioch*, used till A.D. 284, placed the creation 5502 B.C. (4) The *Era of Alexandria*, which made the creation 5492 B.C. This is also the *Abyssinian Era*. (5) The *Jewish Era*, which places the creation in 3760 B.C.

The Greeks computed their time by periods of four years, called *Olympiads*, from the occurrence every fourth year of the Olympic games. The first Olympiad, being the year in which Corœbus was victor in the Olympic games, was in the year 776 B.C. The Romans dated from the supposed era of the foundation of their city (Ab Urbe Condita, A.U.C.), the 21st of April, in the third year of the sixth Olympiad, or 753 B.C. (according to some authorities, 752 B.C.).

The *Christian Era*, or mode of computing from the birth of Christ as a starting-point, was first introduced in the sixth century, and was generally adopted by the year 1000. This event is believed to have taken place earlier, perhaps by four years, than the received date. The Julian epoch, based on the coincidence of the solar, lunar, and indictional periods, is fixed at 4713 B.C., and is the only epoch established on an astronomical basis. The *Mohammedan Era*, or *Hejra*, commences on 16th July, 622, and the years are computed by lunar months. The Chinese reckon their time by cycles of 60 years. Instead of numbering them as we do, they give a different name to every year in the cycle.

EPONYM. Person after whom anything is named. In Greece it was the unofficial title of magistrates after whom the year was named and of the heroes who gave their names to a tribe or people. Thus, Pelops was the eponym of the Peloponnese.

EPPING, a village of England, in Essex (giving name to a parliamentary division), 16½ miles from London, in the midst of an ancient royal forest which one time covered nearly the whole of Essex. *See* EPPING FOREST. Pop. (1931), 4,956.

EPPING FOREST. District of Essex. It occupies about 6,000 acres between the Rivers Lea and Roding, with Leytonstone, Epping, Chingford, Woodford and Loughton on its borders. Acquired by the corporation of the city of London and opened in 1882 it is a popular pleasure resort. It is wooded and contains two ancient camps, Ambresbury and Loughton. In 1928 Knighton Wood, 37 acres, was added.

EPSOM, a town in the county of Surrey, England, 14¼ miles S.W. of London, formerly celebrated for a mineral spring, from the water of which the well-known Epsom salts were manufactured. The principal attraction Epsom can now boast of is the grand race-meeting held on the Downs, the chief races being the Derby and Oaks. Epsom gives name to one of the seven parliamentary divisions of the county. Pop. (1931), 27,089.

EPSOM SALTS, sulphate of magnesium ($MgSo_4\ 7H_2O$), a cathartic salt which appears in capillary fibres or acicular crystals. It is found covering crevices of rocks, in mineral springs, &c.; but is commonly prepared by artificial processes from magnesian limestone by treating it with sulphuric acid, or by dissolving the mineral *kieserite* ($MgSO_4H_2O$) in boiling water, allowing the insoluble matter to settle, and crystallizing out the Epsom salts from the clear solution. It is employed in medicine as a purgative, and in the arts. The name is derived from its having been first procured from the mineral waters at Epsom.

EPSTEIN, Jacob. British sculptor. Of Russo-Polish parentage, he was born in New York, Nov. 10, 1880, and studied art in New York and Paris, where he came under the influence of Rodin. In 1908 he executed a series of figures on the façade of the British Medical Association building in the Strand, London, a work assailed at the time by much criticism. His figures of Venus, his Rima and Genesis, and the groups entitled Day and Night on the Underground building in Westminster have also provoked lively criticism. His portrait busts are by many considered his best work.

EPWORTH, a small town of N. Lincolnshire, 9 miles N. of Gainsborough, the birth-place of John Wesley, the founder of Methodism. Pop. 1,836.

EQUATION, in algebra, a statement that two expressions have the same numerical value. An equation may be either identical or conditional. An example of an *identical equation*, or *identity*, is $(x + y)(x-y) = x^2-y^2$. The left side here can be transformed into the right side, simply by applying the laws of algebra so as to carry out the operations indicated, without taking account in any way of the numerical values of x and y. An identical equation is, therefore, true for all values of the variables which appear in it.

A *conditional* equation is not true unless certain special values are assigned to the variables. Thus the equation $4x+7=15$ is not true for any value of x except 2. This value 2 is

called a root, or solution, of the equation. An equation may have more than one root, e.g. $x^2+6x=7$ has two roots, 1 and -7; and $2x^3 + 3x^2 = 2x + 3$ has three roots, 1, -1, $-\frac{3}{2}$.

Rational Integral Equations (one Variable). The three equations just given are special cases of the class of rational integral algebraic equations. The general form of these is $ax^n + bx^{n-1} + \ldots + kx + l = 0$, where n is a positive integer, and $a, b, \ldots k, l$ are given numbers. This equation is said to be of degree n. The branch of mathematics called the Theory of Equations is conventionally restricted to equations of this type. The fundamental result in this subject is that every rational integral equation has a root, a theorem which it is by no means easy to prove. It follows without difficulty that an equation of degree n has exactly n roots, real or imaginary. Two or more of the roots, however, may be equal to each other.

To *solve* an equation is to find its roots. The general equation of degree n can always be solved to any degree of approximation desired, when the numerical values of the coefficients $a, b, \ldots$ are assigned. Graphical methods of solution are often the best (*see* GRAPH). When the coefficients $a, b, \ldots$ are arbitrary, the general equation can be solved algebraically if n does not exceed 4, but not for greater values of n. It is not that the algebraical solution, or algebraic formula for the roots, when n is greater than 4, has not been discovered; it does not exist. This was proved more than a hundred years ago by Abel and Galois, two mathematicians of the highest distinction, who both died before they were thirty. For $n = 2$, the roots of the *quadratic* equation $ax^2 + bx + c = 0$ are $\frac{-b \pm \sqrt{(b^2-4ac)}}{2a}$. For $n = 3$, the *cubic* equation $ax^3 + bx^2 + cx + d = 0$ is reduced to the form $z^3 + pz + q = 0$ by putting $x = z - \frac{b}{3a}$; the solution of $z^3 + pz + q = 0$ can be verified to be $z = u - \frac{p}{3u}$, where u is any one of the three cube roots of the quantity $-\frac{1}{2}q + \sqrt{(\frac{1}{4}q^2 + \frac{1}{27}p^3)}$. For $n = 4$, the *biquadratic* equation is solved with the help of the solution of the cubic.

The cubic was first solved by the Italian mathematician Tartaglia, who communicated the solution to Cardan, after binding him to keep it a secret. Cardan, however, gave the solution in his *Algebra*, published at Nürnberg in 1545.

Equations with more than one Variable. A solution of an equation which contains more than one variable is a set of values of the variables making the equation true. Thus the equation $x^2 - y^2 = 9$ has solutions $(x = 5, y = 4)$, $(x = 3, y = 0)$, $(x = 5, y = -4)$, and an unlimited number of others. When several variables occur, there are usually also several *simultaneous* equations connecting them; a solution of these is a set of values of the variables making *all* the equations true.

When the number of equation s is equal to the number of variables, there is in general a limited number of solutions of the system. Thus, e.g. the system of equations $x^2 - y^2 = 9$, $2x - y = 6$ has two solutions $(x = 3, y = 0)$ and $(x = 5, y = 4)$, and no others. A useful rule is that the number of solutions of a system of this type is equal to the product of the degrees of the equations. Exceptions may arise when two solutions coalesce, or when infinite values of the variables occur.

Equations are of great importance in applied mathematics. The data of a problem generally lead to an equation, or a set of equ'tions, among the quantities concerned. In practice a certain number of these quantities are known in any given case; the unknown quantities are then found by the solution of an equation or equations. Non-algebraic equations occur frequently—equations involving trigonometrical functions, for example. For a modern practical method of solving equations of many types, *see* NOMOGRAPHY.—BIBLIOGRAPHY: A. E. Layng, *Elementary Algebra*; C. Smith, *Algebra*. More advanced works are: G. Chrystal, *Algebra*; W. S. Burnside and A. W. Panton, *Theory of Equations*.

EQUATION, PERSONAL, the accustomed error, almost a constant quantity in the case of a practised observer, in timing a celestial phenomenon.

EQUATION OF PAYMENTS, an arithmetical rule for the purpose of ascertaining at what time it is equitable that a person should make payment of a whole debt which is due in different parts, payable at different times.

EQUATION OF THE CENTRE, the difference between the actual heliocentric longitude of a planet revolving in an elliptic orbit and that which it would have at the same instant if it revolved in a circular orbit. It is zero at perihelion and aphelion.

EQUATION OF TIME, the difference between mean and apparent time, or the difference of time as given by a clock and as given by a sun-dial, arising chiefly from the varying velocity of the earth in its orbit and

the eccentricity of the orbit. The sun and the clock agree four times in the year; the greatest difference between them at the beginning of November is fully sixteen minutes. *See* DAY.

EQUA'TOR, that great circle of our globe every point of which is 90° from the poles. All places which are on it have invariably equal days and nights. Our earth is divided by it into the northern and southern hemispheres. From this circle is reckoned the latitude of places both north and south.

There is also a corresponding celestial equator in the plane of the terrestrial, an imaginary great circle in the heavens the plane of which is perpendicular to the axis of the earth. It is everywhere 90° distant from the celestial poles, which coincide with the extremities of the earth's axis, supposed to be produced to meet the heavens. During his apparent yearly course the sun is twice in the celestial, that is, vertically over the terrestrial equator, on 21st March and 23rd September. Then the day and night are equal all over the earth, whence the name *equinox*.

The **magnetic equator** is a line at every point of which the vertical component of the earth's magnetic force is zero; that is to say, a dipping needle carried along the magnetic equator remains horizontal. It is hence also called the *aclinic line*. It has a slightly devious course, but upon the whole keeps fairly near the geographical equator.

EQUATO'RIAL, an astronomical instrument contrived for the purpose of directing a telescope upon any celestial object, and of keeping the object in view for any length of time, notwithstanding the diurnal motion of the earth. For these purposes a principal axis resting on firm supports is mounted exactly parallel to the axis of the earth's rotation, and consequently pointing to the poles of the heavens, being fixed so as to turn on pivots at its extremities. To this there is attached a telescope moving on an axis of its own in such a way that it may either be exactly parallel to the other axis, or at any angle to it; when at right angles it points to the celestial equator. The two axis carry graduated circles, with the help of which, even during the day, the telescope can be pointed to any star whose declination and right ascension are known. By means of clockwork the instrument is given such a motion round its principal axis that the star is kept stationary in the field of view.

EQ'UERRY, in Britain, the name of certain officers of the royal household, in the department of the Master of the Horse, whose duties consist in attendance when the sovereign rides abroad. Equerries also form part of the establishments of the members of the royal family.

EQUESTRIAN ORDER, the order of 'Knights' in ancient Rome. The *equites* or knights originally formed the cavalry of the army. They are said by Livy to have been instituted by Romulus, who selected 300 of them from the three principal tribes. About the time of the Gracchi (123 B.C.) the equites became a distinct order in the state, and the judges and the farmers of the revenue were selected from their ranks. They held their position in virtue of a certain property qualification, and towards the end of the Republic they possessed much influence in the state. They had particular seats assigned to them in the circus and theatre, and the insignia of their rank, in addition to a horse, were a gold ring and a robe with a narrow purple border (the *clavus angustus*). Under the later emperors the order grew less influential, and finally disappeared.

EQ'UIDÆ, the horse family, a division of the odd-toed (perissodactyle) Ungulates or hoofed mammals. There is but one existing genus, Equus, distinguished by the possession of a mane; hard pads (callosities) on the inner side of each fore-limb (and sometimes of the hind-limb); a single functional digit (the third or middle one) terminating in a large curved hoof; a simple stomach; 44 teeth, including 12 incisors with pitted crowns, 4 canines (tushes) reduced in the female, and 28 grinding teeth with broad crowns, except the first (wolf tooth), which is rudimentary.

The forms included are horses, asses, and zebras; the first being distinguished from the others by the presence of callosities ('chestnuts') on the hind-limbs as well as the fore. The domesticated horse (*E. caballus*) has a large flat tail abundantly hair-clad, and is not known with certainty in the wild state, though possibly the tarpan of South Russia (Tartary) may represent the original stock. Another candidate for this honour is the small wild species (*E. przewalskii*) native to the deserts of Central Asia. The domestic ass (*E. asinus*) is related to a number of wild species, such as the onager (*E. onager*) of South Asia, the kiang (*E. hemionus*) of Tibet, and two African species (*E. africanus* and *E. somalicus*). The striped zebras are purely African, and four species are generally recognized—the common or mountain zebra (*E. zebra*), Burchell's

zebra (*E. burchelli*), Grevy's zebra (*E. grevyi*), and the quagga (*E. quagga*).

The geological record enables us to derive horses from a small plantigrade five-toed form (Phenacodus), by gradual increase in size, complication of teeth, loss of digits, and elongation of limbs, to the unguligrade condition.

EQUILIB'RIUM, in statics, the condition when a body is acted on by two or more forces which balance one another. The body may be either at rest or moving with uniform speed in a straight line. In the first case, when the body, being slightly moved out of any position, always tends to return to its position, that position is said to be one of *stable equilibrium*; when the body, after a slight displacement, tends to move away from its previous position, the body is in *unstable equilibrium*. If, after displacement, the body tends to remain at rest, its state is one of *neutral equilibrium*.

EQUINOC'TIAL, in astronomy, the circle in the heavens otherwise known as the celestial equator. When the sun is on the equator, there is equal length of day and night over all the earth: hence the name *equinoctial*.

Equinoctial gales, storms which have been supposed to take place about the time of the sun's crossing the equator, that is, at the vernal and autumnal equinoxes, in March and September.

Equinoctial points are the two points wherein the celestial equator and ecliptic intersect each other; the one, the first point of Aries, is called the *vernal* point; and the other, in Libra, the *autumnal* point. These points move backward or westward at the rate of 50″ of arc in a year. This is called the precession of the equinoxes.

EQ'UINOX, one of the equinoctial points. The term is also applied to the dates at which the sun passes through them, viz. 21st March and 23rd September, when day and night are of equal length all over the world. *See* DAY; EARTH; EQUINOCTIAL; SEASONS.

EQUISETALES, a group of Pteridophytes, represented at the present day only by the genus Equisetum (q.v.). It was much more prominent in the Carboniferous flora, in which large woody horse-tails (Calamites) played an important part.

EQUISE'TUM, a genus of vascular cryptogamous plants with hollow jointed stems, type of the group Equisetales, growing in wet places, and popularly called *horse-tails*.

EQUITATION. Horsemanship, especially for military purposes. The British army has a school of equitation at Weedon and there is one for the Indian army at Saugor.

EQUITES (Lat. horsemen). Name of a class in Roman society ranking between the senators and the commoners. Originally applied to those wealthy enough to serve as horse soldiers, the term became, on the development of the paid army, somewhat synonymous with knights.

EQ'UITY (Lat. *aequus*, fair, equal), in English law, the system of supplemental law administered in certain courts, founded upon defined rules, recorded precedents, and established principles, the judges, however, liberally expounding and developing them to meet new exigencies. While it aims at assisting the defects of the common law, by extending relief to those rights of property which the strict law does not recognize, and by giving more ample and distributive redress than the ordinary tribunals afford, equity by no means either controls, mitigates, or supersedes the common law, but rather guides itself by its analogies, and does not assume any power to subvert its doctrines.

The Court of Chancery was formerly in England the especial court of equity, but large powers were by the Judicature Act of 1873 given to all the divisions of the Supreme Court to administer equity, although many matters of equitable jurisdiction are still left to the chancery division in the first instance.—BIBLIOGRAPHY: F. T. White and O. O. Tudor, *Leading Cases in Equity*; C. Thwaites, *Student's Guide to Equity*.

EQUITY OF REDEMPTION, in law, the advantage allowed to a mortgager of a reasonable time to redeem an estate mortgaged, when it is of greater value than the sum for which it is mortgaged.

EQUIV'ALENT, in chemistry, the number of parts by weight of an element which will combine with or displace 8 parts by weight of oxygen or 1·008 parts by weight of hydrogen.

ERA. Epoch from which years are counted and the series so reckoned. An historical event usually determines the choice, *e.g.* the Greek Olympiads, from 776 B.C., the Roman, from Rome's foundation, 753 B.C., the Hindu Saka, from A.D. 78, the Mohammedan, from A.D. 622 and the Christian from Christ's nativity. The pre-Christian is reckoned backwards. *See also* EPOCH.

ERANTHIS. *See* WINTER ACONITE.

ÉRARD, Sébastien, a celebrated musical-instrument maker, born at Strasbourg in 1752, died 1831. He

went to Paris at the age of eighteen, and in concert with his brother, Jean Baptiste, produced pianofortes superior to any that had previously been made in France. He afterwards established a manufactory in London, and made considerable improvements in the mechanism of the harp.

ERASIS'TRATUS, an ancient Greek physician and anatomist, said to have been a grandson of Aristotle. He lived in the third century before the Christian era, and was court physician of Seleucus Nicator, King of Syria. He was the first who systematically dissected the human body, and his description of the brain and nerves is much more exact than any given by his predecessors. He classified the nerves into nerves of sensation and of locomotion, and, it is said, almost stumbled upon the discovery of the



Desiderius Erasmus

circulation of the blood. Of his works only the titles and some fragments remain.

ERAS'MUS, Desiderius, a Dutch scholar, one of the greatest of the Renaissance and Reformation period, born at Rotterdam in 1467, died in 1536. His original name was Gerard, but this he changed according to a fashion of the time. After the death of his parents, whom he lost in his fourteenth year, his guardians compelled him to enter a monastery; and at the age of seventeen he assumed the monastic habit. The Bishop of Cambrai delivered him from this constraint. In 1492 he travelled to Paris to perfect himself in theology and literature. He became the instructor of several rich Englishmen (from one of whom—Lord Mountjoy—he received a pension for life), and accompanied them to England in 1497, where he was graciously received by the king.

Returning soon after to the Continent, he took his doctor's degree, was relieved from his monastic vows by dispensation from the Pope, and published several of his works. In 1510 he returned to England, wrote his *Praise of Folly* while residing with Sir Thomas More, and was appointed Lady Margaret professor of divinity and Greek lecturer at Cambridge. In 1514 he returned to the Continent and lived chiefly at Basel, where he died.

To extensive learning Erasmus joined a refined taste and a delicate wit, and rendered great and lasting service to the cause of reviving scholarship. Although Erasmus took no direct part in the Reformation, and was reproached by Luther for lukewarmness, he attacked the disorders of monasticism and superstition, and everywhere promoted the cause of truth. A humanist rather than a reformer or a theologian, he waged war upon ignorance and superstition.

He edited various classics, the first edition of the Greek Testament from MSS. (with Latin translation), &c., but his best-known books are the *Encomium Moriæ* (Praise of Folly) and his *Colloquies*. His letters are very valuable in reference to the history of that period.—BIBLIOGRAPHY: S. Knight, *Life of Erasmus*; C. Butler, *Life of Erasmus*; E. F. H. Capey, *Life of Erasmus*; P. S. Allen, *The Age of Erasmus*.

ERAS'TUS (Gr. *erastos*, beloved, translation of Ger. *Lieber*), the learned name of Thomas Lieber, a Swiss physician, who maintained the opinions from which the well-known epithet of *Erastian*, as now used, is derived. He was born at Baden in 1523, and died at Basel 1584. He was successively professor of medicine at Heidelberg, and of ethics at Basel. In his writings he maintained the complete subordination of the ecclesiastical to the secular power; and denied to the Church the right to exclude any one from Church ordinances, or to inflict excommunication.

ER'ATO, in Greek mythology, one of the nine Muses, whose name signifies loving or lovely. She presided over lyric and especially amatory poetry, and is generally represented crowned with roses and myrtle, and with the lyre in the left hand and the plectrum in the right in the act of playing.

ERATOS'THENES, an ancient Greek astronomer, born at Cyrene, in Africa, 276 B.C., died about 194 B.C. He was librarian at Alexandria, and gained his greatest renown by his investigations of the size of the earth. He rendered much service to the

science of astronomy, and first observed the obliquity of the ecliptic. Of the writings attributed to him one only remains complete—*Katasterismoi*—which treats of the constellations.

ER'BIUM, a rare metal found along with yttrium, terbium, and other rare elements in some rare minerals. Its properties are but little known. It was discovered by Mosander in 1843.

ERCILLA Y ZUNIGA (er-thil'yà ē thō-nyē'gà), **Don Alonso de,** Spanish soldier and poet, born 1533, died 1595. He became page to the Infant Don Philip, accompanied him on his travels, and in 1554 went with him to England, on the occasion of his marriage with Queen Mary. After this he fought against the Araucanians of South America (Chile), and his epic *La Araucana* is based on the events of this war. It is written in excellent Spanish, and occupies an honourable position in the national literature. The first fifteen cantos were published in 1569, and the continuations, thirty-seven cantos, appeared in 1578 and 1589.

ERCKMANN-CHATRIAN (shât-riăn), the joint name of two French-Alsatian writers of fiction. Émile Erckmann, born at Pfalzburg 1822, studied law at Paris, and died in 1899. Alexandre Chatrian, born near Pfalzburg in 1826, died in 1890, was for some time teacher in the Pfalzburg College. They formed a literary partnership in 1847, but it was not till the appearance of *L'Illustre Docteur Mathéus* in 1859 that success attended them. Among their most popular books are: *L'Ami Fritz, Madame Thérèse, Histoire d'un Conscrit de* 1813, *L'Histoire d'un Paysan,* and *Waterloo,* most of which have been translated into English. Their drama *Le Juif Polonais* was made famous by Sir Henry Irving under the name of *The Bells.*

ERCOLE DA FERRARA. Name taken by the Italian painter, Ercole di Giulio Grandi. Born about 1462 he lived chiefly at Ferrara, where he was employed by the duke. Two of his pictures, "The Madonna and Child" and "The Conversion of S. Paul," are in the National Gallery, London. He died in 1531.

ERDMANN, Johann Eduard, German philosopher, born 1805, died 1892. He studied theology at Dorpat and Berlin; in 1829 became a clergyman, but in 1832 returned to Berlin and took his degree in philosophy. In 1836 he became professor extraordinary of philosophy at Halle, being appointed ordinary professor in 1839. He wrote numerous philosophical works, mostly characterized by Hegelian tendencies, including: *Body and Soul, Nature and Creation, Outlines of Psychology, Outlines of Logic and Metaphysics, Psychological Letters,* and *Belief and Knowledge.* His greatest work is his *Outlines of the History of Philosophy,* which has been translated into English (3 vols., 1889).

ER'EBUS, in Greek mythology, the son of Chaos and Darkness, and father of Æther and Hemera (day). The name Erebus was also given to the infernal regions.

ER'EBUS, MOUNT, a volcano of the antarctic regions in S. Victoria Land; height, 12,500 feet; discovered by Ross, 1841.

ERECHTHEUS (e-rek'thūs), in Greek mythology, a mythical king of Athens to whom a fine temple, the *Erechthēum,* was built on the Acropolis. In some representations of him he is depicted as half snake, so that he was one of the autochthones, the earth-born ancestors of the Athenians.

ERECTION, LORDS OF, in Scots history, those private owners into whose hands the ecclesiastical estates belonging to the clergy had passed during the religious changes of the Reformation period.

ERETRIA. City of Greece. Situated on the west coast, 15 m. S.E. of Chalcis, its stubborn resistance to the Persian advance occasioned its destruction in 490 B.C. Its importance declined under Macedonian and Roman rule. American excavations at the foot of the acropolis, 1890—95 exposed remains of theatre, temple, and gymnasium.

ER'FURT (Lat. *Erfordia,* 'ford of Erpe, its legendary founder), an important town in the Prussian province of Saxony, on the River Gera, formerly a fortress with two citadels, now given up as such. It has a fine cathedral dating from the thirteenth century and several handsome Gothic churches. The university, founded in 1378 and suppressed in 1816, was long an important institution. There is still an academy of science and a library with 60,000 volumes. The monastery (now an orphanage) was the residence of Luther from 1501 to 1508. Erfurt is a busy industrial town and is in a very flourishing condition. The industries are varied, including clothing, machinery, leather, shoes, ironmongery, and chemicals. Flower-growing is extensively carried on in the neighbourhood, plants and seed being produced for sale in great quantities. Pop. (1926), 135,579.

ERG, in physics, unit of energy or work done. It is the quantity of work done by a force of one dyne moving

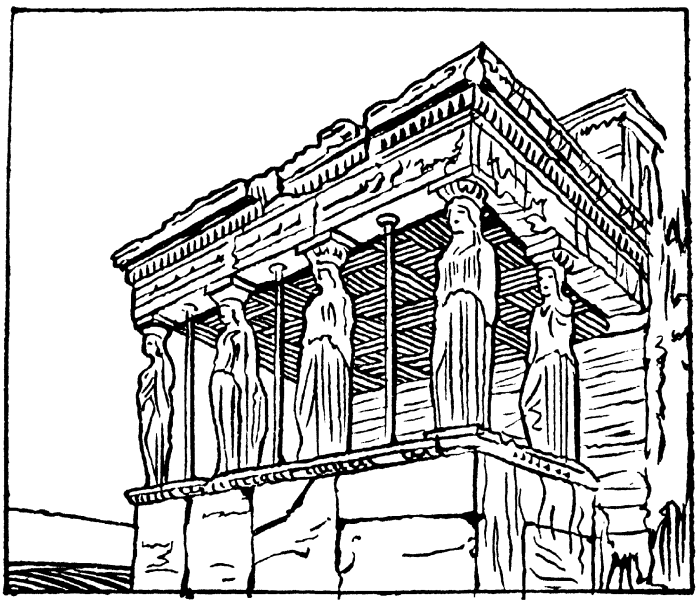
through a distance of one centimetre. Power is expressed in ergs per second.

ERGOSTEROL, unsaponifiable part of a natural fat, sterol (q.v.). Named from its discovery in ergot of rye, ergosterol is found also in yeast. It is present in minute proportion as an impurity of cholesterol found in all animal cells. When irradiated by sunlight, ergosterol in superficial tissue cells (skin, etc.) yields up the anti-rachitic vitamin D essential to health. Ergosterol in solution, irradiated by ultra-violet rays, is used to supply natural bodily deficiency in this vitamin, and is included in the 6th edition of the *British Pharmacopoeia.*

ER'GOT, the altered grain of rye and other grasses caused by the attack of an ascomycetous fungus called *Claviceps purpurea.* The grain is replaced by a dense fungoid tissue (sclerotium) largely charged with an oily fluid. In its perfect state this germinates and produces the Claviceps fructification. When diseased rye of this kind is eaten in food for some time, it sometimes causes death by a kind of mortification called dry gangrene. Ergot is used in obstetric practice to promote the contraction of the uterus.

ERICA (e-rī'ka), the heaths, a large genus of branched rigid shrubs, type of the nat. ord. Ericaceæ, most of which are natives of South Africa, a few being found in Europe and Asia. The leaves are narrow and rigid; the flowers are globose or tubular, and four-lobed. Five species are found in Britain.

ERICACEÆ, a nat. ord. of gamopetalous Dicotyledons. Representative genera: Calluna, Erica, Rhododendron.



Portion of the Erectheum (showing Caryatides)

ERICHSEN (er'ik-sen), **Sir John Eric,** surgeon, born 1818, died in 1896. He was the son of a Copenhagen merchant, but spent nearly all his life in England. He studied at University College, London, became a member of the Royal College of Surgeons in 1839, a fellow in 1845, and in 1850 professor of surgery and hospital surgeon at University College. In 1865 he succeeded Quain as professor of clinical surgery in the same college, but retired in 1875. Appointed president of University College in 1887, he also held that post till his death. He was chief surgeon extra-

ordinary to Queen Victoria, and in 1895 was made a baronet.

His most important work was his *Science and Art of Surgery* (1853), which has gone through many editions, and has been translated into several languages. He also published a volume on *Concussion of the Spine* (1875).

ERICHT, loch of Scotland. It is on the borders of the counties of Perth and Inverness and is 14¼ miles long. The River Ericht, which flows from it to Loch Rannoch, 5¼ miles away, is used to generate power for the national scheme for providing electricity. It has been widened and deepened and a dam has been built across it.

ER'ICSSON, John, engineer, born in Sweden 1803, died in 1889. He served for a time in the Swedish army; removed to London in 1826, and to New York in 1839. He is identified with numerous inventions and improvements in steam machinery and its applications. His chief inventions are his caloric engine, the screw propeller (1836), which has revolutionized navigation, and his turret-ships, the first of which, the *Monitor*, distinguished itself in the American Civil War, and inaugurated a new era in naval warfare. He afterwards devoted himself to studies of the earth's motion and the intensity of solar heat.

ERIDANUS (Eridā'-nus), the River Eridanus (modern Po), one of the constellations of the ancient astronomy, in which Ptolemy catalogued thirty-four stars. Appropriately to its name, it covers a large expanse of the heavens, its northern portion, just to south-west of Orion, reaching the celestial equator. The part visible in our latitudes does not contain bright stars, but at the southern extremity is the first magnitude Achernar, a conspicuous object to southern observers.

ERIDGE, village of Sussex. It is 3 miles from Tunbridge Wells and 38 from London, on the S. Rly. Eridge Castle, the seat of the Marquess of Abergavenny, is a modern building standing in a large park.

ERIE (ē'ri), one of the great chain of North American lakes, between Lakes Huron and Ontario, about 240 miles long, 57 miles broad at its centre, from 40 to 60 fathoms deep at the deepest part; area, 9,910 sq. miles. The whole of its southern shore is within the territory of the United States, and its northern within that of Canada. It receives the waters of the upper lakes by Detroit River at its south-western extremity, and discharges its waters into Lake Ontario by the Niagara River at its north-east end. The Welland Canal enables vessels to pass from it to Lake Ontario. It is shallow compared with the other lakes of the series, and is subject to violent storms. The principal harbours are those on the United States side—Buffalo, Erie, and Cleveland.

ERIE, a city, Pennsylvania, United States, an important railway and commercial centre on the southern shore of Lake Erie. There are numerous ironworks (including foundries, rolling-mills, and blast-furnaces), petroleum refineries, breweries, tanneries, and wood-working factories. The harbour is one of the best on the lake. Pop. (1930), 115,967.

ERIE CANAL, the largest in the United States, serving to connect the great lakes with the sea. It begins at Buffalo on Lake Erie, and extends to the Hudson at Albany. It is 340 miles long; has in all 72 locks; a surface width 70 feet, bottom width 42 feet, and depth 9 feet. It is carried over several large streams on stone aqueducts; cost nearly £2,000,000, and was opened in 1825. The navigation is free.

ERIGENA (e-rij e-na), **Joannes Scotus** (*Scotus*, Scot, and *Erigena*, Irish-born), an eminent mediæval scholar and metaphysician, probably born of Scotch parentage in Ireland about 800–810, died in France about 875. He spent a great part of his life at the court of Charles the Bald of France, and was placed at the head of the school of the palace. The king further imposed upon him the double task of translating into Latin the Greek works of the pseudo Dionysius the Areopagite, and of composing a treatise against Godeschalc on *Predestination and Freewill*.

This treatise, and another, *De Divisione Naturæ*, contained many views in opposition to the teachings of the Church. They were condemned by the Councils of Valencia in 855 and of Langres in 859, and Pope Nicholas I demanded the immediate disgrace of the culprit. His subsequent history is not known.—Cf. Gardner, *Studies in John the Scot*.

ERIN, name for Ireland. Its origin is uncertain but its general use dates from the time of Thomas Moore's poems. It occurs in the phrase Erin go bragh, or Erin for ever.

ERIN'NA, a Greek poetess who lived about 600 B.C. She is said to have been an intimate friend of Sappho, and died at the age of eighteen. She acquired a high reputation for poetry, and her chief work was called *Elakatê* (The Distaff), of which nothing has come down to us. An epitaph or two which are still extant are generally regarded as spurious.

ERINUS, variety of starwort,

suitable for the rock garden. It is of low growth and bears purplish blue or white flowers in early summer. It grows in the Alps and is called erinus alpinus.

ERIODEN'DRON, the wool tree, a genus of plants, nat. ord. Malvaceæ (mallows). There are eight species natives of America, but one belongs to Asia and Africa. The species are noble plants, growing from 50 to 100 feet high, having palmate leaves and red or white flowers. The woolly coat of the seeds of some of the species is used in different countries for stuffing cushions and similar purposes.

ERIS, in Greek mythology, the goddess of discord, the sister of Ares, and, according to Hesiod, daughter of Nyx (night).

ER'ITH, a town of England, in Kent, on the Thames, about 14 miles



Ermines (*Putorius ermineus*)

east of London, a pleasant summer resort. Pop. (1931), 32,780.

ERITRE'A, or **ERYTHRÆ'A** (from Gr. *erythros*, red, referring to the Red Sea), the official name of an Italian colonial possession stretching along the African shore of the Red Sea, and between it and Abyssinia, from the Egyptian coast territory to the French territory of Obok, at the Strait of Bab-el-Mandeb. The coast-line is about 670 miles in length, the area of the colony about 45,754 sq. miles. Pop., largely nomadic, about 510,000. The chief town is Massawa.

ER'IVAN, a fortified city in Armenia, formerly the capital of a Russian government of the same name in Transcaucasia, on the Sanga, north of Mount Ararat. It has a citadel, barracks, a cannon foundry, and some manufactures. Pop. 66,413.

ERIVAN, ARMENIAN REPUBLIC OF (Armenia), is a Transcaucasian Soviet Republic. In 1917 Transcaucasia refused to recognize the Bolsheviks, and in April, 1918, a separate Transcaucasian Republic was formed. This, however, dissolved in May, and Georgia and Armenia declared their independence. The Armenian Republic was recognized by the Allies in January, 1920, and its *de jure* recognition was embodied in the abortive Treaty of Sèvres between the Allies and Turkey in August, 1920.

Armenia was declared a Socialist Soviet Republic in 1921. It is bounded by Georgia, Azerbaijan, Persia, and Asia Minor; area, 11,945 sq. miles. The rest of ancient Armenia is divided between Persia (6520 sq. miles) and Turkey (35,600 sq. miles), and is still claimed by the Armenians. Armenia occupies the uplands between the Iranian Plateau and Asia Minor, and the surface is really a series of plateaus culminating in Mount Ararat (16,920 feet). It is watered by the Euphrates, Tigris, Aras, and Kur.

The climate in the uplands is severe, but the valleys are fertile and produce cereals, cotton, flax, rice, tobacco, and fruit. Sericulture, sheep-breeding, and fruit-growing are capable of great and profitable development. The mineral wealth is enormous: naphtha, sulphur, bitumen, and nitre abound, and in the mountains, gold, silver, copper, and salt are found. Erivan (pop. 66,413) is the capital, and Batum, in Georgia, is a free port to all Transcaucasian states. The population of Armenia in 1931 was 1,032,700. For history, religion, literature, &c., *see* ARMENIA.—BIBLIOGRAPHY: Kevork Aslan, *Armenia and the Armenians*; W. Ll. Williams, *Armenia, Past and Present*; N. Ter Gregor, *History of Armenia*.

ERL-KING, in German mythology an evil forest spirit. He was inimical to children and was gigantic, draped, bearded and crowned with gold. Herder's *Stimmen der Volker*, 1778, in translating *The Elf King's Daughter* confounds *elle* (Danish elf) with *erle* (German alder). The mistake was perpetuated and the Erl-King established as an alder wraith.

ERLANG'EN, a town of Bavaria, 11 miles N.N.W. of Nüremberg. The Protestant university, founded in 1743, is the chief institution. The industries include cotton spinning and weaving, mirrors, hosiery, gloves, and combs. Pop. 29,597.

ERLAU, or **EGER,** a town, Hungary, on the Eger, 65 miles E.N.E. of Budapest. It has sundry manufactures; and the red wines of the district are largely exported. Pop. 30,328.

ER'MINE, the stoat (*Putorius ermineus*), a mammal of the weasel family widely distributed through the northern parts of both hemispheres, with a considerable range to the south. It is not generally known that the ermine and stoat are the same. In winter, in cold countries or severe

seasons, the fur changes from a reddish-brown to a yellowish-white, or almost pure white, under which shade the animal is recognized as the ermine. In both states the tip of the tail is black. Its fur is short, soft, and silky, the best skins being brought from Russia, Sweden, and Norway.

ERMINE STREET, early English name for an ancient British highway leading from London through Lincoln to York and Hadrian's Wall. It was one of four reputedly enjoying royal protection, and coincided in part with the Romano-British road system.

ERNE (ėrn), the name often given to all the eagles of the genus Haliaëtus, but more specifically to the white-tailed sea-eagle.

ERNE, LOUGH (Lo*h* Ern), a lake, Ireland, County Fermanagh, consisting of a north or lower, and a south or upper lake (with the town of Enniskillen between), connected by a narrow winding channel, and properly forming only expansions of the River Erne. Its entire length is about 31 miles; average breadth, 6 miles. It contains numerous small islands, and is well stocked with fish.—The River Erne rises in Lough Gowna, in the county of Longford, flows through Loughs Oughter and Erne, and falls into Donegal Bay below Ballyshannon. Length, 72 miles.

ERNEST, King of Hanover. Fifth son of George III, of Great Britain, he was born at Kew, June 5, 1771, and educated at Göttingen, became an officer in the army of Hanover and saw service against the French. In 1799 he was created Duke of Cumberland and Teviotdale and for over 30 years took part in English politics as an antagonist of reform. In 1837, on the death of William IV, he became King of Hanover and ruled that country until his death, 18th Nov., 1851.

EROS, an asteroid discovered in Aug., 1898. It completes its orbit in 642 days, and has a mean distance from the sun of 135½ million miles, or 6 million less than that of Mars, and was the first to be discovered of the class of minor planets which come within the orbit of Mars. The diameter is supposed to be 20 miles.

EROSION THEORY, in geology, the theory, now held by all geologists, that valleys are, in the great majority of cases, due to the wearing influences of subaerial agents, such as rivers and glaciers, as opposed to the theory which regards them as the result of fissures in the earth's crusts produced by strains during its upheaval.

EROT'IC (from the Gr. *crōs*, love), relating to love.—*Erotic poetry*, amatory poetry.—The name of *erotic* writers has been applied, in Greek literature, particularly to a class of romance writers, and to the writers of the *Milesian Tales*.

ERRAT'ICS or **ERRATIC BLOCKS,** in geology, boulders or large masses of angular rock which have been transported to a distance from their original positions by the action of ice during a glacial period. Thus on the slopes of the Jura Mountains immense blocks of granite are found which have travelled 60 miles from their original situation. Similarly, masses of Scottish and Lake-district granites and of Welsh rocks (some of which weigh several tons) occur not uncommonly in the surface soil of the Midland counties of England.

ERROL, Earl of, Scottish title held by the family of Hay. It was given in 1453 to **William Hay,** constable of Scotland, and has since been held by his descendants. The earl is still lord high constable of Scotland. His estates are in Aberdeenshire. The Earl's eldest son is called Lord Kilmarnock.

Victor Alexander Hay (1876–1928), the 20th earl, was in the diplomatic service. In 1919 he was sent to Berlin as the first British representative there after the war. From 1921–27 he was British high commissioner in the Rhineland, being known as Lord Kilmarnock until he succeeded to the title on his father's death, 8th July, 1927. He died 19th Feb., 1928. **Josslyn Victor Hay,** the 21st earl, was born in 1901.

ERROMAN'GA or **ERROMAN'GO,** one of the more important of the New Hebrides Islands, with an area of about 400 sq. miles, hilly and not very fertile, but with spots well cultivated. Several missionaries have been murdered by the natives—including the missionary John Williams—but perhaps half of the 2,500 natives are now Christians.

ERRORS OF OBSERVATION. In scientific measurements, objects and instruments alike are so constituted that numerical results can only be approximate. We have to find the value of some quantity, not exactly, but to so many significant figures. Even so, when a number of measurements are made of the same quantity, it regularly happens that different values are obtained, the difference between a value as obtained and the true value being called an *error of observation*. It remains to combine the various measurements in such a way as to obtain the best result which they are capable of yielding.

The usual method is to take the arithmetic mean of the values obtained

as the correct value. It is also customary in careful work to state the average deviation of the observed values from the mean. For example, various experimenters found the following numbers for the charge on an electron: 4·67, 4·77, 4·65, 4·79, 4·69. Here the *mean* is 4·71, and the average *deviation* from the mean, taken without regard to algebraic sign, is ·05. The final result is stated as 4·71 + ·05. The ambiguous term + ·05 is sometimes called the probable error. The smaller the probable error, the more reliable is the mean result.

A case of much practical importance occurs when the results obtained by two distinct methods differ by greater amounts than can be accounted for by the uncertainty of either result. In this case there must be a *constant error* present in at least one of the sets of measurements. Recognition of a constant error has occasionally led to an important discovery; for instance, the hint which led to the detection of argon in the atmosphere came from the observed discrepancy in the densities of atmospheric nitrogen and nitrogen from ammonia.

In many measurements what is sought is not the value of a single quantity, but the relation between the values of two variable quantities. In such cases graphical methods are of great service. Corresponding values of the two variables are found and plotted; and a smooth curve, or it may be a straight line, is drawn to lie as evenly as possible among the plotted points. Where great accuracy is wanted, analytical methods are also available. *See* SQUARES, METHOD OF LEAST; PROBABILITY.

ERSCH (ersh), **John Samuel**, German bibliographer, born 1766, died 1828. He was principal librarian and professor of geography and statistics at Halle. Among his publications are: a *Dictionary of French Writers*; a *Manual of German Literature*; and, in connection with Gruber, the *Universal Encyclopædia of Arts and Sciences*.

ERSKINE, Ebenezer, the founder of the Secession Church in Scotland, born 1680, died 1754. He studied at Edinburgh, and was ordained minister of Portmoak, in Fife, in 1703, in which situation he continued for twenty-eight years, when he removed to Stirling. His attitude towards patronage and other abuses in the Church led to his being deposed, when, in conjunction with his brother and others, he founded the Secession Church. Erskine was the leader of the Burghers (q.v.). He is the author of several volumes of sermons.

ERSKINE, The Hon. Henry, Scottish barrister, was the third son of Henry David, tenth Earl of Buchan; born at Edinburgh 1746, died 1817. After studying at the Universities of St. Andrews, Edinburgh, and Glasgow, he adopted the legal profession, and in 1768 was called to the Bar. He twice held the office of Lord-Advocate, was for long the leader of the Scottish Bar, and held a high reputation as a wit.

ERSKINE, John, of Carnock, afterwards of Cardross, Scottish jurist, born 1695, died 1768. He was called to the Scottish Bar in 1719, and was author of *Principles of the Law of Scotland*, and the *Institutes of the Law of Scotland*, both works of authority.

ERSKINE, Ralph, brother of Ebenezer Erskine, born 1685, died 1752. He was ordained to the parish of Dunfermline in 1711, and in 1737 joined his brother, who had seceded from the Established Church. His *Gospel Sonnets* and other religious works were once very popular.

ERSKINE, Thomas Lord Erskine, Scottish lawyer, the youngest son of the tenth Earl of Buchan, was born in 1750, and died in 1823. He was educated partly at the High School of Edinburgh, and partly at the University of St. Andrews. After serving four years in the navy and seven in the army, he commenced the study of law, and in 1778 both took his degree at Cambridge and was called to the Bar. His success was immediate. In May, 1783, he took silk, and the same year was elected member of Parliament for Portsmouth, a seat he held (except from 1784–90, when he had no seat) till 1806, when he was raised to the peerage.

The rights of juries he firmly maintained on all occasions, but particularly in the celebrated trial of the Dean of St. Asaph for libel. In 1789 he defended Stockdale, a bookseller, for publishing what was charged as a libellous pamphlet in favour of Warren Hastings. In 1792, being employed to defend Thomas Paine, when prosecuted for the second part of his work *The Rights of Man*, he declared that, waiving all personal convictions, he deemed it right, as an English advocate, to obey the call: by the maintenance of which principle he lost his office of Attorney-General to the Prince of Wales.

In the trials of Hardy, Tooke, and others for high treason in 1794, which lasted for several weeks, the ability displayed by Erskine was acknowledged by all parties. He was a warm partisan of Fox, and a strenuous opposer of the war with France. In 1802 the Prince of Wales not only restored him to his office of Attorney-

General, but made him Keeper of Seals for the Duchy of Cornwall. On the death of Pitt, in 1806, Erskine was created a peer, and raised to the dignity of Lord Chancellor. During his short tenure of office the Bill for the abolition of slavery was passed. After he retired with the usual pension, he took little part in politics.

ERUPTIVE ROCKS, in geology, those which, as lavas, have broken through other rocks while in a molten state, and become eruptive at the surface.

ERVINE, St. John Greer. Irish writer. Born in Belfast, 28 Dec., 1883, he early began to write plays and made his name as a dramatic critic. Among his plays are: *Jane Clegg*, *Mary, Mary Quite Contrary* and *The Second Mrs. Fraser*. He has also written novels, including *The Foolish Lovers* and *The Wayward Man*, short stories, and a life of Parnell.

ERVUM. *See* LENTIL.

ERYNGIUM, a genus of plants belonging to the nat. ord. Umbelliferæ. There are upwards of 100 species found in temperate and sub-tropical climates, but chiefly in South America. *E. maritimum*, also called sea-holly, is the only truly native British species. It frequents sandy shores, and is distinguished by its rigid, spiny, glaucous, veined leaves, and its dense heads of blue flowers. The roots are sometimes candied, and are reputed to be stimulating and restorative, as well as to have aphrodisiac properties. It is mentioned by Shakespeare, *Merry Wives* v. 5, 23, as an aphrodisiac.

ERYSIP'ELAS, ROSE, or **ST. ANTHONY'S FIRE,** is a contagious disease of the skin due to infection by a germ, the Streptococcus, and accompanied by severe general disturbance. Cold, damp weather favours its appearance. It rarely affects those under fifteen years, and is commoner in women than men.

The disease is characterized by sudden onset, with shivering, headache, vomiting, and occasionally sore throat, followed by the appearance of the typical erysipelatous flush on the skin of the affected part, most usually the face. This part becomes deep red, and is much swollen, with a glossy, tender surface. It is definitely raised, and has a spreading edge merging into the normal parts around. In extreme cases there is marked disfigurement.

Local treatment to allay pain and prevent spreading is by the application of lotions and ointments, and general treatment in the form of stimulating foods is given to maintain strength. Serum treatment has been used, but so far there have been very conflicting results. The disease is not so common nor so fatal as previously.

ERYSIPHA'LES, an important family of ascomycetous Fungi, distinguished by the presence of typical sexual organs and closed ascus-fruits (*cleistocarps*) which bear characteristic appendages concerned with dispersal; also by the fact that each segment of the septate mycelium contains a single nucleus. They are all parasites, appearing on leaves, stems, or fruits as white patches of mycelium ('mildew'). During summer innumerable conidia are produced, which spread the disease rapidly; in autumn the black ascus-fruits develop and carry the fungus through the winter. Erysiphales are responsible for many important plant-diseases, e.g. the mildew of hops (*Sphærotheca Castagnei*), vine (*Uncinula spiralis*), wheat (*Erysiphe communis*), and the American gooseberry mildew (*Sphærotheca Mors-uvæ*), a "notifiable" disease in Britain.

ERYTHE'MA is redness of the skin and in this sense is applied to a number of general conditions which bring about redness of the skin, e.g. abscess, œdema, scarlet fever, &c. Of late, in medicine, its use has been more restricted, and refers only to an inflammation of part of the skin. This disease is characterized by redness and tenderness, and may become sufficiently severe to lead to the production of bullæ in the centre of the affected part. Dermatologists recognize various types of erythema, such as *erythema multiforme*, and *nodosum*.

ERYTHRÆ'AN SEA, in ancient geography, a name given to what is now called the Indian Ocean, but including the Persian and Arabian Gulfs. The name was eventually restricted to the Arabian Gulf.

ERYTHRI'NA. *See* CORAL TREE.

ERYTHROPHLŒ'UM, a genus of tropical trees, nat. ord. Leguminosæ, containing three species, two found in Africa and the third in Australia. The *E. guineense* of Guinea has a poisonous juice, which is used by the natives as a test of innocence and guilt, hence the name "ordeal tree."

ERYX, an ancient city and a mountain in the west of Sicily, about 2 miles from the sea-coast. The mountain, now Monte San Giuliano, rises direct from the plain to a height of 2,184 feet. On the summit anciently stood a celebrated temple of Venus. All traces of the ancient town of Eryx have now disappeared, and its site is occupied by the modern town of San Giuliano.

ERZBERGER, Matthias, German politician, born at Buttenhausen in 1875. Educated at Freiburg, where he studied political economy, he took

an interest in 1897 in the Christian Socialist movement, and entered the Reichstag as a member of the Centre or Catholic party. He became prominent in 1917, when he accused the German Government of misrepresenting the military situation, and urged for a statement of Germany's peace aims. Secretary of State in 1918, he became Minister of Finance in 1919 in Bauer's Cabinet, but was compelled to resign in 1920. He was murdered on 26th Aug., 1921, by two young men of the militarist party.

ERZERUM, ERZEROUM, or **ERZEROOM** (er'ze-rom), a city of Armenia, formerly the capital of a Turkish vilayet with an area of 27,000 sq. miles, and a pop. of 270,426 (1927). The town is about 6,000 feet above sea-level, and forms an important strategical centre. It is irregularly built, its narrow dirty streets, flanked by mean houses, being crowded together in the small space enclosed by its lofty walls. The Moslem element prevails largely over the Christian, although it is the metropolis of the Armenian Church in union with Rome. In addition to important manufactures, especially in copper and iron, it carries on an extensive trade, and is a chief halting-place for Persian pilgrims on their way to Mecca. The town was captured by the Russians in Feb., 1916, and recaptured by the Turks in March, 1918. Pop. 31,457.

ERZGEBIRGE (erts'ge-bir-ge; 'Ore Mountains'), a chain of European mountains forming a natural boundary between Saxony and Bohemia, nearly 120 miles in length and 25 miles broad. The highest summits, which are on the side of Saxony, rise to 4,062 feet. The mountains are rich in silver, iron, copper, lead, cobalt, and arsenic.

ESARHAD'DON (Assyr. *Asur-akhi-iddina*, Asur has given a brother), the son of Sennacherib, and one of the most powerful of all the Assyrian monarchs. He extended the empire on all sides, and is the only Assyrian monarch who actually reigned at Babylon. He died about 667 B.C.

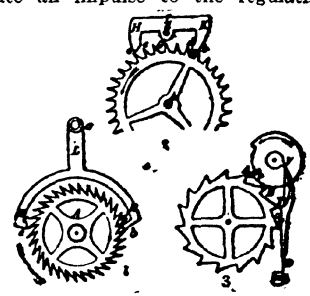
E'SAU, the eldest son of Isaac, and twin-brother of Jacob. His name (which signifies rough, hairy) was due to his singular appearance at birth, being "red, and all over like an hairy garment." The story of his losing the paternal blessing through the craft of Rebekah and Jacob, with other facts, is told in *Genesis* xxvii. He was the progenitor of the Edomites.

ESBJERG, a Danish seaport in South-West Jutland, opposite the Island of Fanö. Pop. 27,405.

ESCALATOR, moving stairway. It has been adopted in many stations on the London tube railways. It is driven by electric power and consists of an endless chain of steps passing round rollers at the top and bottom of the escalator, each step being fixed to a framework having two wheels not set in the same line. It requires less attention and carries more passengers in a given time than the ordinary type of lift.

ESCALLONIA, a genus of saxifragaceous shrubs and trees, natives chiefly of the Andes. *E. rubra* is a handsome evergreen shrub, with shiny, resinous, aromatic leaves, and fine pink flowers; it is hardy in many parts of Britain, and makes an excellent hedge, especially near the sea, where it bears the salt-laden winds without damage.

ESCAPE'MENT, the general contrivance in a timepiece by which the pressure of the wheels (which move always in one direction) and the vibratory motion of the pendulum or balance-wheel are accommodated the one to the other. By this contrivance the wheelwork is made to communicate an impulse to the regulating



1, Dead-beat or repose escapement. The pallets are concentric with the axis *a*, and thus while a tooth is against the pallet the wheel is stationary. 2, Recoil escapement. The pallets are not concentric to axis *a*, and therefore a slight recoil of the wheel takes place after the escape of a tooth (whence the name escapement). When the pallets leave a tooth, the teeth slide along their surfaces, giving an impulse to the pendulum. Lettering for 1 and 2: The anchor H L K is made to oscillate on the axis *a* by the pendulum. The teeth of the escapement-wheel A come alternately against the outer surface of the pallet K and the inner surface of the pallet H. 3, Chronometer escapement. As the balance rotates in the direction of the arrow, the tooth V presses the spring against the lever, thus pressing aside the lever and removing the detent from the tooth of the wheel. As the balance returns, V presses aside and passes the spring without moving the lever, which then rests against the stop E.

power (which in a clock is the pendulum and in a watch the balance-wheel), so as to restore to it the small portion of force which it loses in every vibration, in consequence of friction and the resistance of the air. The leading

requisite of a good escapement is that the impulse communicated to the pendulum or balance-wheel shall be invariable, notwithstanding any irregularity or foulness in the train of wheels. Various kinds of escapements have been contrived, some of which are shown in the accompanying figure. *See* CLOCK; WATCH.

ES'CAR, or ESKER, a geological formation in the superficial drift, generally consisting of a long linear ridge of sand and gravel, sometimes including blocks of considerable size. The materials are derived from the waste of till or boulder-clay, and their arrangement took place probably in water flowing in channels beneath ice-sheets, the escar becoming exposed as the ice finally melted away. In Sweden escars have been formed, season by season, at the mouths of glacier-tunnels as the ice shrank back, the ice-front opening on a lake. *See* KAMES.

ESCARPMENT, term applied to the steep abrupt slope of strata. It is due to the denudation of the softer underlying beds leaving the outstanding hard rock as a cliff-like ridge in one direction, and a gentle dip-slope in the other. One of the commonest forms of land surface, it occurs usually in areas of gently inclined beds. The North and South Downs, the Cotswolds, Snowdon and Scafell show good examples of escarpments.

ESCHATO'LOGY (es-ka-; Gr. *eschatos*, last, and *logia*, account), in theology, the "doctrine respecting the last things," which treats of the millennium, the second advent of Christ, the resurrection, judgment, conflagration of the world, and the final state of the dead.

ESCHEAT, in law, was the term commonly employed to denote a reversion of lands in default of heirs on the death of the owner intestate. Land, if freehold, escheated to the King, or to the mesne lord; if copyhold, to the lord of the manor. In recent times escheat was rare, for persons owning land as a rule made wills, and even if they did not, some person having the right to take the land was usually found. By the Administration of Estates Act, 1925, escheat is abolished. *See* DESCENT.

ESCHENBACH (esh'en-bâh), **Wolfram von**, German mediæval poet or minnesinger, flourished in the first half of the thirteenth century. The most esteemed of his numerous works are: *The Parzival* (printed 1477); *The Titurel*, or *The Guardian of the Graal* (printed 1477), and *The Willehalm*, a poem on the deeds of William of Orange, a contemporary of Charlemagne.

ESCHSCHOLTZIA (esh-sholt'si-a), a small genus of glabrous whitish plants, of the poppy order, natives of California and the neighbouring regions. They have divided leaves, and yellow peduncled flowers. The sepals cohere and fall off as the flower opens in the form of a cap. They are now common in the gardens of Great Britain.

ESCHWEGE (esh'va-ge), a town of Germany, in the Prussian province of Hesse-Nassau, on the Werra, 26 miles E.S.E. of Cassel. Pop. 12,723.

ESCHWEILER (esh'vī-lèr), a town of Prussia, in the province of Rheinland, 8 miles E.N.E. of Aix-la-Chapelle, on the Inde. It is the seat of large and varied manufacturing industries, especially in iron, copper, and zinc, and has coal-mines. Pop. 26,107.

ESCOBAR Y MENDOZA (es-kobär' ē men-*do*'-tha), **Antonio**, a Spanish casuist and Jesuit, born 1589, died 1669. His principal works are: *Summula Casuum Conscientiæ*, and several scriptural commentaries. His casuistry was severely criticized by Pascal in his *Lettres Provinciales*, and the extreme laxity of his moral principles was ridiculed by Boileau, Molière, and La Fontaine.

ESCROW', a legal writing delivered to a third person to be delivered by him to the person whom it purports to benefit, when some condition is performed. Upon the performance of this condition it becomes an absolute deed, but if the condition be not performed, it remains an *escrow* or scroll.

ESCUDO, coin current in various countries. It replaced the milreis as the monetary unit in Portugal at the 1911 revolution, having a par value of 4s. 5½d., divided into 100 centavos. One thousand escudos make a conto. In Spain and Chile also the escudo is current.

ESCU'RIAL (Sp. *el Escorial*), a remarkable building in Spain, comprising at once a palace, a convent, a church, and a mausoleum. It is distant from Madrid about 24 miles in a north-westerly direction, and situated on the acclivity of the Sierra Guadarrama, the range of mountains which divides New from Old Castile. It was built by Philip II, and dedicated to St. Lawrence, in commemoration of the victory of St. Quentin, fought on the festival of the saint in 1557. It is popularly considered to be built on the plan of a gridiron, from the fact that St. Lawrence is said to have been broiled alive on a sort of large gridiron.

The building is a rectangular parallelogram measuring 744 feet in length by 580 feet in breadth. The interior is divided into courts, formerly inhabited

by monks and ecclesiastics, while a projection 460 feet in length (the handle of the gridiron) contains the royal palace. It was begun in 1563 and finished in 1584. It is of moderate height, and its innumerable windows (said to be 11,000) give it (apart from the church) somewhat the aspect of a large mill or barracks.

The church is the finest portion of the whole building. The dome is 60 feet in diameter, and its height at the centre is about 320 feet. Under it is the Pantheon or family vault of the Spanish sovereigns. The library contains a valuable collection, including a rich store of Arabic MSS.

The Escurial was partly burned in 1671, when many MSS. were destroyed, and was pillaged by the French in 1808 and 1813. It was restored by Ferdinand VII, but the monks, with



The Court of the Escurial

their revenues which supported it, have long since disappeared. In 1872 it was fired by lightning, and suffered serious damage.—Cf. A. F. Calvert, *The Escorial*.

ESDRAË'LON, PLAIN OF, a fertile plain in Northern Palestine, between the Mediterranean and the Jordan, drained by the River Kishon, and now traversed by the railway from Haifa to Damascus. This plain is celebrated for four battles having been fought there. Sisera was defeated there; Gideon and his three hundred won a battle there; Saul and Jonathan fought there; and it was there that Josiah was killed. In the centre of the plain is Megiddo (q.v.), identified with Armageddon (*Rev.* xvi, 16). Allenby won a great victory here in Sept., 1918.

ESDRAS, BOOKS OF, two apocryphal books, which, in the *Vulgate* and other editions, are incorporated with the canonical books of Scripture. In the *Vulgate* the canonical books of *Ezra* and *Nehemiah* are called the first and second, and the apocryphal books the third and fourth books of *Esdras*. The *Geneva Bible* (1560) first adopted the present nomenclature, calling the two apocryphal books first and second *Esdras*. The subject of the first book of *Esdras* is the same as that of *Ezra* and *Nehemiah*, and in general it appears to be copied from the canonical Scriptures. The second book of *Esdras* is supposed to have been either of much later date or to have been interpolated by Christian writers.

E'SERIN, or PHYSOSTIGMIN, a drug obtained from Calabar-bean, the active principle of this plant, used as a remedy in cases of tetanus (lock-jaw). A solution of eserin dropped in the eye causes contraction of the pupil, and hence its use in some eye ailments, as, for instance, glaucoma.

ESH, town of Durham. Situated 4 miles W.N.W. of Durham, it is near Ushaw Moor colliery. Here is the Roman Catholic College of S. Cuthbert, founded in 1894 for the dispossessed seminary at Douai. The chief industry is coal mining. Pop. 10,175.

ESHER, a village and parish of England, north-west Surrey. Here is Claremont, built by Sir John Vanbrugh, in 1816 settled upon Princess Charlotte and her husband, afterwards the residence of the Orleans family. 'Wolsey's Tower' is the gatehouse of a palace built by William Waynflete, Bishop of Winchester. Pop. (Esher and The Dittons urban district, 1931), 17,075.

ESHER, English title held since 1897 by the family of Brett. **William Baliol Brett** was born 13th Aug., 1817, and educated at Westminster and Caius College, Cambridge. He became a barrister in 1840 and in 1866 a Conservative M.P. In 1868 he was made solicitor-general and in the same year a judge. In 1883 he became Master of the Rolls and in 1885 was made a baron. He retired and was made a viscount in 1897 and died 24th May, 1899.

His son and successor, **Reginald Baliol Brett,** the 2nd viscount, was born 30th June, 1852, and educated at Eton and Cambridge. From 1880–85 he was Liberal M.P. for Penrhyn-Falmouth, and from 1895 to 1902 secretary to the Office of Works. In 1904 he was chairman of the committee of inquiry concerning the War Office. He was joint editor of *The Letters of Queen Victoria*. He died 22nd Jan., 1930, when his son, **Oliver,** became the 3rd viscount

ESK (Celtic for water), the name of two small rivers in England—one in Cumberland and the other in Yorkshire; and of several in Scotland, the chief being the Esk in Dumfriesshire, the North Esk and South Esk in Forfarshire, and the North Esk and South Esk in Edinburghshire.

ESKI-DJUMNA, a town of Bulgaria, on the northern slope of the Binar-Dagh. Pop. 10,540.

ESKILSTU'NA, a town of Sweden, on a river of the same name connecting Lake Mälar with Lake Hjelmar, with ironworks and manufactures of steel goods and weapons, It is named after St. Eskil, the English apostle of Christianity in Södermanland. Pop. 32,674.

ES'KIMOS. *See* ESQUIMAUX.

ESKI-SAGRA, or **STARA ZAGORA,** a town of Bulgaria, on the south slope of the Balkans, 50 miles N.E. of Philippopolis. In its vicinity are extensive rose-gardens, orchards, and mineral springs. Pop. 28,957.

ESKI-SHEHR, a town of Turkey in Asia Minor, 90 miles S.E. of the Sea of Marmara, with warm baths and manufactures of meerschaum pipes. Fighting took place near the town in 1921, between the Greeks and Turks. Pop. 32,341.

ESMARCH (es'märh), **Johannes Friedrich August von,** German surgeon, born in 1823, died in 1908. He held high official positions during the Schleswig-Holstein and Franco-German Wars, and was a great authority on gunshot wounds. He also originated valuable improvements in barrack-hospitals and ambulances, introduced the antiseptic treatment into Germany, and was the author of several surgical works.

ESMOND, Henry Vernon, pseudonym of H. V. Jack, an English dramatist. Born 3rd Nov., 1869, he became an actor and playwright. In 1895 he won a success with *Bogey,* and others followed. Perhaps the most popular are *Eliza Comes to Stay, The Dangerous Age* and *Birds of a Feather.* He died 17th April, 1922.

ES'NEH, a town of Upper Egypt, on the left bank of the Nile, 28 miles S.S.W. of Thebes, on the site of the ancient Latopolis, now easily reached by railway and river. Among the ruins there is a beautiful portico of twenty-four lofty and massive columns, belonging to a temple of Kneph (the only portion of the temple cleared out), and erected in the Ptolemaic and Roman period, with a zodiac on the ceiling. Esneh has a caravan trade, manufactures cottons and pottery, and is very healthy. There is an irrigation barrage here. Pop. 16,000.

ESOC'IDÆ, the family of fishes to which the true pike (*Esox lucius*) belongs, as also the much larger maskinongy (*E. nobilior*) of America.

ESPAL'IER, in gardening, a sort of trelliswork on which the branches of fruit trees or bushes are extended horizontally, with the object of securing for the plant a freer circulation of air as well as a full exposure to the sun. Trees thus trained are not subjected to such marked nor so rapid variations of temperature as wall trees.

ESPARTERO (es-pär-tā'rō), **Baldomero,** Duke of Vittoria, a Spanish statesman, born 1792, died 1879. The son of a wheelwright, he was educated for the priesthood, but joined the army as a volunteer in 1808. He took a leading part in the conflict with the Carlists, and was one of the most prominent men in Spain during several decades of the nineteenth century. He was regent of the kingdom from 1841 to 1843, and again head of the Government from 1854 to 1858, He was exiled to England for



Esocidae (*Esox Lucius*)

several years (1843–7). In 1870 his name was vaguely put forward in the Cortes as a candidate for the throne, but the proposal was not supported with any enthusiasm, and the closing years of his life were spent in retirement.

ESPAR'TO, or **ALFA,** a plant growing in Spain and North Africa, long applied to the manufacture of cordage and matting, and also extensively used for paper-making. This plant, called by botanists *Stipa* or *Macrochlōa tenacissima,* is a species of grass 2 to 4 feet high, covering large tracts in its native regions, and also cultivated, especially in Spain.

ESPERANTO, an artificial language for international use invented by Dr. Zamenhof of Warsaw, who first published an account of it in 1887. The language was afterwards taken up for practical purposes in many countries, its use being promoted by special societies and periodicals.

Its structure is so simple that the whole grammar can be completely mastered in an hour. There are no exceptions to the rules, perfect regularity being a leading feature of the language. The essential roots number only some 2,000, including grammatical inflex-

ions, prefixes, and suffixes, and these are chosen from the principal European languages in such a way as to make their mastery easy to any person of ordinary education.

The alphabet consists of twenty-eight letters, each with an invariable sound. There are no silent letters. The accent is always on the penultimate syllable. All nouns end in *-o* in the singular, and all adjectives in *-a*. The plural of these is formed by adding *-j* (pronounced *y*). All derived adverbs end in *-e*. The only case inflexion is *-n* for the objective. The verbal endings are: *-i* for the infinitive; *-as, -is, -os* for the present, past, and future tenses respectively; *-us* for the conditional; *-u* for the imperative; *-anta, -inta, -onta* for the present, past, and future participles active respectively; *-ata, -ita, -ota* for the present, past, and future participles passive respectively. The definite article is *la* in all cases and numbers, and there is no indefinite article. An ingenious system of prefixes and suffixes enables all shades of meaning to be expressed. Thus: *bona*, good, *malbona*, evil; *patro*, father, *patrino*, mother; *gepatroj*, parents; *kudri*, to sew, *kudrilo*, needle; *arbo*, tree, *arbaro*, forest; *bela*, beautiful, *beleco*, beauty; *morti*, to die, *mortigi*, to kill.

The following is the Lord's Prayer in Esperanto: Patro Nia, kiu estas en la cielo, sankta estu Via nomo. Venu regeco Via. Estu farata volo Via, kiel en la cielo, tiel ankaŭ sur la tero. Panon nian ciutagan donu al ni hodiaŭ, kaj pardonu al ni suldojn niajn, kiel ni ankaŭ pardonas al niaj suldantoj. Ne konduku nin en tenton; sed liberigu nin de la malbono: car Via estas la regado, la forto, kaj la gloro eterne. Amen!

The British Esperanto Association was founded in the autumn of 1904; its official organ is *The British Esperantist*. More than twenty International Esperanto congresses have been held since 1905.—BIBLIOGRAPHY: J. C. O'Connor, *Esperanto: the Student's Complete Text-Book* (revised by Dr. Zamenhof); Underhill, *Esperanto and its Availability for Scientific Writings*.

ESPIONAGE (from the French word *espion*, a spy) is the acquirement of information by secret methods and by special agents, as opposed to its acquirement openly by combatants in the ordinary course of military operations. Espionage is recognized by international law under the Hague Convention, Article 24 of the Annexe to which reads as follows: "Ruses of war and the *employment of measures necessary for obtaining information* about the enemy and the country are considered permissible." The right given by this rule does not, however, extend to the employment of force to extract information from enemy subjects as to their own armies, so that it follows that methods of espionage must be of a persuasive, and, so to speak, peaceful nature.

Espionage is carried on both in peace and war, but the conditions under which secret service agents work differ to a very marked extent according to the state of affairs between the two countries. In peace-time, though many countries maintain secret service agents in other states, yet these same agents can expect no assistance from their Governments in the event of their being detected. In this case it is a diplomatic fiction that nothing is known of them or of the reasons for their activities. The agent, therefore, in consideration of a sufficient allowance, takes the risk of a lengthy term of imprisonment if he is so unfortunate as to be found out.

In time of war the condition of non-interference naturally exists as a matter of course, and the secret service agent or spy is liable to the death penalty if discovered, and the fact that he has or has not obtained and transmitted information does not affect the case. In time of peace every nation of any importance maintains representatives in other states. Among the recognized duties of these representatives is the obtaining and transmitting of information about naval and military matters which may be of interest to their Governments. This is not regarded as espionage provided the information is obtained by the representative in his official capacity; it becomes so when resort is had to disguise or dissimulation, and, in fact, dissimulation is the essence of the offence. It follows, therefore, that a spy—one who practises espionage—must act in a clandestine manner in order to bring himself within the technical definition of the offence (by international law).

The characteristics of the act of spying are laid down in Article 29 of the Hague Convention, and the definition there given is as follows: "A person can only be considered a spy when, acting clandestinely or on false pretences, he obtains or endeavours to obtain information in the zone of operations of a belligerent, with the intention of communicating it to the hostile party. . . ."

From this definition it appears that action in the 'zone of operations' is a necessary concomitant of the offence, and that, therefore, persons operating outside that zone cannot technically be charged with espionage; and to a certain extent this is so. A person may be domiciled in a belligerent country, and may, while pursuing his ordinary vocation, collect and transmit openly information of value to his

own country; in the absence of dissimulation, such a person could not be charged with espionage, though he could be with war-treason. As, by international law, war-treason is punishable by death, the result is the same as if all the characteristics of spying had been present.

Espionage has been brought to a fine art in many countries, and complex organizations for its practice exist. Information may conceivably be collected with comparative ease by trained agents, but it is when it comes to disposing of that information that the troubles of the secret service agent begin. A poison requires an antidote, and the system of counter-espionage to a great extent provides this antidote. In acordance with this system, steps are taken to mark down and know all secret-service agents engaged in espionage work in the country concerned; their operations are then followed and, to a certain extent, controlled till such time as the psychological moment arrives when all, including the master-brain, are drawn into the net and disposed of.

In a military sense a spy means a man, whether soldier or civilian, who penetrates in disguise behind the enemy lines and brings back information about his dispositions. By the customs of war the penalty inflicted on a spy caught in the act is death after trial; but should a man known to have acted as a spy on some former occasion be subsequently captured in the course of military operations, he cannot be punished for his former act, and must be treated as a prisoner of war.

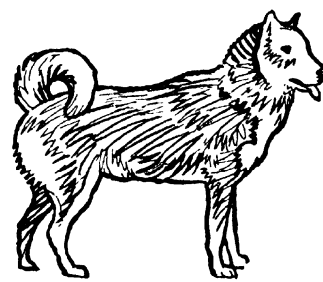
The following examples may serve to show what can be considered spying and what cannot. 'A', a soldier, in presence of the enemy, volunteers to obtain exact information as to the strength of a certain hostile post. To this end he, wearing his uniform and carrying a weapon of some kind, approaches the post by stealth, and secretes himself in a convenient place for seeing and hearing. If he is discovered, and attempts to escape, he may be shot in the process; but if he is captured, he must be treated as a prisoner of war and not as a spy. 'B', another soldier, speaking the enemy language, disguises himself as an officer of the enemy forces, and in this disguise penetrates behind the lines and mixes with the enemy troops. On discovery and capture he may be tried as a spy and shot.

In the first case 'A' was acting as a combatant in the ordinary course of military operations, and no disguise was present; in the second case 'B' was acting clandestinely and under false pretences, i.e. was masquerading as an officer of the enemy forces, and the necessary dissimulation was present.

ESPIR'ITO SANTO ('Holy Spirit'), one of the maritime states of Brazil, bounded north by Bahia, south by Rio-de-Janeiro; length, about 260 miles; breadth, about 120 miles; area, 17,308 sq. miles. Pop. 661,416.

ESPIR'ITU-SANTO, an island of the Pacific, the largest of the New Hebrides, with some 20,000 inhabitants.

ESPRITS FORTS (Fr., bold spirits), a term applied to the French school of freethinkers, which included Voltaire, Diderot, Helvetius, D'Alembert, and others. The Esprits Forts, are, however, distinguished from the English freethinkers. Whilst the latter were only aiming at freedom of religious thought, the Esprits Forts were more



Eskimo Dog

radical and revolutionary, seeking to bring about the abolition of the existing order and the substitution of a system based upon pure reason and the supremacy of intellect.

ESQUIMAULT (es-kwi'mâlt), a harbour and naval station on the south-east coast of Vancouver Island, about 3 miles from Victoria, the capital of British Columbia. The harbour is almost landlocked, and, with the 'Royal Roads' outside, is capable of giving safe anchorage to a fleet of vessels of the largest size. It is the station of H.M. ships on the Pacific coast, is a fortified naval arsenal, and since 1906 has been garrisoned by Canadian troops. Pop. 6,484.

ESQUIMAUX (es'ki-mōz), or **ESKIMOS**, a race inhabiting the Arctic coasts of North America, from Greenland to Bering Strait, and extending into Asia. They call themselves *Innuit*, 'the people,' 'men'; their other name is from an Algonquin word signifying eaters of raw flesh, and seems to have been given them first by the Jesuit Father Biard in 1611. They consist of three principal stocks—the Greenlanders; the Esquimaux proper,

in Labrador; and the Western Esquimaux, found along Hudson Bay, the west side of Baffin Bay, the polar shores as far as the mouths of the Coppermine and Mackenzie Rivers, and both on the American and Asiatic sides of Bering Strait.

The entire Eskimo population is estimated at 27,000, of which 15,600 live in North America and 11,000 in Greenland. Their leading physical peculiarities are a stunted stature, flattened nose, projecting cheek-bones, eyes often oblique, and yellow and brownish skin. Seal-skins, reindeer and other furs are used as materials for dress, according to the season, as well as skins of otters, foxes, and martens. In summer they live in tents, covered with skins; in winter they may be said to burrow beneath the snow. In Greenland houses built of stone and cemented with turf are used as permanent habitations.

Vegetation being extremely stunted within the limits of their territories, their food consists of the flesh of whales, seals, and walruses, often eaten raw; and they show remarkable skill in fishing and hunting. Their weapons are bows and arrows, spears or lances, generally pointed with bone, but sometimes with metal. Their only domestic animal is the Esquimaux dog. In intellect they are by no means deficient; in manners they are kind and hospitable. Their religious ideas appear scanty, but success has attended the labours of the Danish missionaries in teaching them the Christian religion. —BIBLIOGRAPHY: H. Rink, *Tales and Traditions of the Eskimo*; V. Stefansson, *My Life with the Eskimo*.

ESQUIMAUX DOG, or **ESKIMO DOG,** a breed of dogs extensively spread over the northern regions of America and of Eastern Asia. It is rather larger than the English pointer, but appears smaller on account of the shortness of its legs. It has oblique eyes, an elongated muzzle, and a bushy tail, which give it a wolfish appearance. The colour is generally a deep dun, obscurely barred and patched with darker colour. It is the only beast of burden in these latitudes, and with a team of such dogs attached to his sledge the Eskimo will cover 60 miles a day for several successive days.

ES'QUIRE (O.Fr. *escuyer*, from Lat. *scutum*, a shield); originally, a shield-bearer or armour-bearer; an attendant on a knight; hence in modern times a title of dignity next in degree below a knight. In England this title is properly given to the younger sons of noblemen, to officers of the king's courts and of the household, to counsellors at law, justices of the peace while in commission, sheriffs, gentlemen who have held commissions in the army and navy, &c. It is usually given to all professional and literary men, and nowadays, in the addresses of letters, *esquire* may be put as a complimentary adjunct to almost any person's name. In heraldry the helmet of an esquire is represented sideways, with the vizor closed.

ESQUIROS (es-kē-ros), **Henri Alphonse,** French poet, romancist, and miscellaneous writer, born at Paris 1812, died at Versailles 1876. His first work, a volume of poetry, *Les Hirondelles*, appeared in 1834. This was followed by numerous romances, and a commentary on the life of Christ (*L'Evangile du Peuple*), for which he was prosecuted and imprisoned. He then published *Les Chants d'un Prisonnier*, poems written in prison; *Les Vierges Folles*; *Les Vierges Sages*; *L'Histoire des Montagnards*. Having to leave France in 1851, he resided for years in England, and wrote a series of essays for the *Revue des Deux Mondes* on English life and character, which were translated under the title of *The English at Home*, and were very popular. He also wrote a similar work on the Dutch. Other works are: *Religious Life in England*, and *Charlotte Corday*.

ESSAD TOPTANI, PASHA, Albanian soldier and national leader, born at Tirana in 1856. He was a descendant of the Toptani family who had ruled in Albania in the fifteenth century. Trained for the army, he served in Macedonia and Anatolia, and in 1897 was rewarded with the title of Pasha for his services in the war against Greece. Abdul Hamid, however, who feared the power of the Toptani family, had the brother of Essad Pasha murdered, and the latter became the mortal enemy of the Sultan. He nevertheless accepted the rank of brigadier-general, and commanded the local troops at Janina.

In 1908 he joined the Young Turks, and was one of the deputation which brought the news of his deposition to the Sultan. He was in command of the troops at Scutari, when the powers declared in favour of the autonomy of Albania in 1912. Essad Pasha had hoped to be chosen ruler of the new state of Albania created by the Treaty of London, but as the Prince of Wied had been appointed *mbret*, he accepted the office of Minister of War and of the Interior.

Suspected by the *mbret* he was compelled to flee from Durazzo. After the departure of the Prince of Wied, at the outbreak of the European War, he returned to Durazzo, and was appointed by the Senate (on 5th Oct., 1914) President of the Provisional Government. In spite of Austrian

advances he declared war on the Central Powers, and escaped when the Austrians entered Albania. He rendered valuable services to the Allies at Salonica, but the Italians, who saw in the Pasha an enemy to their own views upon Albania, refused to grant him permission to return to his country. Essad Pasha, therefore, remained in Paris, where he was assassinated by an Albanian student named Averic Rustem on 13th June, 1920. The assassin was acquitted by a French jury in December of the same year, prominent Albanians having pleaded in favour of the murderer, and maintained that the Pasha was an ambitious adventurer and a traitor to his country.

ES'SAY, a composition in which something is attempted to be proved or illustrated, usually shorter and less methodical and finished than a systematic or formal treatise; so that it may be a short disquisition on a subject of taste, philosophy, or common life. The essay was the invention of Montaigne in the sixteenth century, and Francis Bacon was another illustrious author who employed the literary form of the essay.

Caution or modesty has induced many writers of note to give the title of essay to their most elaborate productions: thus we have Locke's *Essay on the Human Understanding*. There is a class of English writers to whom the descriptive term *essayist* is applied, the most illustrious being Addison, Steele, Charles Lamb, Hazlitt, De Quincey, Macaulay, Carlyle, Froude, Matthew Arnold, R. L. Stevenson, and Austin Dobson.

ESSEG, now Osijek, a town of Yugo Slavia, formerly in Hungary, on the Drava, 13 miles from its confluence with the Danube. It has barracks, town house, normal school, an important trade, and several fairs. Pop. 40,339.

ESSEN, a town of Rhenish Prussia, situated between the Ruhr and the Emscher, 18 miles north-east of Düsseldorf, founded in the ninth century, and adorned with a fine church dating from 873. It increased with great rapidity, and became celebrated for the steel and ironworks of Krupp, the most extensive in Europe, employing till the end of the European War over 27,000 workmen. This great establishment was started in 1827 with only two workmen. In March and April, 1920, heavy fighting took place at Essen between the Government and the Communist troops. Pop. 629,564.

ESSENCE, solution of the more important constituents of certain substances. In most essences the solvent is alcohol, but in a few water is used. In medicine drugs containing oils soluble in alcohol are sometimes used in the form of essences, examples being the essences of peppermint, ginger and anise. Many alcoholic essences are used in perfumery.

ESSENES (es-sēnz'), or **ESSÆANS,** a sect among the Jews, the origin of which is unknown, as well as the etymology of their name. The word may be a derivation from the Syr. *hasya*, the pious ones, or *āsyā*, physician. The Essenes appear to have sprung up in the course of the century preceding the Christian era, and disappeared on the dispersion of the Jews after the siege of Jerusalem. The sect appears to have been an outcome of Jewish mysticism and asceticism, which gradually assumed the form of a distinct organization. They were remarkable for their strictness and abstinence, and had a rule of life analogous to that of a monastic order. Property was owned in common.

ESSENTIAL OILS. An essential oil is distinguished from a fatty oil by its characteristic odour, and by being slightly soluble in water and more volatile. Most of the essential oils are decomposed by alkali, but they do not yield soaps as do the fatty oils. An essential oil usually contains one chief ingredient, which may be a compound of carbon and hydrogen, e.g. *turpentine*, in which the characteristic odour is due to *pinene* ($C_{10}H_{16}$); or a compound of carbon, hydrogen, and oxygen, e.g. bitter almond oil where the chief ingredient is *benzaldehyde* (C_6H_5CHO); or *cinnamon bark*, containing *cinnamic aldehyde* ($C_6H_5CH:CH\cdot CHO$).

The extraction of these oils from plants containing them is usually accomplished by a process of distillation with water. In some cases this is not practicable, as the oil may be decomposed by water, e.g. to obtain the essential oil from violets the flowers are macerated with hot lard; the fat absorbs the essential oil, which is then extracted from the lard by means of alcohol. In other cases the oil is extracted by means of a solvent such as petroleum spirit. Large quantities of essential oils are extracted yearly for the preparation of perfumes, the preparation of various flavourings (essences), and for use in the soap industry. Many essential oils are now manufactured synthetically, e.g. oil of wintergreen owes its fragrance to methyl salicylate, pineapple oil to ethylbutyrate, pear oil to amylacetate.

ESSEQUIBO (es-se-kē'bō), a river of British Guiana, which flows into the Atlantic by an estuary 20 miles in width after a course of about 600 miles. The district or division of Essequibo is well cultivated and extremely

fertile, producing coffee, cotton, cocoa, and sugar. It was the subject of a discussion between the British and Venezuelan Governments, settled by the Arbitration Treaty of 2nd Feb., 1897.

ESSEX, EARL OF. *See* CROMWELL, THOMAS.

ESSEX, Robert Devereux, second Earl of, in the Devereux line, was born at Netherwood, Herefordshire, in 1567. Having appeared at court, he soon became a favourite of Queen Elizabeth, by whom he was kept in attendance against his will during the defeat of the Armada. He served with more or less distinction in expeditions to Portugal and France, the latter on behalf of Henry of Navarre. In 1596 he was commander of the troops in an expedition against Spain, and distinguished



Earl of Essex

himself by the capture of Cadiz. In an expedition next year he was less fortunate, and the queen, with whom he was always quarrelling, received him coldly.

Presuming on the favour of Elizabeth, he behaved with rudeness to her at a Privy Council, received a box on the ear, and was told to "go and be hanged." After some months a reconciliation took place, and he was appointed Lord-Lieutenant of Ireland (1599), which was then in a state of rebellion. He returned to England in September, having been entirely unsuccessful in his government, was made a prisoner in his own house, and foolishly tried to excite an insurrection in London. After a skirmish with a party of soldiers he was compelled to surrender, and sent to the Tower. Tried for treason on 19th Feb., he was executed on 26th Feb., 1601.

ESSEX, a maritime county in the south-east of England, bounded by Suffolk, the Thames, Hertford, and Middlesex; area, 979,532 acres. The surface is generally level, except in the north-west, where it is undulating and sometimes hilly. The soil is in general extremely fertile, and particularly well adapted for the growth of wheat. Beans and pease also thrive uncommonly well. The other principal productions are potatoes, barley, oats, mangolds, turnips, tares, rape, mustard and trefoil. The raising of caraway, coriander, and teazel is almost peculiar to this county.

It had formerly a great extent of forest, the only survival of which is Epping Forest. The principal rivers in the county are the Roding, Crouch, Chelmer, Blackwater, and Colne. It has also the Thames, Lea, and Stour as boundary rivers. On the coast are some valuable oyster-beds, the oysters from which are exported in considerable quantities. The manufactures of the county are not very extensive, the chief being crape, silks, and straw-plait.

The chief towns are: Chelmsford, the county town; West Ham, Colchester, Southend, and Harwich. The county has eight parliamentary divisions, each returning one member. Pop. 1,755,459 (1931).—Cf. *Victoria History of the Counties of England.*

ESSLINGEN (es'ling-ĕn), a town of Germany, in Württemberg, on the Neckar, 7 miles E.S.E. of Stuttgart. It is of Roman origin, was long an imperial free town, has walls flanked with towers, a castle, and an ancient Gothic church, dating from the thirteenth century, with a tower 230 feet high. In 1488 the Swabian League was formed at Esslingen. It has manufactures of machinery, articles of wood, cutlery, philosophical instruments, and spinning and other mills. Pop. 40,586

ESTABLISHED CHURCH, a Church having a form of doctrine and government established by law in any country for the teaching of Christianity within its boundaries, and usually endowed by the State. The upholders of the establishment theory maintain that it is the duty of a State to provide for the religious instruction of the people. On the other hand, it is argued that the State has no right to endow or support any particular sect or denomination, unless they assume that that denomination alone is possessed of religious truth and worth. Regarding the established *Church of England, see* ENGLAND; for *Church of Scotland, see* SCOTLAND.

ESTATE, the interest or quantity of interest a man has in lands, tenements, or other effects. Estates are *real* or *personal. Real estate* comprises lands, tenements, and hereditaments, held in freehold. *Personal estate* comprises interests for terms of years in

lands, tenements, and hereditaments, and property of every other description. *Real* estate descends to heirs; *personal* to executors or administrators.

In ordinary language, an estate is a piece of landed property, especially one of some size. **Estate duty**, *see* DEATH DUTIES. In political history the term estate is applied to a distinct order or class in society. The term 'fourth-estate' is often used to designate the Press.

ESTATES OF SCOTLAND, the name given to a body of similar constitution to the English Parliament, but with important differences, the king himself, as well as his officers, being responsible to the Estates for wrongs done. They held the power of declaring war, or entering on a peace or treaty, and with them rested the right of declaring, with or without the consent of the king, resolutions of the assembly to be law.

To prevent a Bill being hurried through Parliament, it was submitted to and discussed by a committee called the *Lords of the Articles*. If sanctioned by this committee, the Bill was passed on to the whole House for approval. Another committee appointed by the Estates was called the *Auditors of Complaints*, whose duty was to hear appeals against the decisions of the king's judges, and, if necessary, to reverse their sentences.

ESTATES OF THE REALM, in Britain, are the Lords Spiritual, the Lords Temporal, and the Commons. From the circumstance that the Lords Spiritual and Temporal meet in one House, and practically form one branch of the legislature, the popular error has arisen that the sovereign forms one of the three Estates of the Realm.

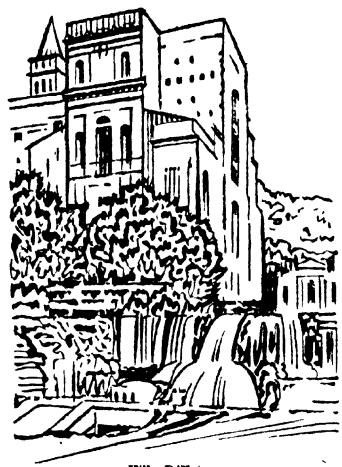
ESTE (es'tā), a town of North Italy, 16 miles S.W. of Padua. It has a castle, the cradle of the Este family. It has also manufactures of silk goods, earthenware, and majolica; and numerous silk-mills and whetstone quarries. Pop. 12,660.

ESTE (es'tā), one of the most ancient and illustrious families of Italy. In the eleventh century the House of Este became connected by marriage with the German Welfs or Guelphs, and founded the German branch of the House of Este, the Dukes of Brunswick and Hanover. The sovereigns of Ferrara and Modena were of this family, several of them being famous as patrons of letters. The lives of Bolardo, Ariosto, and Tasso were closely connected with members of this House. The last male representative of the Estes died in 1798. His daughter married a son of the German emperor Francis I.

ESTEPO'NA, a seaport of Southern Spain, province of Malaga, 23 miles north-east of Gibraltar. Pop. 9,673.

ESTERHA'ZY, a family of Hungarian magnates whose authentic genealogy goes back to the first half of the thirteenth century. They were zealous partisans of the House of Habsburg, to whom, during the reigns of Frederick II and Leopold I, they lent a powerful support.

Among the more prominent members of the family are: Paul IV, Prince Esterhazy, a general and literary savant, 1635–1713; his grandson, Nicholas Joseph, a great patron of arts and music, founder of the school in



Villa D'Este

which Haydn and Pleyel, among others, were formed, 1714—90; Nicholas, Prince Esterhazy, distinguished as a field-marshal and foreign Ambassador, 1765–1833; Prince Paul Anthony, a distinguished and able diplomatist, born 1786, died 1866; was successively Austrian Ambassador at Dresden, Rome, and London. He was a supporter of the national Hungarian movement.

ESTERS, or **ETHEREAL SALTS**, in chemistry, a general term for substances formed by the union of an acid and an alcohol with elimination of water. Thus ethyl acetate is formed from ethyl alcohol and acetic acid. Many of them are volatile, pleasant-smelling substances.

ESTHER, BOOK OF, book of the Old Testament. It narrates an episode at the court of the Persian King Ahasuerus (Xerxes) in Susa, 5th cen-

tury B.C. The royal consort Vashti was deposed, and her place taken by Esther, related to a Jewish exile, Mordecai. Esther and Mordecai frustrated the plots of the grand vizier, Haman, against the Jewish people, whose deliverance was thereafter commemorated by the Purim festival. Written after 300 B.C., the Book of Esther was expanded by Maccabean additions which form a separate section of the Old Testament Apocrypha.

ESTIMATE, calculation of probable cost; a provisional valuation. In building, printing and other business transactions it is usual for the prospective customer or client to ask for a statement giving an estimate of probable cost. He often asks for two or more estimates from different firms in order to compare one with another.

In parliamentary procedure the proposed expenditure of the country is put before the House of Commons in the form of estimates. These are divided into navy, army, civil service and other branches and each shows the amount of money required for the coming financial year. After they have been passed the Chancellor of the Exchequer can frame his budget. Each year the House appoints a committee to examine the estimates and report on them.

ESTON, a town of England, North Riding of Yorkshire, 4 miles S.E. of Middlesbrough, with steelworks and iron-mines. Pop. (1931), 31,142.

ESTONIA, a republic of North-Western Europe, formerly a dependency of Imperial Russia. It is situated on the Baltic, and is bounded by the Gulf of Finland, Russia, Latvia, and the Baltic Sea. The Republic comprises the former Russian government of Estland, the northern part of Livonia, and portions of certain other provinces, the total area being 18,353 sq. miles; pop. (1932), 1,120,000. The boundary with Russia was fixed by the Peace Treary of February, 1920, and that with Latvia was demarcated in July of the same year. Estonia is divided into eleven districts. The capital, Tallin (Revel), on the Gulf of Finland, has a population of 134,000, and is a busy port. Other towns are Dorpat Parau, and Narva, the last of which is a manufacturing town.

Physical Features. The Republic has, for the most part, a flat or undulating surface. The whole of the north side, however, rises considerably above the sea, and presents to it ranges of high cliffs. The Narva is the only river of any importance, but there are numerous small rivers and lakes. About a fourth of the surface is covered with forests of pine, birch, and alder, while one-half is devoted to agriculture.

Agriculture. The agricultural land was at one time divided into great landed properties, but a recent Agrarian Reform Bill has parcelled these estates out to the peasants. The principal crops are rye, wheat, barley, and potatoes; flax, hops, and tobacco are also grown.

Commerce and Industry. Cattle are reared extensively. There are productive sea fisheries, and there are 1270 industrial establishments employing about 35,740 men. In 1932 the total value of exports was 45,570,900 Estonian kroons, and of imports 36,860,200 Estonian kroons. The principal exports were timber, potatoes, paper, flax, cement, and spirits. The Estonian mercantile marine in 1932 consisted of 97 steamers and 247 sailing-vessels, with a total tonnage of 114,993 tons.

There were, in 1931, 777 miles of railway track. The currency unit became, in 1928, the *kroon* of 100 *sents*, the value being the same as that of the Swedish *krone* (1*s.* 1⅛*d.*). Five-sixths of the people are Lutherans and the rest are mainly Greek Catholics. The metric system of weights and measures has been in use since 1929. Elementary education is free and compulsory, there are numerous secondary, trade, and training schools, and at Dorpat is the Estonian university (reconstituted 1919).

Constitution. By the Constitution adopted in 1920 the power of the State is in the hands of the people, to whom the sovereign power is assured by means of elections to the *Riigikogu* or State Assembly, the referendum, and the right of initiating new laws. The executive power consists of the *Riigivanem* (State Head or Prime Minister) and the ministers, who are chosen by the Assembly. It was proposed in 1933 to alter the constitution so as to provide for a President. Military service is compulsory.

History. In the tenth and twelfth centuries Estonia belonged to Denmark, and after being annexed by Sweden it was seized by Russia in 1710. After the Russian Revolution, Estonia declared her independence in Feb., 1918, and was recognized as a *de facto* independent state by Britain, France, Italy, Japan, Poland, and Sweden in May, 1919. An armistice with the Bolshevists was concluded in Dec., 1919. In Nov., 1924, a Communist rising took place in Revel, and was only put down after much bloodshed.—BIBLIOGRAPHY: John Buchan, *The Baltic and Caucasian States*; E. Vesterinen, *Agricultural Conditions in Estonia.*

ESTOP'PEL (Fr. *étouper*; Lat. *stuppare*, to stuff with tow, to cram), in law, anything done by a party him-

self, which puts a period to an action by closing the ground of controversy. Estoppels are divided into three classes: by Record, by Deed; and in Pais, or by Conduct.

ESTO'VERS (O.Fr. *estover*, need, necessity), in law, necessaries or supplies. **Common of estovers** is the liberty of taking the necessary wood for a house or farm from another's estate.

ESTREMADU'RA, an ancient division of Spain, now consisting of the provinces of Badajoz and Caceres. It is fertile, but not cultivated to its full extent. The Tagus and Guadiana intersect it east to west. Immense flocks of sheep graze on the rich plains. The area is about 16,000 sq. miles, and the pop. 1,258,600.

ESTREMADURA, a maritime province of Portugal, divided by the Tagus into two nearly equal parts, of which the northern is the more mountainous. Wines and olives are the principal produce. The principal city is Lisbon. Area, 6,937 sq. miles. Pop. (1930), 1,818,760.

ESTREMOZ', a town of Portugal, in the province of Alemtejo, 22 miles west of Elvas. Pop. about 8,000.

ESZTERGOM *See* GRAN.

ÉTAMPES (ā-tänp), a town of France, department of Seine-et-Oise, 30 miles S. by W. of Paris. Pop. 10,070.

ÉTAPLES, a town of Northern France, department of Pas-de-Calais, on the right bank of the estuary of the Canche, 15 miles south of Boulogne. During the European War, Étaples became a place of great importance. It was a huge British encampment, including many hospitals, and a cemetery with over 11,000 graves. It was also of importance as a training-centre, and the famous 'Bull-ring' was there. Pop. 6,530.

ETAP'PEN (Ger.), a department in Continental armies the business of which is to relieve the commanders of the field army of all responsibility for their communications in the rear. The officers of this department supervise all arrangements for loading and unloading at stations, forwarding, feeding, and billeting.

ETA'WAH, a town, India, United Provinces, capital of district of the same name, on left bank of the Jumna, picturesquely situated among ravines, and richly planted with trees. It has some good buildings, and a considerable trade. Pop. 41,558.—The district has an area of 1,691 sq. miles, and a pop. of 760,120.

ETCHING, a method of engraving lines upon a metal plate by means of acid, whence the term has come to denote an impression taken on paper or similar material from the etched plate. Sometimes, though incorrectly, applied to a line-drawing in pen and ink. The usual process is to cover the plate (generally of copper) with an *etching-ground* of waxes and resins, on which the lines are opened up by means of a sharp-pointed *etching-needle*, either from a design transferred to the ground, or by the artist working directly. The lines are then *bitten* by putting the plate into dilute nitric or hydrochloric acid, the back and edges being protected by *stopping-out varnish*. The plate is removed when the lightest lines are sufficiently bitten. If some lines need deeper biting, the rest may be covered with stopping-out varnish, and the plate replaced in the acid; or acid may be applied locally. If a plate is removed before biting is complete, in order to take a trial impression, it is recovered with a transparent ground, additional lines opened up if necessary, and *rebitten*.

In *soft-ground etching*, the ground is mixed with tallow, thin paper laid upon it, and the design firmly drawn thereon with a pencil. When the paper is removed, the ground adheres to it where the lines were drawn. The plate is bitten in the usual way. This produces the effect of a chalk or pencil drawing.

Dry-point is a method of working direct on to the copper with a sharp point, which raises a *burr* on each side of the line, giving it a characteristic quality. Dry-point, etching proper, and engraving proper are often combined in one plate; and a mixture of etching with mezzotint or aquatint is not uncommon.

In *printing*, a matter of first-rate importance, the ink is rubbed into the lines and superfluous ink *wiped* from the surface of the plate, ink being left in any place where a tint is required. Impressions may then be taken by hand; but a press is generally used, being more expeditious and yielding more even results. The papers used are various, but those of Japanese make are most popular. The number of good impressions possible from one plate is limited by the wearing of the plate; in particular, the burr of dry-point soon disappears.

A *state* is the name given to each stage in the progress of a print, which is the result of new work on the plate. Differences due to variations in the amount of ink used, or to wiping, do not constitute states; but the addition of a title, artist's signature, &c., will make a state. As distinct from the engraved line, the etched line has a freedom and spontaneity resembling that made by pen or pencil.

The process was apparently used as a means of decorating metal some time

before prints were taken. The earliest-known etching is dated 1513. Among the first to use the process was Albrecht Dürer (1471–1528), who between 1515 and 1518 produced six plates on iron, showing great power and precision, but hardly realizing all the qualities of the medium. Among his followers, the German Little Masters, Hans Sebald Beham and Albrecht Altdorfer were responsible for some interesting plates as was Lucas van Leyden (1494–1533), the Dutchman. Among the earliest Italian etchers were Francesco Mazzuoli (1503–40) and Andrea Schiavone (1522–82), who show more freedom and delicacy than the Germans.

But at this time etching was mainly the by-product of artists whose chief work was painting or engraving. Its great period opened in the seventeenth century. Jacques Callot (1592–1635), born at Nancy, who worked there and at Rome, produced about one thousand plates of small size, the most important being two series of the *Miseries of War*. He is remarkable for his fine sense of design, the fantastic, grotesque quality of his figures, and the delicacy and variety of his line, obtained by rebiting and by combining engraving with etching. Claude Lorrain (1600–82), the landscape painter, possibly under the influence of Callot, produced some fifty plates, very delicately etched, and suggestive of atmosphere. Sir Anthony Van Dyck (1599–1641), beside being court painter to Charles I of England, was the greatest Flemish etcher of his day. His eighteen etched portraits of famous contemporaries (fifteen of which were included in his *Iconography*, published 1645), in their direct handling and vivid characterization, are among the finest work of the kind ever done.

But the central figure in etching, not only of the seventeenth century but of all time, is Rembrandt van Ryn (1606–69), whose work is unrivalled both in quality and influence. His etchings show the same realism, understanding of humanity, and creative imagination which mark all his work. Roughly, they fall into three groups, according to the time at which they were produced. In the first period, the ordinary etched line is mainly used, and the artist is evidently feeling his way; in the second, chiaroscuro is more marked, and dry-point used freely; in the third, the handling is very free and vigorous, chiaroscuro becomes the dominant feature, and dry-point the usual method.

Development on these lines marks all his plates, which consist of (1) portraits, e.g. *Jan Six* (*c.* 1646) and *Clement de Jonghe* (1651); (2) figure compositions, many of scriptural subjects, which include the masterpiece *Christ receiving Little Children* (*c.* 1650), commonly known as 'The Hundred Guilder Print'; (3) landscapes, e.g. *The Goldweigher's Field*, the least numerous class, but one which has inspired the greatest mass of work.

The Dutch painters contemporary with or following Rembrandt were in some cases prolific etchers, notably Ferdinand Bol and Adrian van Ostade, and reproduce in that medium the characteristics of their painting.

In the eighteenth century etching fell somewhat into disuse, save in Italy, where G. B. Tiepolo (1696–1770), the decorative painter, produced some fifty plates, and Antonio Canale (Canaletto, 1697–1768) showed in his few etchings the same power to express structure and aerial perspective as in his painting. More prolific was G. B. Piranesi (1720–88), who published a series of views of the Classical and Renaissance architecture of Rome, professedly with an archæological aim, but of great artistic interest. His imaginative power, bold design, and vigorous handling are best seen in the fantastic plates of his *Carceri*.

In England, William Hogarth (1697–1764) produced a few etchings; Thomas Rowlandson (1756–1827), the caricaturist, use detching as the basis of his aquatints; and John Crome (1768–1821), the landscape painter, etched some characteristic plates. But it was Francisco Goya (1746–1828) whose work ushered in a new era. His bitterly satirical *Caprichos* (1793–6, 72 plates), *Proverbios* (1810–5, 18 plates), *Desastres de la Guerra* (*c.* 1810, 82 plates), and the more popular but no less remarkable *Tauromaquia* (*c.* 1815, 33 plates illustrating bull-fighting), in all of which the bitten line is allied with aquatint, show a powerful and fantastic imagination, brilliant design and draughtsmanship, and superb technique.

Widely different in character are the 71 plates of the *Liber Studiorum*, one of the most remarkable works of J. M. W. Turner (1775–1851). In these etching merely provides the ground plan for the use of mezzotint, or, more rarely, aquatint.

In the nineteenth century the revival inaugurated by Goya was carried on in France by several of the Barbizon group of landscape painters, notably by J. F. Millet (1814–75), responsible for some simple but impressive plates. A more important figure as an etcher is Alphonse Legros (1837–1911), whose admirable portraits recall those of Van Dyck, though elsewhere he shows something of Goya's taste for the grotesque. This last also appears in the work of Charles Méryon (1821–68), one of the greatest of French etchers, whose feeling for decorative design and decisive

handling are best seen in his views of Paris. Apart from other etchers of the period are Jules Jacquemart and Félix Braquemond, remarkable for their exquisite delicacy in the reproduction of surface texture.

Of the Impressionist painters, Camille Pissarro (1830–1903) produced some very individual plates, marked by the use of broken lines and much rebiting, in the effort to secure atmospheric effect. Similarly, by means of open shading and absence of outline, Anders Zorn (1860–1918), the Swede, has aimed at reproducing the play of light round objects; but his portraits are his best work.

The chief figure in nineteenth-century etching, however, is J. A. M'N. Whistler (1834–1903), whose *French Set* (1858), *Thames Set* (1871), *Venice Set* (1880), and *Twenty-six Etchings* (1886) show his delicate yet decisive handling, his economy of means, his feeling for design, and his power of securing luminosity and atmosphere. Part of his success was due to insistence upon printing his own plates. His brother-in-law, Sir Francis Seymour Haden (1818–1910), the distinguished doctor, also took a prominent part in the revival of etching, and in his plates showed remarkable skill.

The same accomplishment marks the work of William Strang, A.R.A. (died 1921), who has produced many notable portraits of contemporary celebrities, including R. L. Stevenson and Thomas Hardy. Another artist of great technical skill, excelling in the use of drypoint, is Félicien Rops (1833–98), a Belgian, whose work is remarkable for its union of satire and licentiousness.

The most notable living etchers are chiefly found in England, and include Sir Frank Short, famous also for his mezzotints; D. Y. Cameron, a disciple of Whistler, though of marked individuality in his treatment of architecture; Muirhead Bone, whose architectural work is unrivalled and has inspired many followers; James M'Bey; and Augustus John, who stands apart from his contemporaries in his preference for figure subjects. In France, Jean-Louis Forain has produced some remarkable work, notably series dealing with the life of Christ, and with Lourdes, which show his satiric power and a very distinctive technique. *See* ENGRAVING.—BIBLIOGRAPHY: A. M. Hind, *A Short History of Engraving and Etching* (very complete and authoritative). For technical details, M. Lalanne, *Etching*; Paton, *Etching and Mezzotint Engraving*.

ETE'OCLES and **POLYNI'CES**, two heroes of ancient Greek legend, sons of Œdipus, King of Thebes. After their father's banishment from Thebes, Eteocles usurped the throne to the exclusion of his brother, an act which led to an expedition of Polynices and six others against Thebes. This war is known as the Seven against Thebes, and forms the basis of Æschylus's *The Seven against Thebes*. The two brothers fell by each other's hand. *See* ANTIGONE.

ETE'SIAN WINDS (Gr. *etos*, year), winds which, blowing over the Mediterranean regions from a general northerly direction during some weeks of the summer, replace the heated air that rises from the Sahara and other parts of Africa. By carrying with them moisture from the sea, they add greatly to the fertility of Egypt.

ETHANE (C_2H_6), a hydrocarbon belonging to the paraffin series. It is a colourless inflammable gas, and is found amongst the gaseous constituents of the Pennsylvanian oil-wells.

ETH'ELBERT, King of Kent, born about A.D. 560, died 616. He succeeded his father, Hermenric, and reduced all the English states, except Northumberland, to the condition of his dependents. Ethelbert married Bertha, the daughter of Caribert, King of Paris, and a Christian princess, an event which led indirectly to the introduction of Christianity into England by St. Augustine. Ethelbert was the first English king to draw up a code of laws.

ETHELBERT, King of England, son of Ethelwulf, succeeded to the government of the eastern side of the kindgom in A.D. 857, and in 860, on the death of his brother Ethelbald, became sole king. His reign was much disturbed by the inroads of the Danes. He died in 866.

ETH'ELRED I, King of England, son of Ethelwulf, succeeded his brother Ethelbert in A.D. 866. The Danes became so formidable in his reign as to threaten the conquest of the whole kingdom. Ethelred died in consequence of a wound received in an action with the Danes in 871, and was succeeded by his brother Alfred.

ETHELRED II, King of England, son of Edgar, born A.D. 968, succeeded his brother, Edward the Martyr, in 978, and, for his want of vigour and capacity, was surnamed *the Unready*. In his reign began the practice of buying off the Danes by presents of money. After repeated payments of tribute, he effected, in 1002, a massacre of the Danes; but this led to Sweyn gathering a large force together and carrying fire and sword through the country. They were again bribed to depart; but, upon a new invasion, Sweyn obliged the nobles to swear allegiance to him as King of England; while Ethelred, in 1013, fled to Normandy. On the

death of Sweyn he was invited to resume the government, and died at London in the midst of his struggle with Canute (1016).

ETH'ELWULF, King of England, succeeded his father, Egbert, about A.D. 837, died 857. His reign was in great measure occupied in repelling Danish incursions; but he is best remembered for his donation to the clergy, which is often quoted as the origin of the system of tithes. Alfred the Great was the youngest of his five children.

ETH'ENDUN, BATTLE OF, the victory which Alfred the Great gained over the Danes (878), and which led to the treaty with Guthrum, the Danish king of East England. The locality is doubtful.

ETHER, or **ÆTHER,** sometimes called *luminiferous ether* to prevent confusion with the well-known volatile liquid of the same name, a hypothetical medium filling the whole of what seems to be empty space, and even the interstices between the atoms of material bodies. Most thinkers believe that such a medium must be postulated if we are to explain the transmission of physical actions between bodies at a distance from one another.

With the exception of ordinary mechanical pressures and tensions, the simplest examples of influences that can pass across space are sound and light. Sound, we know, is carried by the air, a medium more subtle than solid or liquid bodies, but still easily recognizable by its effects on our senses, and by its mechanical, physical, and chemical properties.

We know a good deal about air, and about the process that goes on when sound is passing through it. But the ether is incomparably more elusive than air. It affects the sense of sight, indeed, as the air affects the sense of hearing; but, so far as we know, it has no weight, no specific heat, no chemical affinity. Except that it is the medium which conveys light, electric and magnetic actions and possibly gravitation, we know extremely little about it. An extreme school of modern physicists is even inclined to deny, or at least to ignore, its existence altogether.

Early speculators regarded the ether as a species of fluid, which could be displaced by ordinary matter, so that upholders of the wave theory of light necessarily thought of waves like those of sound, in which the direction of vibration is in the line of transmission, for no other kind of wave can occur in a fluid. Young and Fresnel, however, insisted on the view that the movements of the medium are at right angles to the direction of propagation, and pointed out that this might be explained by supposing the medium to possess elasticity of shape.

The obvious objection to the conception of a solid which permits the planets to move through it with apparently perfect freedom was met long afterwards by Stokes and Kelvin, who instanced such substances as shoemaker's wax and jelly, which are rigid enough to be capable of elastic vibration, and yet permit bodies to pass through them with more or less ease.

Fresnel's work called attention to the subject of the elasticity of bodies, and led to the discovery of the general equation of vibration of an elastic solid by Navier in 1821. Navier's equations, slightly generalized, were used by Cauchy with a certain amount of success to explain reflection, refraction, and the phenomena of crystal-optics.

In 1837 George Green published a variety of elastic solid theory which was a decided improvement on Cauchy's, but many difficulties remained, and it is now almost universally agreed that the vibrations of an ordinary elastic solid do not furnish an exact parallel to the vibrations which constitute light. One of the chief difficulties is that in an ordinary elastic solid two types of waves can occur, one distortional, with the displacement of a particle perpendicular to the direction of transmission, and the other dilatational, with the displacement along the line of transmission, as in sound. Waves of light must be of the distortional kind, and the velocity of the other kind of wave may be quite different from the velocity of light.

A kind of ether in which this difficulty of the longitudinal wave does not occur was imagined by Cauchy and afterwards discussed by Lord Kelvin, who called it the contractile, or labile, ether. This is an elastic body with negative compressibility, like homogeneous foam which is prevented from collapsing by attachment to the sides of a containing vessel.

Another type of quasi-elastic solid was brought forward by James MacCullagh in 1839. MacCullagh's solid possesses what may be called elasticity of rotation, but offers no resistance to deformations in which elementary parts of the solid preserve their orientation. The equations of motion of this ether devised by MacCullagh are very similar to those obtained much later from a very different physical point of view by Clerk Maxwell. Elastic solid theories, however, have fallen into the background before the advancing popularity of the electromagnetic theory of James Clerk Maxwell.

Maxwell's equations of the electro-

magnetic field are deduced from easily demonstrable experimental facts, supplemented by the characteristic hypothesis that the electric current always travels in a closed circuit, even in cases where, as in the discharge of a condenser, the material circuit is open, so that the path of the current has to be completed through the ether. Other essential features of Maxwell's view are that electric, magnetic, and electromagnetic action is transmitted by means of stresses in a medium which possesses some sort of elasticity and inertia not exactly of an ordinary mechanical kind, and that the energy of all such action resides in the medium.

'Maxwell's equations,' especially as modified by H. A. Lorentz so as to take account of the atomic structure of electricity, are fundamental in modern electro-dynamics and the electron theory of matter. The form of Maxwell's equations shows that electromagnetic action can be propagated in waves with a definite velocity, which depends on the specific inductive capacity and the magnetic permeability of the medium. Maxwell had no difficulty in showing from experimental data that the velocity given by his theory, which turns out to depend on the ratio of the electro-static and electro-magnetic units of charge, is identical with the known velocity of light. He concludes that waves of light are electric waves.

The actual production of waves by electrical means was experimentally demonstrated by Sir Oliver Lodge, and more completely by Heinrich Hertz, and is now a commonplace of wireless telegraphy and telephony. The question of the nature of the mechanical process by which physical actions are carried on in the ether weighed heavily on Maxwell, as on other nineteenth-century physicists. Mechanical models of many kinds have been devised to represent ethereal action. Were it sufficient for the purpose, certainly nothing could be simpler than the elastic solid model. Other models of much interest are the gyrostatic ether and the vortex sponge ether of Lord Kelvin, and the molecular vortex ether of Maxwell.

It is recorded that the celebrated mathematician Gauss had made out a theory of electro-dynamics, but always declined to publish it because he was unable to devise a mental picture of the physical action represented by his mathematics; and it was probably a similar reason that led Lord Kelvin to declare, so late as 1904, that "the electro-magnetic theory has not helped us hitherto."

Sir J. J. Thomson has developed a theory of moving tubes of electric force, which produce magnetic fields by their motion. Possibly light may consist of tremors in these tubes, and if the tubes are discrete, it may become practicable to reconcile the modern quantum theory (q.v.) with the phenomena of interference of light, with which at present it seems to be utterly inconsistent.

The extraordinary developments in both theoretical and experimental physics during recent years have diverted attention to some extent from the question of the constitution of the ether, and the problem of its mode of working is more frequently considered from a mathematical and pseudo-metaphysical point of view than from the old standpoint of Newtonian dynamics. It was from a question about the ether, however, that the theory of relativity, the most important of recent speculations, took its origin. Is the ether fixed, or does it move? Is it carried along with the earth in its motion round the sun, or does the ether pass through the atoms of material bodies as the sea passes through the meshes of a net? The elastic solid analogy, and the simplicity of the classical explanation of the aberration of light, are evidence in favour of a fixed ether. But the celebrated interference experiment of Michelson and Morley, which was capable of detecting a comparatively small relative velocity of earth and ether, gave a null result. Various electrical experiments also point to the conclusion that the medium in which optical and electrical effects take place is carried along with the earth in its motion. We are thus placed in a dilemma. We must either reconcile the idea of a fixed ether with the Michelson-Morley and kindred experiments, or we must explain aberration on the supposition that earth and ether move together. Both alternatives have had their supporters.

Those who, like Sir Joseph Larmor and Sir Oliver Lodge, believe in a fixed ether rely on the hypothesis of the 'Fitzgerald contraction,' according to which bodies moving through the ether with velocity v are contracted in the direction of their motion by the fraction $\sqrt{(1-v^2/c^2)}$ of their length, c being the velocity of light. This contraction is in ordinary cases very small, amounting only to a few inches for the diameter of the earth when moving round the sun. The hypothesis follows naturally enough from the accepted theory of the motion of electrons, and leads to a perfectly simple explanation of the Michelson-Morley result.

The most prominent champion of a moving ether was Sir George Stokes. He assumed that, so far as the earth's motion through it is concerned, the

ether behaves as a perfect liquid, so that it moves along with the earth, and he proved that aberration would be unaffected by this motion, provided it is everywhere irrotational, or free from spin.

Stokes's theory has been extended by Larmor so as to cover a very important set of phenomena found by Arago and Airy, and explained in a general way by Fresnel. These phenomena relate to the velocity of light in material media which are in motion relative to the earth, running water for example. Fresnel proved that all the experimental results are explained if the velocity of light in the water, with respect to the earth, is given by the formula $c'+v(1-1/m^2)$, where c' is the velocity of light in still water, v is the velocity of the water relative to the earth, and m is the index of refraction of water.

At present the fashionable view of all the phenomena is that taken in Einstein's theory of relativity (q.v.), which makes revolutionary suppositions with respect to the measurement of space and time, and assumes that the velocity of light is a universal constant, independent of the motion either of the source of light or of the observer. Once its initial assumptions are granted, the theory undoubtedly gives simple and natural explanations of the chief optical and electrical phenomena, and in particular leads at once to Fresnel's formula given above.

Most English writers on the subject, among whom A. S. Eddington, E. Cunningham, and A. N. Whitehead are prominent, continue to believe that an ether exists, in spite of the fact that as relativists they hold that no experiment can ever enable us to determine our motion through it.—BIBLIOGRAPHY: E. T. Whittaker, *History of the Theories of Æther and Electricity*; Sir Joseph Larmor, *Æther and Matter*; A. S. Eddington, *Space, Time, and Gravitation*; O. W. Richardson, *Electron Theory of Matter*; R. W. Wood, *Physical Optics*.

ETHER, or **ETHYL ETHER,** $(C_2H_5)_2O$, a colourless, inflammable liquid produced by distillation of alcohol with concentrated sulphuric acid. It is almost immiscible with water, lighter than alcohol, has a sweet taste, and evaporates rapidly in air, producing extreme cold. The vapour of ether mixed with air forms an explosive mixture. Ether is a valuable solvent for many organic substances, fats, oils, &c., and is also used in surgery as an anæsthetic.

ETHEREGE (eth'ê-rej), **Sir George,** English writer of comedy, born about 1635, died about 1691. He studied at Cambridge, travelled afterwards on the Continent, and then returned to enter himself at one of the Inns of Court. Devoting himself less to legal studies than to literature and society, he wrote several plays. In 1664 he had his first comedy represented, *The Comical Revenge, or, Love in a Tub*, which was well received. Four years later his *She Would if She Could* appeared, a brilliant play, though frivolous and immoral. Eight years afterwards (1676) he produced his best comedy, *The Man of Mode, or Sir Fopling Flutter*. Etherege's plays are witty and sparkling, and the characters, genuine portraits of the men and women he saw, are vividly if lightly drawn.

ETHICAL CULTURE. It has been said by a prominent leader of the movement for ethical culture that the one dogma admitted is the doctrine of personality. The movement eliminates from its teaching all hitherto received religions, admits no Christian symbolism, and acknowledges neither a personal Creator nor a personal Saviour. Christ is, however, highly reverenced as a man. The world as it *should be* is regarded not as an unattainable though beautiful ideal to be admired and longed for, but as a possible reality to be achieved by strenuous concerted action.

The means by which it is hoped to bring about this much-to-be-desired result is the reaction on each other of carefully selected and highly cultivated personalities. Such virtues, therefore, as kindness, pity, justice, charity, temperance, and chastity are deemed less necessary as a personal moral duty in each human being than as a means by which a perfect world may be attained. Man's duty is towards no divine being, but to his fellow-man. In place of that help from above which theologians deem needful to attain even a short step in the direction of perfection, the power of conscience is considered as sufficient for all needs, and disciples are counselled that they should

> More strictly, then, the inward judge obey,

since they no longer believe in divine anger or approval.

Germs of the movement may be found in many writers, and Emerson seems to have foreseen it when he said: "The mind of this age has fallen away from theology to morals. I conceive it to be an advance." But the obvious founder of ethical societies was Felix Adler (born 1851), who, in 1876, established in New York a Society of Ethical Culture. He also set in motion such useful work as training-schools, kindergartens, and nursing. In 1885 his associate, W. Salter, established the Chicago

Ethical Society. Both have written extensively on the subject; while English supporters of the movement include Sir Leslie Stephen, Sir J. Seeley, Professor Sidgwick, and others.

Several ethical societies exist in Britain, carrying out much educational and philanthropic work. There are both Sunday services and Sunday schools, and in many cases the branches are more or less closely affiliated with labour and its associations. With regard to this community of work and aim, it may be noted that while ethical culturists look forward to a time when no man shall exploit his fellow human beings for personal ends, absolute equality for all is not promised, being recognized as impossible. —BIBLIOGRAPHY: Felix Adler, *Creed and Deed*; W. M. Salter, *Ethical Religion*.

ETH'ICS, otherwise called *Moral Philosophy* or *Morals*, is the science which treats of the nature and laws of the actions of intelligent beings, considered as to whether they are *right* or *wrong*, *good* or *bad*. Its subject-matter is human conduct and character in view of a standard or ideal. It refers to constant elements in human nature, and, like æsthetics and logic, is of universal application.

The science is more or less closely connected with theology, psychology, politics, political economy, and jurisprudence, but what most strictly belongs to it is the investigation of the principles and basis of duty or the moral law, and an inquiry into the nature and origin of the faculty by which duty is recognized. Various answers have been given to the question why we call an action good or bad, such as that it is consistent or not with the will of God, or with the nature of things, or with the greatest happiness of the greatest number, or that an inward faculty decides it to be such or such; and a great variety of *ethical* systems has been proposed.

Ancient Ethical Systems. The foundations of the leading systems were laid in antiquity, the names of Socrates, Plato, Aristotle, Epicurus, the Cynics, and the Stoics being especially prominent. All the Greek philosophers, however, considered ethics from an individualistic standpoint, and paid little attention either to politics or to sociology. The introduction of Christianity brought a new element into ethical speculation, and among Christians ethics were intimately associated with theology, and morality was regarded as based on and regulated by a definite code contained in the sacred writings.

The speculations of the Greeks were not, however, disregarded, and some of the ablest Christian moralists (as Augustine, Peter Lombard, Erigena, Anselm, and Aquinas) endeavoured to harmonize the Greek theories with the Christian dogmatics.

Most modern ethical systems consider the subject as apart from theology and as based on independent philosophical principles, and they fall into one of two great classes—the utilitarian systems, which recognize as the chief good, happiness, or the greatest possible satisfaction of the tendencies of our nature; and the rationalistic systems, which recognize that ideas of law and obligation can have their source only in reason.

Utilitarianism has been rightly called universal hedonism, as distinguished from the hedonism of Epicurus, which was egoistic. The first of the modern Utilitarian school in England was Hobbes (1588–1679). Among subsequent names are those of Cudworth, Locke, Clarke, Shaftesbury, Butler, Hutcheson, Hume, Adam Smith, Reid, Paley, Whewell, Bentham, J. S. Mill, &c. Paley held that men ought to act so as to further the greatest possible happiness of the race, because God wills the happiness of men, and rewards and punishes them according to their actions, the divine commands being ascertained from Scripture and the light of nature.

Bentham's utilitarianism is considerably different from Paley's. It was entirely dissociated from theology or Scripture, and maintained that increase of happiness ought to be the sole object of the moralist and legislator, pleasure and pain being the sole test of actions. To utilitarianism as a special development belong the later 'evolution ethics' represented by Herbert Spencer, in which biological conceptions, such as 'the preservation of the human race,' take the place of the Benthamite criterion for determining what is good and bad in actions.

Rationalism. Another theory of ethics places the moral principle in the sentimental part of our nature, that is, in the direct sympathetic pleasure or sympathetic indignation we have with the impulses which prompt to action or expression. By means of this theory, which he treats as an original and inexplicable fact in human nature, Adam Smith explains all the phenomena of the moral consciousness.

In considering the ethical systems of the Rationalistic school, systems which recognize that the ideas of law and obligation can have their source only in reason, the question, what is the source of the laws by which reason governs, gives rise to a number of psychological theories, amongst which we may notice Clarke's view of the moral principles as rational intuitions or axioms analogous to those of mathe-

matics; Butler's theory of the natural authority of conscience; the position of Reid, Stewart, and other members of the later Intuitional school, who conceive a moral faculty implanted in man which not only perceives the 'rightness' or 'moral obligation' of actions, but also impels the will to perform what is seen to be right.

Very similar, as far as classification goes, is the position of Kant, who holds that reason recognizes the immediate obligation of certain kinds of conduct, and that an action is only good when done from a good motive, and that this motive must be essentially different from a natural inclination of any kind.—BIBLIOGRAPHY: H. Sidgwick, *The Method of Ethics*; A. C. Bradley, *Ethical Studies*; H. Spencer, *Principles of Ethics*; L. Stephen, *The Science of Ethics; The English Utilitarians*; W. Wundt, *Ethics*; J. Martineau, *Types of Ethical Theory*; A. Sutherland, *The Origin and Growth of the Moral Instinct*; E. Westermarck, *The Origin and Development of Moral Ideas*; W. R. Sorley, *The Moral Life*; C. Read, *Natural and Social Morality*.

ETHIOPIA, or **ÆTHIOPIA** (Heb. *Cush*), in ancient geography, the country lying to the south of Egypt, and comprehending the modern Nubia, Kordofan, Abyssinia, and other adjacent districts; but its limits were not clearly defined. It was vaguely spoken of in Greek and Roman accounts as the land of the *Ichthyophagi* or fish-eaters, the *Macrobii* or long-livers, the *Troglodytes* or dwellers in caves, and of the *Pygmies* or dwarf races.

In ancient times its history was closely connected with that of Egypt, and about the eighth century B.C. it imposed a dynasty on Lower Egypt, and acquired a predominant influence in the valley of the Nile. In sacred history Ethiopia is repeatedly mentioned as a powerful military kingdom (*see* particularly *Is.* xx, 5). In the sixth century B.C. the Persian Cambyses invaded Ethiopia: but the country maintained its independence till it became tributary to the Romans in the reign of Augustus. Subsequently Ethiopia came to be the designation of the country now known as Abyssinia (q.v.), and the Abyssinian monarchs still call themselves rulers of Ethiopia.

ETHIOPIAN LANGUAGE, THE, or more accurately the *Geez* language, is the old official and ecclesiastical language of Abyssinia, introduced into that kingdom by settlers from South Arabia. In the fourteenth century it was supplanted as the language of the Christian Church of Abyssinia by the Amharic. It is a Semitic language resembling Aramaic and Hebrew as well as Arabic. It has a Christian literature of some importance. The principal work is a translation of the Bible, including the Old and New Testaments and *Apocrypha*, to which are appended some non-canonical writings, such as the *Shepherd of Hermas* and the *Book of Enoch*. The language is to some extent represented by the modern dialects of Tigre, and by that spoken by some nomadic tribes of the Sudan. For the Ethiopian or Abyssinian Church, *see* ABYSSINIA and COPT.

ETH'MOID BONE (Gr. *ethmoeides*, like a sieve), a light spongy bone situated in the upper part of the cavity of the nose. The olfactory nerves pass upward through its numerous perforations to reach the brain.

ETHNOL'OGY AND ETHNOG'RAPHY, sciences dealing with man, the aim of the former being to analyse and interpret the meaning of the social phenomena of mankind, as shown in their customs, languages, institutions, &c., the latter being more concerned with descriptive details and the orderly collection of facts relating to particular tribes and localities.

Definition. Both terms, however, are used very loosely and in a variety of ways, often being confused with *anthropology*, the general science or natural history of mankind, of which the other two are parts. Anthropology, again, is sometimes used in the narrower sense implied in the word *somatology*, the study of the physical structure and distinctive characteristics of the various races of mankind. When the term ethnology is used by the politician or journalist, in most cases it is intended to refer to the racial components in a given territory; in other words, it is used in the sense in which the scientific writer would employ the word anthropology.

For instance, when the endeavour was made in the earlier part of the nineteenth century to liberate the Greeks from Turkish dominion, the plea was put forward that they differed in race; and the delimitation of the territory of the Greek state was claimed on what was called 'the ethnological basis,' the geographical distribution of people of Greek nationality. Even since then, and especially during the European War and the subsequent attempt at a settlement, claims have been put forward to fix the boundaries of Italy, Yugo-Slavia, Czecho-Slovakia, Poland, &c., on the basis of race and nationality.

But further confusion arises from the attempt to apply this anthropological or ethnological test in deciding whether physical type, language, religion, or social traditions and usages are to be the test of nationality. In

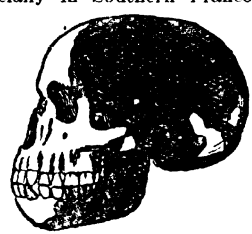
this article it will be convenient to give the term enthology its widest meaning, and to consider not merely the customs, beliefs, and institutions of various peoples, but also the early history of the human family, its differentiation into races and the significance of their geographical distribution, and the different phases of culture which are found in the various communities even of the same race.

Early Man. During the last eighty years the discovery of a series of fossilized remains of extinct genera and species of the human family and of apes has given us a glimpse of the origin and early history of mankind. Man's ancestors probably parted company with those of the anthropoid apes somewhere in the neighbourhood of Northern India early in the Miocene period; and before the close of the Pliocene period their descendants had gradually acquired the highly developed brain and the intelligence which imply the emergence of the distinctively human characteristics. The most significant token of the attainment of the status of men was the acquisition of the power of speech, which enabled its possessors to hand on the accumulated knowledge and the fruits of experience, and so enormously to increase their powers.

The earliest known representative of the human family was the Ape-man *Pithecanthropus*, who at the end of the Pliocene period wandered east as far as Java, where the fossilized remains of a skull were found thirty years ago by Professor Eugen Dubois. At a later date a much more highly developed type, one, moreover, that was much closer to the ancestry of modern men than the aberrant Ape-man of Java, wandered as far west as England, where a representative of this extinct genus was discovered by the late Mr. Charles Dawson in 1912 at Piltdown, in Sussex. This very primitive member of the human family has been called the 'Dawn-man' or *Eoanthropus* by Dr. Smith Woodward. He has a brain which, though poorly developed, is definitely human, but his face (and especially the jaws) retains considerable resemblance to that of an ape.

Of the other fossilized remains of extinct varieties of the human family, the most important are those known respectively as Heidelberg man and Neanderthal man. The former is almost as old as the Piltdown man, and its former existence was revealed by the discovery in the Mauer Sands, near Heidelberg, in 1908, of a very massive and chinless jaw. At a much later date Europe was inhabited by a brutal species of mankind, Neanderthal man, which became extinct when in the Neoanthropic Age men of our own species made their way into Europe and completely superseded the less efficient Neanderthal species. The latter were men of vast strength, with short, clumsy, thick-set limbs, a stooping gait, thick neck, and a great flattened head with a coarse face.

Homo Sapiens. These people inhabited Europe in the days when the elephant and the woolly rhinoceros lived there; they made the rough stone implements known as Mousterian. But in spite of their enormous strength, these people were not able to hold their own in competition with the nimbler wits and the more skilled hands of *Homo sapiens*, who introduced into Europe a more finished technique in making implements, and revealed his genius and manual dexterity in the remarkable pictures which he painted on the walls of caves, especially in Southern France and



The Piltdown Skull

Northern Spain. We have no information concerning the place of origin or the course of the wanderings of these earliest members of our own species.

Australian Aborigines But an extremely primitive race has survived until the present time to demonstrate the original type of *Homo sapiens*. The aboriginal Australian, like all existing races of men, belongs to the same species as ourselves, but it represents with singularly little modification the original type and colouring of *Homo sapiens*. Fossilized remains of the proto-Australian race have been found in Queensland (at Talgai) and in Java (at Wadjak); but the wandering of the race from its original Asiatic centre of characterization is indicated by the survival of remnants of this people in the pre-Dravidian jungle tribes of India (mainly in the Deccan), the Vedda of Ceylon, the Sakai of the Malay Peninsula, the Toala of Celebes, and other peoples of the Malay Archipelago, whose existence blazes the track from India to Australia.

The Australian race is on the average about 5 feet 2 inches in height; their skin is dark-brown or black; hair black and wavy or curly; skull typi-

cally long (dolichocephalic), with a relatively small brain-case; the nose is flat and broad, and the jaws large and prominent. What lowly culture these people now possess has been mainly acquired within relatively recent times by contact with more civilized peoples.

Negro and Negroid Races. Long after the proto-Australians separated from the rest of mankind and wandered east, another group wandered west, and, probably in tropical Africa, became specialized in structure to become the Negro race. The negro, like the Australian, retains many primitive characters, such as the black



Australian Aborigine, from the east side of Lake Eyre

skin and the small brain, but in other respects, such, for example, as the extremely flattened and curved hair ('pepper-corns'), he has become highly specialized and sharply differentiated from all other varieties of mankind.

At an early period in the history of the race the negro divided into two groups—a pygmy variety or Negrillo, and the ordinary tall negro. One of the branches of the pygmy stock became further specialized in structure (in the course of which the black colour of the skin was lost), and became the Bushman race which has gradually been pushed into the deserts of South Africa (*see* HOTTENTOT).

After the differentiation of the Negro race into pygmy and tall varieties, representatives of both divisions spread along the southern coast of Asia, the former, known in the East as Negritos, reaching the Andaman Islands, the Malay Peninsula (Semangs), the Philippines (Aetas), and New Guinea (Pygmies), and the taller Negroids to Melanesia, New Guinea, and the neighbouring islands of the Malay Archipelago. Many authorities regard the extinct Tasmanian people as a branch of this race.

But the vast majority of the Negro race is found in Africa south of the Sahara Desert and the populations sprung from them in the American continent and the West Indies.

The African negro is subdivided into two main groups known respectively as Nilotic and Bantu; but in addition there are the pygmies of the equatorial and Congo regions, and the Bushmen and Hottentots of the Kalahari Desert, Namaqualand, Lake Ngami, and the Orange River.

The Nilotic negro ranges across the continent from Somaliland to Nigeria, and is differentiated from the Bantu chiefly from the fact that along this belt there has been a constant passing to and fro of Hamitic and Semitic peoples for many centuries, leading not only to very considerable recent racial admixture, but also to cultural and especially linguistic influences, which have brought about the breaking up of the population into a series of nations of varied speech and customs.

Among the Bantus, on the other hand, although their culture is lower than that of the Nilotic negroes, there is more uniformity both of race and customs. In race they are negro mixed in early times with the proto-Hamitic peoples of East Africa, whence the mongrel population moved south, driving the Bushmen and Hottentots before them.

Development of Racial Characteristics. After the ancestors of the Australian and Negro races had separated from the rest of mankind, which had spread throughout a great part of Asia, North-Eastern Africa, and Europe, the coming of the Glacial epoch created barriers of ice which shut up the various groups each within its own domain. Somewhere in Eastern Asia, possibly in the basin of the Yellow River, the proto-Mongolian race gradually assumed its characteristic traits. In East Africa and the neighbouring tract of Asia the ancestors of the Brown or so-called Mediterranean race were free to roam east and west from India to the African and European coasts of the Atlantic. Farther north, probably in Europe, the Nordic or Blond race

(in the map labelled Northern or Teutonic race) assumed its distinctive features; and somewhere in the region between its area of characterization and that of the yellow race—probably in the region to the north-east of the Caspian—the so-called Alpine (Armenoid) or proto-Slav race developed.

It is distinguished from the Brown and Blond races by the broad skull and heavy jaw, no less than by the robustness of build and the great tendency to hairiness; from the Mongolian people the Armenoids are distinguished by the prominence of the nose, the character of the hair, and the colour of the skin. The term Alpine, which is usually applied to this race, is singularly inappropriate; for, although in Europe and Asia Minor the members of this race show a partiality for high mountains, the vast majority of the members of the race dwell in the plains of Russia, which also may have been the original home of the race.

In view of the topographical relationship of the area of characterization of this race to the homes of the other races, Nordic, Brown, Negro, Australian, and Mongol, arranged in a great arc around it, it might not be inappropriate to call the so-called Alpine (Armenoid or proto-Slav) race by the non-committal title 'Central.' At the close of the Glacial epoch, when the melting of the ice unlocked the domains of these races, members of the Central race poured into Asia Minor and Syria, and down to the head of the Persian Gulf; they also made their way north of the Caspian and Black Sea into Europe, mingling there with the Nordic people. But they also moved east in Siberia and mingled with the proto-Mongolian race.

It was soon after this event that members of the proto-Mongolian stock, possibly with some admixture of people of the Central race, wandered to North-Eastern Asia and crossed the Bering Strait to colonize America for the first time. From the north-west coast of America these immigrants in course of time made their way south and east, until eventually the whole of the New World from Hudson Bay to Cape Horn was inhabited.

Many centuries afterward (especially between 300 B.C. and A.D. 1000) there was a great influx of a variety of other peoples from Polynesia and the Old World on to the Pacific coast of the Americas, which profoundly altered the physical type of the population of Central America and the Andean coast.

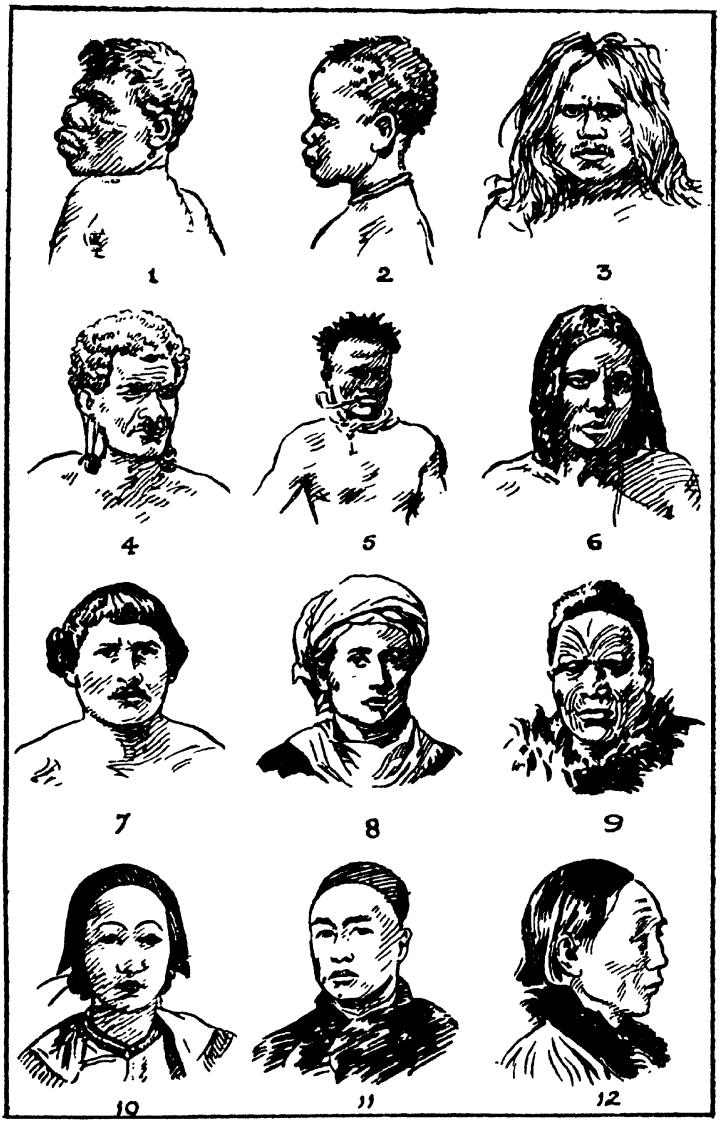
The Mongol Race. The members of the proto-Mongolian race who remained in Asia spread over a large area from the Arctic Ocean south to Tibet, China, Indo-China and the Malay Archipelago, the Philippines, Formosa, Nicobar Islands, and Madagascar. Their domain became divided geographically into three minor areas of characterization, of the Northern, Southern, and Oceanic Mongols respectively. In the Northern Mongols are included the Koreans, the Japanese and the people of Liu-Kiu, the Tungus (including the Manchu, Gold, &c.), the Kalmuks, Buriats, Koryaks, Chuckchis, Kamchadales, Gilyaks.

The Central Race. The Central race became differentiated into a considerable number of varieties. Apart from the Slavs, there were several groups which became isolated the one from the other in Asia Minor and Syria. One of these developed in an extreme degree the characteristic features of the race—the brachycephaly, the prominence of the nose and the high-ramus of the jaw. These are the Armenian and kindred people. Another branch gave origin to the Northern Semites, who made their way into Palestine and Mesopotamia. (The Southern Semites belong to another race—the Brown.) Another branch of the Central race preceded these two in making their way to the sea-coasts of the Levant and the Persian Gulf—this may be called the Maritime branch of the Central race.

The Slav branch of the Central race was making its way into Europe long before the Neolithic phase of culture there. It passed north of the Black Sea via Poland. But at the end of the Neolithic phase there were two streams of other branches of the race—the true Alpine subdivision passing from Anatolia into the Carpathians and the Alps to Switzerland, Bavaria, Savoy, and Brittany, and the Maritime division passing round the coasts to the Iberian Peninsula, the British Isles, and Western Europe.

The Brown Race. The Brown race spread in East Africa from Somaliland to the Mediterranean and all its coasts, to Western Europe, and the British Isles; in the other direction to Arabia, the shores of the Persian Gulf, and eastward along the coast to India, where it mingled with the pre-Dravidian (proto-Australian) population to give rise to the mongrel Dravidian people. The spread of these Brown people farther east into the Malay Archipelago explains the origin of the Indonesians, who occupied the islands before the coming south of the Mongols, but after the proto-Australians and the proto-Negroes had passed through towards Australia and Melanesia respectively.

From very early times there has been an intermingling of the different



ETHNOLOGY

1. Australian
2. Akka Pygmy (Negrillo)
3. Vedda, Full-face (Pre-Davidian)
4. Solomon Islander (Melanesian)
5. Andaman Islander (Negrito)
6. Nubian Girl
7. Carib (Southern American)
8. Javanese (Oceanic Mongol)
9. Maori (Polynesian)
10. Chinese Lady (Southern Mongol)
11. Chinaman (Southern Mongol)
12. Kalmuk (Northern Mongol)



ETHNOLOGY

1. Vedda, Profile (Pre-Davidian)
2. Papuan
3. Bushman
4. Touareg (Western Hamite)
5. Zulu (Bantu)
6. Somali (Ethiopian Hamite)
7. Sikh (Indo-Aryan)
8. Eskimo
9. Lapp (Mongoloid
10. North American Indian
11. Turk
12. Arab (Semite)

races. In East Africa every degree of intermingling of the Hamatic branch of the Brown race has been taking place for more than sixty centuries with negroes, both of the Sudanese and the Bantu stocks. At a later time Arabs poured into Africa and added their quota to the mixture. In India the original pre-Dravidian (proto-Australian) aborigines became diluted with a large influx of the Brown race to form the Dravidian people, who acquired a high civilization from the west. At a later date people of the Central race speaking an Aryan language swarmed through the north-western frontier and introduced their language and culture into India.

Before this happened the Brown race had extended farther east and provided the basis for the population of Indonesia, supplanting to a great extent the earlier proto-Australian and Negroid peoples there. Then the Malays came down from the north and added to the Indonesian mixture a strong Mongolian element. Colonists from the Malay Archipelago settled in Madagascar and added to its mixture of Brown (Semites and Hamites) and Black (Bantu) elements representatives of the Mongolian (Malay) race. In the course of their maritime expeditions the Malay Archipelago gave to Japan a not inconsiderable contribution both of people and culture.

Racial Admixture in Siberia. But the area of the most complex admixture of races in ancient times was Siberia. With the melting of the ice barriers at the close of the Glacial epoch the proto-Mongolian and proto-Central peoples came into intimate contact; and to this mixture was added a proto-Nordic element, as well as a not inconsiderable influx of members of the Brown race, who came from the south through Turkestan to exploit the gold and copper of the Yenesei region.

The presence of their dolichocephalic skulls in a region where brachycephaly is the rule has been a perpetual puzzle to anthropologists, who at the present time attempt to solve the problem by assuming the presence of an aboriginal race of long-headed people, who were exterminated by the Mongols and the Turks.

The greed for the riches of the headwaters of the Yenesei has made Siberia the home of strife for fifty centuries. This has led not only to a puzzling admixture of races in the affected area, but has started raids of Mongols and Turks, which at various times extended as far as Europe (Huns and Avars), India, and China.

So mixed are the races in Siberia that it is not easy to determine whether some of them should be classed as mainly Turki or mainly Mongol; and this applies also to the colonies (Bulgars, Magyars, Finns, Lapps, &c.) which at various times the Asiatic invaders left behind them in Europe, each of which has been profoundly altered by admixture since then.

In the great Mongolian domain that occupies so great a part of Northern and Eastern Asia there are certain definitely alien elements. The Yakuts (of the region near the Lena River) are definitely Turki in race, and the curious hairy Ainus (of Yezo, Sakhalin, and some of the Kurile Islands) are certainly members of the Central race.

American Races. A peculiar branch of the northern Mongols is clearly differentiated from the rest to form the Eskimo people who occupy Greenland and Arctic America. They present a marked contrast to the American Indians. The American Indian may be regarded essentially as a branch of the proto-Mongolian race mixed to some extent with a proto-Central element. But on the Pacific littoral there has been considerable admixture with a variety of peoples from Eastern Asia and Oceania for several centuries (*c.* 300 B.C. to A.D. 1000). Although the peoples conform on the whole to a definite type as regards the characters of their hair and features, there is a considerable range of variation as regards height, skull-form, and other racial features.

The people of the states where a high civilization prevailed ten centuries ago —Mexico, Central America, Peru, and Chile—are clearly differentiated from the rest of the American population by the more obtrusive evidence of admixture with Polynesian and Asiatic peoples.

In addition to the peoples of the north-west coast (Haidas and Salish) and of the ancient civilizations (Mayas and Aztecs) of Central America and Mexico, the population of North America can be divided into the following tribes: (1) Athabascan, (2) Algonquin, (3) Iroquoian, (4) Siouan, (5) Shoshonean, (6) Muskhogean, and (7) Pueblo (in Arizona, north of Mexico).

In South America the centre of the ancient civilization was in the region of the Quichua (Inca) and Aymara peoples. The semi-civilized Chibcha people occupied the table-land of Bogota.

To the south of Peru the coastal people (Araucanians) were to some extent influenced by the more highly civilized Incas to their north. The presence of gold in the Matto Grosso region of Brazil attracted men from Peru, and set in motion migrations of people towards the Rio de la Plata in the south and towards Venezuela in

the north. Among the linguistically distinct peoples found in the latter area are the Tupi, Arawaks, and Caribs. A very primitive people, the Botocudo, occupy the eastern coast of Brazil south of the River San Francisco.

Growth of Civilization. From the beginning man was a maker of implements of stone and bone; but for a vast number of centuries he was merely a hunter who did not attempt anything more in the way of industry. Civilization probably originated in the Nile Valley when men found barley growing there naturally, and discovered that it provided them with a supply of food which could maintain them throughout the year. When the population in the valley increased, so that the natural supply of barley became inadequate, men learned to imitate the inundation, and by scraping channels in the sand to render the desert fertile.

Thus was agriculture and irrigation invented, and thus were men led to organize the labour of the community under the direction of a leader who was primarily an irrigation engineer, but eventually became a king and the god Osiris, the dead king, whose reputation as the bestower of life-giving water became apotheosized as the giver of life and immortality.

Pottery was probably invented as an outcome of the mode of life and the needs of these early agriculturists, and the domestication of cattle and the use of their milk for food helped to neutralize the ill-effects of a too exclusively cereal diet. Other events followed in the train of this first adoption of a settled mode of life. The disposal of the dead in the sands that fringed the area of cultivation, and the natural preservation of the corpse that often resulted, shaped the beliefs of the people with reference to the fate of the dead. Incidentally it led to the invention of the arts of the carpenter, the stonemason, and the embalmer; and as an outcome of these practices architecture, as well as the ritual of the temple, had its origin.

Early Beliefs and Practices. Long before these events primitive man had begun to ponder over the meaning of death. At first he associated it with such injuries as he had learned by experience killed animals that he hunted; and as the escape of blood caused unconsciousness and death, he framed the belief that blood was the substance of consciousness and of life. To exchange blood was to share knowledge; to give blood was to confer fresh vital substance, i.e. to minimize the risk of extinction or prolong the existence of living or dead. This is the fundamental idea underlying all religious belief and ritual—the giving of life and immortality.

But the act of birth is also a process of life-giving. The cowrie-shell (and subsequently other shells and the pearls contained in them) came to be regarded as a symbol of this life-giving power, and an amulet which could protect both the living and the dead from the risk of extinction. The demand for these precious elixirs of life became so intense that they acquired a fictitious value as currency, and models of them were made to serve as amulets in their stead.

The beauty and the lightness of the models of such shells made of the soft useless plastic metal found in the Egyptian and Nubian deserts was probably the means by which gold first acquired any value, and afterwards by confusion came to be credited with the



Egyptian

same life-giving attributes as were at first bestowed merely upon the form of the amulets made from it. Thus gold came to be regarded as an elixir of life, and men began to search for the precious substance far and wide, incidentally spreading abroad the germs of the arts and crafts, the beliefs and practices of our common civilization.

The use of malachite as a cosmetic provided the circumstances that eventually led men to discover how a gold-like substance, copper, could be obtained from the green ore; and in course of time it came to be realized that the metal was useful for other purposes than the mere making of amulets and jewellery. When the full value of copper as a material for making tools and weapons was fully appreciated, the ore became of tremendous economic importance, and men sought for it far and wide, as they had previously prospected for flint and gold.

Diffusion of Primitive Culture. The people who introduced the Neolithic culture into Europe brought with them from Egypt a knowledge of agriculture, of pottery-making, of domestication of animals, of linen, and of the characteristic burial customs and religious beliefs. But these rudiments of civilization were also diffused

to Crete and Cyprus, to Syria and Asia Minor, to Elam and Sumer by prospectors searching for the things which the growth of civilization was making valuable, the incense and the timber, the gold and precious stones, the copper and other metals.

It is probable that the germs of Egyptian civilization were first planted in Elam by men prospecting for copper, and that Sumerian and Babylonian civilization received their initial inspiration in this way. Crete was inoculated with the germs of civilization by Egypt directly, as well as indirectly, from Asia Minor, which was subjected to the double influence of Egyptian and Sumerian culture. In the Age of Copper, Elamite culture was diffused abroad by miners to Turkestan and Baluchistan, thence respectively to Siberia and China (Shensi province), and to India.

In the neighbourhood of the south-eastern corner of the Caspian the alloy bronze was probably invented soon after 3000 B.C. by mixing tin and



Assyrian

copper; and the influence of this epoch-making event rapidly spread to Babylonia, to Crete, and to Europe, where it inaugurated the Age of Bronze. It also spread to China, to India, and many centuries later across the Pacific to Central America.

Early Migrations. The needs of the early Egyptians compelled them to devise sea-going ships, which in turn became the models of the Cretans, the people of East Africa, the Babylonians, the Phœnicians, and the Greeks. These ships trafficked in the Eastern Mediterranean and the Red Sea, then farther west and east, to the Atlantic seaboard of Western Europe and the shores of the Indian Ocean. The search for gold and pearls led early mariners to Southern India and Ceylon, to Burmah and Indonesia, to the whole coast-line of Eastern Asia, New Guinea, and Melanesia, and in course of time to Polynesia, and the coasts of Central America and Peru.

Wherever these adventurers found gold or copper, pearls or precious stones, they settled to exploit these sources of wealth, and incidentally planted the germs of their methods of cultivation, their stonework, their burial customs and beliefs. Such expeditions were probably responsible for introducing into Polynesia its first colonists, a mixture of people of Brown and Maritime Central races, mingled with other elements in the course of their easterly wanderings.

The earliest movement into Polynesia apparently took with it a considerable element of Melanesian blood, which eventually was carried to New Zealand and the Moriori Islands in the south, and to Easter Island and the American coast in the east. The germs of the ancient civilizations of Central America and Peru were carried across the Pacific from Cambodia and Indonesia between the years 300 B.C. and A.D. 1000, the periods of greatest activity being probably the third and fourth centuries A.D.

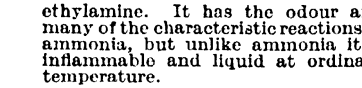
The elements of this imported culture were planted in Honduras and Guatemala and the Isthmus region (Costa Rica, Panama, and Colombia), and from there spread in the fifth century A.D. to Yucatan and then to Mexico. It also spread from the isthmus down the Pacific littoral of South America, the earliest centre of civilization being the region around Lake Titicaca.

From Mexico the culture spread in a degraded form up the Mississippi to the Great Lakes, as well as north-west into Arizona.—BIBLIOGRAPHY: A. H. Keane, *Man, Past and Present*, revised edition by A. Hingston Quiggin and A. C. Haddon, is a useful guide to the literature of anthropology and ethnology; *see also* Robert Munro, *Prehistoric Britain*; W. J. Sollas, *Ancient Hunters and their Modern Representatives*; M. Boule, *Les Hommes fossiles*; G. Elliot Smith, *The Migrations of Early Culture*; such periodicals as the *Journal of the Royal Anthropological Institute*, *Man*, and especially *L'Anthropologie*, give the current literature.

ETH'YL, the name given to the radicle C_2H_5, contained in ether, $(C_2H_5)_2O$, alcohol, C_2H_5OH, &c. *Ethyl* has not been isolated, as it immediately combines with another *ethyl* group forming diethyl or butane, $C_2H_5 - C_2H_5$. *Ethyl chloride*, C_2H_5Cl, formed by the action of hydrochloric acid on alcohol, is much used for the production of low temperature—as a local anæsthetic. *Ethyl nitrate*, $C_2H_5NO_3$ constitutes *sweet spirits of nitrate* when dissolved in alcohol.

ETH'YLAMINE, $C_2H_5NH_2$, an organic base formed by the substitu-

tion of 1 atom of hydrogen in ammonia by ethyl group. Thus



ethylamine. It has the odour and many of the characteristic reactions of ammonia, but unlike ammonia it is inflammable and liquid at ordinary temperature.

ETH'YLENE, or **OLEFIANT GAS,** C_2H_4, an unsaturated hydrocarbon, the first member of the olefine series. It is a colourless gas with a faint odour, and burns with a bright luminous flame. It is a constituent of ordinary coal-gas, and may be obtained from alcohol by heating it with twice its volume of concentrated sulphuric acid.

ÉTIENNE (ā-ti-ān), **ST.,** a town of Southern France, department of Loire, on the Furens, 32 miles S.W. of Lyons. It has spacious streets with substantial houses, but, owing to the number of public works, presents a dingy appearance. The principal buildings and institutions are the cathedral, an ancient Romanesque structure; the town house, court-house, exchange, communal college, mining school, gallery of arts, library, and museum.

The town stands in the centre of one of the most valuable mineral fields of France; and in addition to the extensive collieries, blast-furnaces, and other ironworks in the vicinity, has manufactures of ribbons, silks, cutlery, and fire-arms. Pop. 191,088.

ETIOLATION (Fr. *étioler,* to blanch), or **BLANCHING,** of plants, is a state produced by the absence of light, by which the green colour is prevented from appearing. It is effected artificially, as in the case of celery, by raising up the earth about the stalks of the plants; by tying the leaves together to keep the inner ones from the light; by covering with pots, boxes, or the like, or by setting in a dark place.

The green colour of etiolated plants may be restored by exposure to light. Etiolated plants are also abnormal in other respects; the stems, or in some cases the leaves, become extraordinarily elongated, and the internal structure undergoes modification in various ways.

ETIOLOGY (Gr. *aitia,* cause, and *logos,* discourse, account), a biological term introduced by Huxley, and denoting that branch of biology which deals with the origin and mode of development of organic beings. In medicine the word *etiology,* signifies the study of the causes and origin of disease. The term is also applied in philosophy to the science of Cause and Effect.

ETIVE (et'iv), **LOCH,** an inlet of the sea on the west coast of Scotland, Argyleshire, nearly 20 miles long, of very unequal breadth, but at the broadest part about 1¼ miles. The scenery of its shores is very beautiful. About 3 miles from the sea, at Connel Ferry, a ridge of sunken rocks crossing it causes a turbulent rapid, which at half-tide forms a sort of waterfall.

ETNA, or **ÆTNA, MOUNT,** the greatest volcano in Europe, a mountain in the province of Catania in Sicily; height, 10,758 feet. It rises immediately from the sea, has a circumference of more than 100 miles, and dominates the whole north-east part of Sicily, having a number of towns and villages on its lower slopes. The top is covered with perpetual snow; midway down is the woody or forest region; at the foot is a region of orchards, vineyards, olive groves, &c.

Etna thus presents the variety of climates common to high mountains in lower latitudes, oranges and lemons and other fruits growing at the foot, the vine rather higher up, then oaks, chestnuts, beeches, and pines, while on the loftiest or desert region vegetation is of quite a stunted character.

A more or less distinct margin of cliff separates the mountain proper from the surrounding plain; and the whole mass seems formed of a series of superimposed mountains, the terminal volcano being surrounded by a number of cones, all of volcanic origin, and nearly 100 of which are of considerable size.

The different aspects of the mountain present an astonishing variety of features—woods, forests, pastures, cultivated fields, bare rocky precipices, streams of lava, masses of ashes and scoriæ, as also picturesque towns and villages. From the summit the view presents a splendid panorama, embracing the whole of Sicily, the Lipari Islands, Malta, and Calabria.

The eruptions of Etna have been numerous, and many of them destructive. That of 1169 overwhelmed Catania and buried 15,000 persons in the ruins. In 1669 the lava spread over the country for forty days, and 10,000 persons are estimated to have perished. In 1693 there was an earthquake during the eruption, when over 60,000 lives were lost. One eruption was in 1755, the year of the Lisbon earthquake. There were also eruptions in 1832, 1865, 1874, 1879, and 1886.

Among more recent eruptions are those of 1892, 1899, 1911, and 1914. An eruption is ordinarily preceded by premonitory symptoms of longer or shorter duration. The population of the district of Etna is about 300,000.

E'TON, a town of England, in

Buckinghamshire, on the left bank of the Thames, 22¼ miles west of London. An iron bridge connects it with Windsor, on the opposite side of the river. Eton derives its celebrity wholly from its college, called the King's College of Our Lady of Eton beside Windsor, one of the great public schools of England, founded by Henry VI in 1440. The building, which was commenced in 1441 and finished in 1523, has received important additions in recent times in the shape of mathematical and science schools, and a museum. The college foundation now consists of provost, headmaster, lower master, seventy scholars, and two conducts (or chaplains). The oppidans, or boys not on the foundation, number about 1,100. They are mostly lodged and boarded in the masters' houses. Pop. (1931), 2,005.

ETRÉPILLY, (1) a small town of France, department of Aisne, is situated near Château-Thierry. Millstones are obtained from quarries in the neighbourhood. (2) A small town of France, department of Seine-et-Marne, stands on the left bank of an affluent of the Marne. Agricultural implements are manufactured.

ETRETAT, watering place of Normandy. It stands on the English Channel 16 miles from Havre. The attractions include a casino, gardens and bathing. Pop. 2,020.

ETRU'RIA (Gr. *Tyrrhenia*), the name anciently given to that part of Italy which corresponded partly with the modern Tuscany, and was bounded by the Mediterranean, the Apennines, the River Magra, and the Tiber. The name of Tusci or Etrusci was used by the Romans to designate the race of people anciently inhabiting this country, but the name by which they called themselves was Rasena (or perhaps more correctly Ta-rasena).

History. These Rasena entered Italy at a very early period from the north, and, besides occupying Etruria proper, extended their influence to Campania, Elba, and Corsica. Etruria proper was in a flourishing condition before the foundation of Rome, 753 B.C. It was known very early as a confederation of twelve great cities, each of which formed a republic by itself. Amongst the chief were Veii, Clusium, Volsinii, Arretium, Cortona, Falerii, and Faesulæ; but the list may have varied at different epochs. The chiefs of these republics were styled *lucumônes*, and united the office of priest and general. They were elected for life. After a long struggle with Rome, the Etruscan power was completely broken by the Romans in a series of victories, from the fall of Veii in 396 B.C. to battle at the Vadimonian Lake (283 B.C.).

The Etruscans had attained a high state of civilization. They carried on a flourishing commerce, and at one time were powerful at sea. They were less war-like than most of the nations around them, and had the custom of hiring mercenaries for their armies.

Language and Religion. Of the Etruscan language little is known, although about 6,000 inscriptions have been preserved. It was written in characters essentially the same as the ancient Greek.

The Etruscans were specially distinguished by their religious institutions and ceremonies, which reveal tendencies gloomy and mystical. Their gods were of two orders, the first nameless, mysterious deities, exercising a controlling influence in the background on the lower order of gods, who manage the affairs of the world. At the head of these is a deity resembling the Roman Jupiter (in Etruscan *Tinia*). But it is characteristic of the Etruscan religion that there is also a Vejovis or evil Jupiter. The Etruscan name of Venus was *Turan*, of Vulcan *Sethlans*, of Bacchus *Phuphluns*, of Mercury *Turms*.

Arts and Crafts. Etruscan art was in the main borrowed from Greece. For articles in terra-cotta, a material which they used mainly for ornamental tiles, sarcophagi, and statues, Etruscans were especially celebrated. In the manufacture of pottery they had made great advances; but most of the painted vases popularly known as Etruscan are undoubtedly productions of Greek workmen. The skill of the Etruscans in works of metal is attested by ancient writers, and also by numerous extant specimens, such as necklaces, ear-rings, and bracelets. The bronze candelabra, of which many examples have been preserved, were eagerly sought after both in Greece and Rome. A peculiar manufacture was that of engraved bronze mirrors. These were polished on one side, and have on the other an engraved design, taken in most cases from Greek legend or mythology.

The Etruscans showed great constructive and engineering skill. They were acquainted with the principle of the arch, and the massive ruins of the walls of their ancient cities still testify to the solidity of their constructions. Various arts and inventions were derived by the Romans from the Etruscans.—BIBLIOGRAPHY: G. Dennis, *Cities and Cemeteries in Etruria*; Seymour, *Up Hill and Down Dale in Ancient Etruria*.

ETRURIA, a village of England, in Staffordshire, in the city of Stoke-on-Trent, famous as the place where Josiah Wedgwood established his pottery works in 1769.

ETRURIA, KINGDOM OF, in Italy, founded by Napoleon I in 1801. Its capital was Florence. In 1807 Napoleon incorporated it with the French Empire.

ETRUSCAN VASES, a class of beautiful ancient painted vases made in Etruria, but not strictly speaking a product of Etruscan art, since they were really the productions of a ripe age of Greek art, the workmanship, subjects, style, and inscriptions being all Greek. They are elegant in form and enriched with bands of beautiful foliage and other ornaments, figures and similar subjects of a highly artistic character.

One class has black figures and ornaments on a red ground—the natural colour of the clay; another has the figures left of the natural colour and the ground painted black. The former class belong to a date about 600 B.C., the latter date about a century later, and extend over a period of about 300 or 350 years, when the manufacture seems to have ceased.

During this period there was much variety in the form and ornamentation, gold and other colours besides the primitive ones of black and red being frequently made use of. The subjects represented upon these vases frequently relate to heroic personages of the Greek mythology, but many scenes of an ordinary and even of a domestic character are depicted.

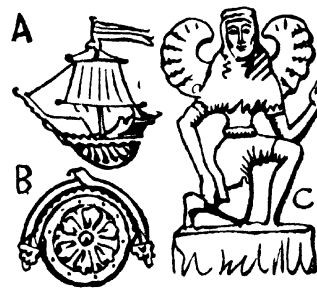
The figures are usually in profile: temples are occasionally introduced;



Etruscan Pottery

and many curious particulars may be learned from these vase pictures regarding the Hellenic ritual, games, festivities, and domestic life.

ETT'RICK, a pastoral district of Scotland, in Selkirkshire, watered by the Ettrick, and anciently part of Ettrick Forest, which included Selkirk with parts of Peebles and Edinburgh. The Ettrick receives the Yarrow 2



A: Shin motive in Etruscan jewellery. B: Etruscan Jewellery. C. Female Figure.

miles above Selkirk, and enters the Tweed 3 miles below. The *Ettrick Shepherd*, the Scottish poet James Hogg, was a native of this district.

ETTY, William, an English painter, born in 1787, died in 1849. He studied at the Royal Academy, worked long without much recognition, but at length in 1820 he won public notice by his *Coral Finders*. In 1828 he was elected an academician.

Among his works, which were greatly admired, are a series of three pictures (1827–31) illustrating the *Deliverance of Bethulia by Judith*, *Benaiah* (one of David's mighty men), and *Women Interceding for the Vanquished*. All these are very large pictures, and are now in the National Gallery of Scotland (Edinburgh). Others of note are: *The Judgment of Paris*; *The Rape of Proserpine*; and *Youth at the Prow, and Pleasure at the Helm*. Etty especially excelled at painting undraped figures.

ETYMOL'OGY (Gr. *etymos*, true, and *logos*, account), a term applied (1) to that part of grammar which treats of the various inflections and modifications of words and shows how they are formed from simple roots; (2) to that branch of philology which traces the history of words from their origin to their latest form and meaning.

Etymology in this latter sense, or the investigation of the origin and growth of words, is amongst the oldest of studies. Plato and other Greek philosophers, the Alexandrian grammarians, the scholiasts, the Roman Varro, and others wrote much on this subject. Their work, however, is made up of conjectures at best ingenious rather than sound, and very often wild and fantastic.

It was not till recent times, and par-

ticularly since the study of Sanskrit, that etymology has been scientifically studied. Languages then began to be properly classed in groups and families, and words were studied by a comparison of their growth and relationship in different languages. It was recognized that the development of language is not an arbitrary or accidental matter, but proceeds according to general laws. The result was a great advance in etymological knowledge and the formation of a new science of *philology*.—Cf. W. W. Skeat, *The Science of Etymology*.

EU (*eu*), a town in Northern France, department of Seine-Inférieure, about 17 miles north-east of Dieppe. It is notable for its old twelfth-century church and the celebrated Château d'Eu, part of which was destroyed in 1902. Pop. 5,740.

EUBŒ'A, formerly called Negropont, a Greek island, the second largest island of the Ægean Sea. It is 90 miles in length; 30 in greatest breadth, reduced at one point to 4 miles. It is separated from the mainland of Greece by the narrow channels of Egripo and Talanta. It is connected with the Bœotian shore by a bridge. There are several mountain peaks over 2,000 feet in height, and one over 7,000 feet.

The island is well-wooded and remarkably fertile. Wine is a staple product, and cotton, wool, pitch, and turpentine are exported. The chief towns are Chalcis and Karysto. The island was anciently divided among seven independent cities, the most important of which were Chalcis and Eretria, and its history is for the most part identical with that of those two cities. With some small islands it forms a modern nomarchy, with a pop. of 154,449.

EUBU'LUS, a Greek comic poet, who flourished at Athens about 375 B.C. His subjects were chiefly mythological, and he delighted in ridiculing the tragic poets, especially Euripides.

EUCAINE, drug used as an anæsthetic. Prepared artificially, it is an alkaloid not unlike cocaine, but less powerful. It is used by dentists.

EUCALYP'TUS, a genus of trees, nat. ord. Myrtaceæ, mostly natives of Australia, and remarkable for their gigantic size, some of them attaining the height of 480 or 500 feet. In the Australian colonies they are known by the name of gum trees, from the gum which exudes from their trunks; individual species are known as 'stringy bark,' 'iron bark,' *karri*, or *jarrah*. The wood of some is excellent for building and many purposes.

The *E. globŭlus*, or blue gum, yields an essential oil which is valuable as a febrifuge, antasthmatic, and antispasmodic. The medicinal properties of this tree also make it useful as a disinfectant, and as an astringent in affections of the respiratory passages, being employed in the form of an infusion, a decoction, or an extract, and cigarettes made of the leaves being also smoked. The *E. globŭlus* and the *E. amygdalina* are found to have an excellent sanitary effect when planted in malarious districts such as the Roman Campagna, parts of which have already been reclaimed by their use. This result is partly brought about by the drainage of the soil (the trees absorbing great quantities of moisture), partly perhaps by the balsamic odour given out.

E. mannifĕra and others yield a sweet secretion resembling manna. Some, especially *E. rostrata*, yield a kind of gum kino. The Eucalyptus has been introduced with success into India, Palestine, Algiers, and Southern France.

EUCHARIST (ū'ak-rist; Gr. *eucharistia*, from *eu*, well, and *charis*, grace), a name for the sacrament of the Lord's Supper, in reference to the blessing and thanksgiving which accompany it.

EUCHARISTIC CONGRESSES, gatherings of the Roman Catholic clergy and laity, held with the object of glorifying the Sacrament of the Eucharist, were inaugurated by Bishop de Ségur, of Lille. The first congress, held in that city (1881) excited little but local interest; but the movement rapidly developed, succeeding congresses being held at Avignon (1882), Liège (1883), Paris (1888), Jerusalem (1893), Lourdes (1899), Rome (1905), and elsewhere. In 1908 the congress held in London was attended by Cardinal Vannutelli, the first Papal legate to visit England for three centuries, by six other cardinals, fourteen archbishops, and seventy bishops. A proposal to carry the Sacrament through London in procession aroused much opposition, and the project was abandoned on the personal intervention of Mr. Asquith, then Premier.

EUCHRE (ū'kĕr), a card-game very popular in America, is usually played by two or four persons. After the cut for deal five cards are dealt (either by twos and threes or by threes and twos) to each player, and the uppermost card of those undealt is turned up for trump. The first player has the option either to 'order up' (namely to make this card trump) or to pass. In the latter case it is left to the next player to decide if he will play first or pass, and so on till the turn of the dealer comes. He must either play on this trump or turn it down, when all the players have again in turn their choice

of making a new trump or passing. If a trump is 'ordered up' or taken in the first round, the dealer may take it into his cards, discarding in its place his poorest card. If the player who elects to play wins five tricks, he counts two; if he wins three tricks, he counts one; if he wins fewer than three tricks, he is *euchred*, and each independent opponent counts two. The cards rank as at whist, except that the knave of the trump suit, called the *right bower* (from the Ger. *bauer*, a peasant), is the highest card, the knave of the other suit of the same colour being the second highest.

EUCKEN, Rudolf Christoph, German philosopher and theologian, born in East Friesland in 1846. Educated at the Universities of Göttingen and Berlin, he was professor of philosophy at Basel from 1871 to 1874, when he obtained a similar appointment at Jena. Opposed both to utilitarianism and positivism, Eucken is one of the leaders of those German philosophers who maintain that the spiritual interests of man should be taken into consideration, and oppose the philosophic systems which treat life only from the physical and biological points of view. His spiritualistic philosophy has found many adherents, and his works are very popular. In 1908 he won the Nobel prize for literature, and in 1910 he was made a D.D. of the University of Glasgow.

His works include: *The Life of the Spirit* (1909), *The Problem of Human Life as viewed by the Great Thinkers* (1909), *The Meaning and Value of Life* (1909), *Main Currents of Modern Thought* (1911), *Can we still be Christians?* (1913). He died in 1926.

EUCLASE, rare mineral. It is composed of hydrated silicate of beryllium and aluminium and contains 1·7 per cent of beryllium oxide. It is found at Minas Geracs in Brazil, in Austria and in the Ural Mountains in the form of extremely brittle striated prisms, which may be colourless or yellow, green or blue.

EUCLEIDES, Greek philosopher. He flourished about 400 B.C. and was a pupil of Socrates. He founded the Megarian school, which was chiefly known for its cultivation of dialectics. The school unites the doctrines of Socrates with those of the Eleatics, and identifies that which exists with the good; that which is not good does not exist. The good is unalterable, one and similar, always the same; it is the intelligence, the reason, God.

EUCLID (*Eucleidēs*), of Alexandria, a distinguished Greek mathematician, who flourished about 300 B.C. His *Stoicheia* (Elements of Geometry), in thirteen books, are still extant, and form the most usual introduction to the study of geometry. The work was known to the Arabs, translations of it having appeared in the time of Harun-al-Rashid and of Al-Mamun. It was translated from the Arabic into Latin by Adelard of Bath, and an English translation from the Latin, by Sir Henry Billingsley, appeared in 1570. The Oxford Edition (1703) was for long the only complete edition of Euclid's works.

In the *Elements*, Euclid made use of the material of earlier mathematicians such as Hippocrates of Chios, Thendins, Endoxus and Theaetetus, but in effect the work was his own, so perfect and complete that only in the last century was any attempt made to supersede it.

Other extant works of Euclid's are the *Data*, containing ninety-four propositions, the *Phænomena*, on the geometrical aspects of Astronomy, the *Optics* and the *Elements of Music*.

The severity and accuracy of Euclid's methods of demonstration have as a whole never been surpassed. —Cf. Sir T. L. Heath, *The Thirteen Books of Euclid's Elements*.

EUDIOM'ETER (Gr. *eudios*, serene), an instrument originally designed for ascertaining the purity of the air or the quantity of oxygen it contains, but now employed generally in the analysis of gaseous mixtures. It consists of a graduated glass tube, either straight or bent in the shape of the letter U, hermetically sealed at one end and open at the other. Two platinum wires, intended for the conveyance of electric sparks through any mixture of gases, are inserted through the glass near the closed end of the tube, and approach but do not touch each other.

To determine the proportion of oxygen in a given specimen of air, hydrogen is introduced into the tube with a measured volume of the air, and the mixture is fired by an electric spark. Water is formed, and the quantity of oxygen can be estimated from the diminution of volume. In a mixture of gases, chemical absorbents may be used to remove the gases one by one, the amounts present being determined by the successive changes of volume.

EUGENE (ū-jēn'), or **François Eugène,** Prince of Savoy, fifth son of Eugène Maurice, Duke of Savoy-Carignan, and Olympia Mancini, a niece of Cardinal Mazarin. He was born at Paris 18th Oct., 1663, and died in Vienna 21st April, 1736. Offended with Louis XIV, he entered the Austrian service in 1683, serving his first campaign as a volunteer against the Turks. Here he distinguished himself so much

that he received a regiment of dragoons. Later, at the sieges of Belgrade and Mayence, he increased his reputation, and on the outbreak of war between France and Austria he received the command of the Imperial forces sent to Piedmont to act in conjunction with the troops of the Duke of Savoy. At the end of the war he was sent as commander-in-chief to Hungary, where he defeated the Turks at the battle of Zenta (11th Sept., 1697).

The War of the Spanish Succession brought Eugene again into the field. In Northern Italy he outmanœuvred Catinat and Villeroi, defeating the latter at Cremona (1702). In 1703 he commanded the Imperial army in Germany, and in co-operation with Marlborough frustrated the plans of France and her allies. In the battle of Blenheim, Eugene and Marlborough defeated the French and Bavarians under Marshal Tallard, 13th Aug., 1704. Next year Eugene, returning to Italy, forced the French to raise the siege of Turin, and in one month drove them out of Italy. During the following years he fought on the Rhine, took Lille, and, in conjunction with Marlborough defeated the French at Oudenarde (1708), and Malplaquet (1709), where he himself was dangerously wounded.

After the recall of Marlborough, which Eugene opposed in person at London, without success, and the defection of England from the alliance against France, his further progress was in a great measure checked. In the war with Turkey, in 1716, Eugene defeated two superior armies at Peterswardein and Temesvar, and, in 1717, took Belgrade, after having gained a decisive victory over a third army that came to its relief. During fifteen years of peace which followed, Eugene served Austria as faithfully in the Cabinet as he had done in the field. He was one of the great generals of modern times. —Cf. G.B. Malleson, *Prince Eugene of Savoy*.

EUGE'NIA (so named in honour of Prince *Eugene*), a genus of Myrtaceæ, nearly related to the myrtle. It contains numerous species, some of which produce delicious fruits. Cloves are the dried flower-buds of *E. caryophyllata*.

EUGENICS has been defined as "the study of agencies under social control that may improve or impair the racial qualities of future generations, either physically or mentally." It is concerned with the investigation of the physical, mental, and moral traits of mankind, and especially with the factors of inheritance of desirable and undesirable qualities.

The interest in the subject is largely due to the untiring zeal of the late Sir Francis Galton, who devoted most of his life to the study of the manifold problems that came within the scope of 'eugenics,' and, in accordance with the terms of his will (1908), founded the Galton Chair of Eugenics in the University of London. The library and laboratory of the Galton benefaction form part of the Department of Applied Statistics, under the direction of Professor Karl Pearson, F.R.S. at University College, London, who is also the editor of the journal *Biometrika*, which is devoted to the statistical side of the problems of anthropology and heredity. The aim of the Galton laboratory is to collect material relating to human heredity, and to investigate its significance; and also to extend the knowledge of eugenics by professional instruction, lectures, publications, and experimental work. The scope of its activities will best be appreciated by the study of such works as the late Sir Francis Galton's *Natural Inheritance* (1889) and *Essays in Eugenics* (1909), and Professor Karl Pearson's *Groundwork of Eugenics* (1909), *Practical Problems of Eugenics* (1909), and *State of National Eugenics* (1909). *The Treasury of Human Inheritance*, issued in parts from the Galton laboratory, is a monumental record of facts relating to the hereditary transmission of human qualities.

The Eugenics Education Society, under the presidency of Major Leonard Darwin, has for its aim the stimulation of public interest in the subject, and the discussion of the problems of heredity. It issues a journal, *The Eugenics Review*, now in its twelfth year.

It has long been known that by means of careful selection of parents it was possible to breed horses, cattle, dogs, &c., and a great variety of food- and flowering-plants, with desirable qualities highly developed. But it is obvious that such direct methods cannot be applied to human beings for the purpose of breeding men and women with special traits. What the eugenic societies aim at doing is to educate the people to realize the far-reaching effects of the inheritance of good or bad qualities, in the hope that such knowledge may exert some influence in the choice of partners in matrimony. But their efforts are especially directed to the exposure of the disastrous results that may ensue from the contamination of a family by the intermarriage of one of its members with an individual subject to some hereditary defect of a physical, mental, or moral nature.

The study of eugenics is intimately related to a wide range of subjects; to genetics, which explains the laws that govern the heredity of specific traits

in man, and suggests certain practical applications of the rules of breeding to race improvement by cutting off undesirable strains and by selecting mates desirable from the eugenic standpoint; to the study of biographies of individuals and the genealogies of families, for the purpose of obtaining data for the investigation of the working of inheritance; to anthropology, history, and archæology, law and politics, economics and sociology, medicine and psychology, and statistical science.

The tremendous stimulus which the rapid development of eugenics has given to the wider recognition of the significance of heredity in human affairs has tended to obscure the importance of social environment and individual experience, especially in children of tender age, in shaping the attitude of the individual. Education is a vastly more important factor—the manner and attitude of the teacher, rather than the subject-matter of his or her lessons—than the eugenic enthusiasts, with their over-emphasis on the dominance of hereditary influences, are willing to admit.

In the causation of many diseases, commonly reputed to be hereditary, such as tuberculosis and certain forms of insanity, the social and physical circumstances probably play a more important part than heredity in determining the onset of the illness, even when some undoubted hereditary aptitude to fall a victim to one or other of these affections is admitted.

In no branch of medicine or sociology is this fallacy more fruitful of error than in the domain of mental disease. Apart from certain physical defects of the nervous system and specific infections, such as syphilis, the causes of mental alienation are to be sought rather in some maladjustment to the individual's social circumstances, often the results of some emotional disturbance, even in early childhood, which created the attitude of mind that eventually determined the mental conflict expressed by the insanity. The study of the effects of the strain of war has shown that anxiety, if sufficiently intense and prolonged, can produce mental disturbance in anyone, whatever his heredity and antecedents.

By over-emphasizing the importance of inheritance in the causation of such conditions as insanity and epilepsy, and ignoring the effects of the profound social disturbance an insane parent may inflict upon any home, and especially upon the impressionable minds of young children in it, the eugenic societies have been responsible for raising up a growing body of opposition to their views. Not only in the domains of medicine and psychology, but also in those of ethnology and sociology, there is a feeling that the eugenic claims have been pushed too far. But when the subject of eugenics has been pruned of these extravagances, it will exert a far-reaching influence upon social and political organization and events by compelling respect for the vast importance of heredity as a factor that plays some part in determining the physical, mental and moral qualities of mankind.

References to the voluminous literature will be found in *The Eugenics*



Empress Eugénie

Review (published by the Eugenics Education Society, Kingsway, London).

EUGÉNIE (eu-zhā-nē), **Marie de Guzman,** ex-Empress of the French, born at Granada, in Spain, 5th May, 1826, died at Seville 11th July, 1920. Her father, the Count de Montijo, was of a noble Spanish family; her mother was of Scotch extraction, maiden name Kirkpatrick. On 29th Jan., 1853, she became the wife of Napoleon III and Empress of the French. On 16th March, 1856, a son was born of the marriage.

When the war broke out with Germany, she was appointed regent (15th July, 1870) during the absence of the emperor, but on the 4th Sept. the Revolution forced her to flee from France. She went to England, where she was joined by the Prince Imperial and afterwards by the emperor. Camden House, Chislehurst, became the residence of the imperial exiles. On 9th Jan., 1873, the emperor died, and six years later the Prince Imperial was slain while with the British Army in the Zulu War. In 1881 the empress transferred her residence to Farnborough, in Hampshire.

During the European War she established a hospital at Farnborough. In 1918 she handed over to Clemenceau the letters which she had received from William I in 1870. The letters shed a striking light upon the ambitions of Prussia. She was buried in the mausoleum at Farnborough.—BIBLIOGRAPHY: De Lano, *The Empress Eugénie*; Tschuddi, *Eugénie, Empress of the French*; Stoddart, *The Life of Empress Eugénie*; E. Legge, *The Empress Eugénie and her Son.*

EUGE'NIUS, the name of four Popes.

1. **Eugenius I,** elected 8th Sept., 654, while his predecessor, Martin I, was still living; died in 657 without having exerted any material influence on his times.

2. **Eugenius II** held the see from 824–827.

3. **Eugenius III,** born at Pisa, was a disciple of St. Bernard of Clairvaux. He was raised to the popedom in 1145; was obliged to quit Rome in 1146 in consequence of the commotions caused by Arnold of Brescia; returned with the help of King Roger of Sicily in 1150, and died in 1153.

4. **Eugenius IV,** from Venice, originally called Gabriel Condolmero, was raised to the popedom in 1431. In consequence of his opposition to the Council of Basel he was deposed. He died in 1447.

EUGENOL, or **ALLYLGUAIACOL,** is found in cloves, the leaves of cinnamon, and other plants. About 90 per cent of *clove oil* is composed of eugenol.

EU'GUBINE TABLES, the name given to seven bronze tablets or tables found in 1444 at the town of Gubbio, the ancient Iguvium or Eugubium, now in the Italian province of Perugia, bearing inscriptions in the language of the ancient Umbrians, which seems to have somewhat resembled the ancient Latin as well as the Oscan. They seem to have been inscribed three or four centuries B.C., and refer to sacrificial usages and ritual.

EUHEM'ERISM, a method or system (so named from its founder Euhemerus, a Greek philosopher) of interpreting myths and mythological deities, by which they are regarded as deifications of dead heroes and poetical exaggerations of real histories.

EULENSPIEGEL (ol'len-spē-gl), **Tyl,** a name which has become associated in Germany with all sorts of wild, whimsical frolics, and with many amusing stories. Some such popular hero of tradition and folk-lore seems to have really existed in Germany, probably in the first half of the fourteenth century, and a collection of popular tales of a frolicsome character, originally written in Low German, purports to contain his adventures. The earliest edition of such is a Strasbourg one of the year 1515 in the British Museum. Better known, however, is that of 1519, published also at Strasbourg by Thomas Mürner (under the title *Howle-glass*). The work was early translated into English and almost all European tongues. A modern English translation appeared in 1890.

EULER (oi'lĕr or ū'lĕr), **Leonard,** a distinguished mathematician, born at Basel in 1707, died at St. Petersburg (Petrograd) in 1783. He was educated at the University of Basel under the Bernouillis, through whose influence he procured a place in the Academy of St. Petersburg. In 1741 he accepted an invitation from Frederick the Great to become professor of mathematics in the Berlin Academy, but in 1766 returned to St, Petersburg, where he became director of the mathematical class of the academy.

Euler's profound and inventive mind gave a new form to the science. He applied the analytic method to mechanics, and greatly improved the integral and differential calculus. He also wrote on physics, and employed himself in metaphysical and philosophical speculations. Amongst his numerous writings are: the *Theoria Motuum Planetarum et Cometarum*, *Introductio in Analysin Infinitorum*, and *Opuscula Analytica.*

EU'MENES (-nēz), the name of two kings of Pergamus.

1. **Eumenes I** succeeded his uncle Philetærus 263 B.C. He reigned for twenty-two years and then died in a fit of drunkenness.

2. **Eumenes II** succeeded his father Attalus 197 B.C., and, like him, attached himself to the Romans, who, as a reward for his services in the war against Antiochus of Syria, bestowed upon him the Thracian Chersonesus and almost all Asia on this side of the Taurus. He died in 159 B.C.

EUMENIDES (ū-men'i-dēz). *See* FURIES.

EUMYCETES, or **HIGHER FUNGI,** a common name for those Fungi which possess a septate mycelium. They also have a well-marked type of 'principal' spore—either the *ascospore* (Ascomycetes) or the *basidiospore* (Basidiomycetes)—and rarely produce definite sexual organs. Opposed to Phycomycetes.

EUNOMIANS, the followers of

Eunomius, Bishop of Cyzicum, in the fourth century A.D., who held that Christ was a created being of a nature unlike that of the Father.

EU'NUCH, an emasculated male. The term is of Greek origin (*eunouchos*, from *eune*, a couch or bed, *echein*, to hold or guard); but eunuchs became known to the Greeks no doubt from the practice among Eastern nations of having them as guardians of their women's apartments. Eunuchs were employed in somewhat similar duties among the Romans in the luxurious times of the empire, and under the Byzantine monarchs they were common. The Mohammedans still have them about their harems.

Emasculation, when effected in early life, produces singular changes in males and assimilates them in some respects to women, causing them in particular to have the voice of a female. Hence it was not uncommon in Italy to castrate boys in order to fit them for soprano singers when adults.

EUON'YMUS, the spindle trees or prickwoods, a genus of shrubs or trees, nat. ord. Celastrineæ, containing about fifty species, natives of the temperate regions of the northern hemisphere. The root-bark of *E. atropurpureus* is the source of euonymin, a bitter principle with a powerful stimulating effect on the liver.

EUPATO'RIA, formerly Koslov, a seaport on the western coast of the Crimea, government of Taurida. It was here that the allied forces landed at the commencement of the Crimean War (14th to 18th Sept, 1854). Pop. 23,000.

EUPATO'RIUM, a genus of plants, chiefly natives of America, belonging to the nat. ord. Compositæ. Their roots are perennial, possessing a rough, bitter, or aromatic taste; the flowers are small, white, reddish, or bluish, in corymbs. Amongst the many species are *E. cannabinum*, or hemp-agrimony, a British plant.

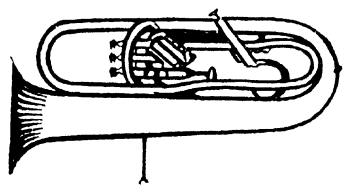
EUPEN (oi'pen), a town and district of Belgium, formerly part of Rhenish Prussia, 7 miles S.S.W. of Aix-la-Chapelle. It has manufactures of woollen and linen cloth, hats, soap, leather, and chemicals; paper, flax, and worsted mills; and an important trade. The town was ceded to Prussia at the Peace of Paris in 1814. On 26th May, 1919, Eupen was occupied by Belgian troops, and by the Treaty of Versailles Eupen and Malmédy were handed over to Belgium. Pop. 13,540.

EUPHEMISM, figure of speech which describes an offensive or unpleasant thing in an indirect way. An example is to describe a lie as a terminological inexactitude.

EUPHO'NIUM, a brass bass instrument, generally introduced into military bands, and frequently met with in the orchestra as a substitute for the superseded ophicleide. It is one of the saxhorn family of instruments. It is tuned in C or in B flat, and is furnished with three or four valves or pistons.

EUPHORBIA. *See* SPURGE.

EUPHORBIA'CEÆ, the spurgeworts, a nat. ord. of herbaceous plants, shrubs, or very large trees, which occur in all regions of the globe. Most of them have an acrid milky juice, and declinous or monœcious flowers. The fruit is dry or slightly fleshy, and three-lobed. Among the genera are: Euphorbia, which yields an oil used as a powerful cathartic; Croton, affording croton-oil; the *Ricinus communis*, or castor-oil plant; the *Buxus sempervirens*, or box-wood plant; the *Manihot utilissima*, which yields the food



Euphonium

known as tapioca or cassava. In most members of the genera the milky juice contains caoutchouc.

EUPHOR'BIUM, a yellowish-white body, which is the solidified juice of certain plants of the genus Euphorbia, either exuding naturally or from incisions made in the bark. It is a powerfully acrid substance, virulently purgative and emetic.

EUPHRA'TES, or **EL FRAT,** a celebrated river of Western Asia, Mesopotamia, having a double source in two streams rising in the Anti-Taurus range. Its total length is about 1,800 miles, and the area of its basin 260,000 sq. miles. It flows mainly in a south-easterly course through the great alluvial plains of Babylonia and Chaldæa till it falls into the Persian Gulf by several mouths, of which only one in Persian territory is navigable. About 100 miles from its mouth it is joined by the Tigris, when the united streams take the name of Shatt-el-Arab.

It is navigable for about 1,200 miles, but navigation is somewhat impeded by rapids and shallows. The melting of snow in the Taurus and Anti-Taurus causes a flooding in spring. The water is highest in May and June, when the current, which rarely exceeds 3 miles an hour, rises to 5. In the Bible (*Gen.*

xv, 18) the Euphrates is *The River*, or *The Great River*.

EU'PHUISM (Gr. *euphues*, well endowed by nature), an affected style of speech which distinguished the conversation and writings of many of the wits of the court of Queen Elizabeth. The name and the style were derived from *Euphues, the Anatomy of Wit* (about 1580), and *Euphues and his England* (about 1582), both written by John Lyly (1554–1606). A well-known euphuist in fiction is Sir Piercie Shafton in Scott's *Monastery*. Scott, however, had not studied Lyly sufficiently, and Sir Piercie raves bombastically rather than talks euphuistically. The chief characteristics of genuine euphuism were extreme artificiality and numerous allusions to natural history embellished by imagination.

EU'POLIS, an Athenian comic poet, who flourished about 429 B.C. Neither the date of his birth nor that of his death is known with certainty. He belongs, like Aristophanes and Cratinus, to the Old Comedy. His works are all lost except small fragments. According to Suidas, he produced seventeen plays, seven of which won the first prize. His best-known plays are the *Kolakes* (Flatterers), in which he attacked the prodigal Callias, and the *Baptæ* (Dippers), in which he attacked Alcibiades and the exotic ritual practised at his clubs.

EURA'SIANS (syncopated from European-Asians), a name euphemistically given to the 'half-castes' of India, the offspring of European fathers and Indian mothers. They are particularly common in the three presidential capitals—Calcutta, Madras, and Bombay. Belonging strictly to neither race, Eurasians are not infrequently ostracized by both; and their anomalous position often exerts a baneful influence upon their character. They generally receive a European education, and the young men are often engaged in Government or mercantile offices. The girls, in spite of their dark tint, are generally very pretty and often marry Europeans.

EURE (*eur*), a river of North-West France, which rises in the department of the Orne, and falls into the Seine after a course of 124 miles, being navigable for about half the distance. It gives its name to a department in the north-west of France, forming part of Normandy; area, 2,330 sq. miles. The surface consists of an extensive plain, intersected by rivers, chief of which is the Seine. It is extensively cultivated; apples, pears, plums, and cherries form important crops, and a little wine is produced. The mining and manufacturing industries are extensive, and the department has a considerable trade in woollen cloth, linen and cotton fabrics, carpets, leather, paper, glass. Evreux is the capital. Pop. (1931), 305,788.

EURE-ET-LOIR (*eur-ĕ-lwär*), a department in the north-west of France, forming part of the old provinces of Orléannais and Île-de-France; area, 2,291 sq. miles. A ridge of no great height divides the department into a north and a south basin, traversed respectively by the Eure and the Loire. The soil is extremely fertile, and there is scarcely any waste land. A considerable portion is occupied by orchards and vineyards, but the greater part is devoted to cereal crops. The department is essentially agricultural, and has few manufactures. The capital is Chartres. Pop. (1931), 254,790.

EURE'KA (Gr. *heuēka*, I have found it), the exclamation of Archimedes when, after long study, he discovered a method of detecting the amount of alloy in King Hiero's crown. Hence the word is used as an expression of triumph at a discovery or supposed discovery.

EURHYTHMICS, a general term, but usually used to denote a system of education evolved by Émile Jaques-Dalcroze of Geneva. This form of training bears on all art, but especially on the art of music. Eurhythmics is essentially an original contribution to education. It aims at training musical sense on the broadest lines, using the body as an instrument of expression. Breaking away from preconceived ideas of music as a phenomenon of sound only, M. Dalcroze claims that music is innate. From this standpoint it follows that musicality as such is capable of cultivation apart from instrumental performance. Rhythm, not being a quality confined to music, but found common to all art, and fundamental to life, can, therefore, be developed from within the human being. This the Dalcroze system claims to do. Rhythm of sound plays a leading part in that it is allied to movement. Exercises at the piano are played to which the pupil listens, and to which he responds in movement—movement so closely allied to the music that it is a form of musical imagery. The technique is developed on simple lines to serve this end only.

The system is progressive, starting from elementary rhythmic structure, and ending with complete musical form. It is far-reaching in educative purpose. It claims to free innate rhythm, to develop it for individual self-expression; to bring mind and body into closer unity, and in their interaction to give poise to both; to train accurate musical listening, ready assimilation of musical language and

its spontaneous translation into terms of movement; to give musical experiences which shall be heard and felt; to cultivate musical expression and creation (in movement); to blend self-discipline with emotion.

EURIP'IDES, the last of the three great Greek writers of tragedies, was born about 480 B.C., and died 406 B.C. Tradition declares that he was born at Salamis, on the very day of the Greek naval victory there. He was, as far as we can tell, of good birth; at any rate, he was well educated, and was able to live a life of ease and leisure, and to collect one of the largest libraries of the time. The comic poets, especially Aristophanes, delighted to say that his mother, Cleito, was a cabbage-woman, but there is probably little or no truth in this statement.

Euripides was originally trained as an athlete, but conceived an intense dislike for that occupation. Greatly daring, he expressed his view openly (Fragment 284). Like a popular modern dramatist, his recreation was probably 'anything except sport.' He then took to painting, but abandoned it in favour of writing tragedies. His first play (not preserved), the *Peliades*, was produced when he was twenty-five years of age. He is said to have written ninety-two dramas, eight of which were satyr-plays. Ancient critics allow seventy-five of these to have been genuine. During his long career he only won the first prize five times.

Euripides did not take any part in public life, but devoted himself entirely to a life of speculation and to writing plays. There is a tradition, not, however, on a very firm basis, that he was twice married, and that both marriages were failures. He is represented by Aristophanes as a woman-hater, but indeed he portrays women more sympathetically than Æschylus or Sophocles. The women had little cause to congratulate themselves on securing Aristophanes as a champion, for his scorpions are far more stinging than Euripides' whips. Euripides left Athens about 409 B.C., and went to the court of King Archelaus in Macedonia. There he died in 406 B.C.; according to some accounts, he was killed by savage dogs which were set on him by some of his rivals at the king's court.

Seventeen tragedies and one satyr-play have been preserved to us. The latter (*The Cyclops*) is interesting as being the only example of a satyr-play which we possess. In itself it is not amusing. It has been admirably translated by Shelley. The seventeen tragedies in the order of their production are: *Alcestis, Medea, Hippolytus, Hecuba, Andromache, Ion, Suppliants, Heracleidæ, Hercules Furens, Iphigenia among the Tauri, Trojan Women, Helena, Phœnissæ, Electra, Orestes, Iphigenia at Aulis*, and *The Bacchæ*. The *Rhesus*, a feeble production long attributed to Euripides, is almost certainly not his work.

The work of Euripides still retains the power of arousing strong likes and dislikes. He has had sturdy supporters and fanatical detractors. The truth is that if the tragedies of Æschylus and Sophocles are looked upon as models for all Greek tragedy, Euripides falls far short of his models. Euripides, however, though he died shortly before Sophocles, belonged to a younger and quite different generation, and held different views about art, morality,



Euripides

religion, and almost everything of importance. His aim was rather different from that of the earlier poets, and he must be judged, not by their standards, but on his own merits. His own merits are amply sufficient to justify the high opinion held of him in the ancient world, and supported by many of the greatest of the moderns.

The dethroning of Euripdes was the result of a German conspiracy, carried out with much energy by Niebuhr, and with even more by Schlegel. They enjoyed themselves while pulling Euripides to pieces much as schoolboys who have detected a flaw in the armour of their master. Many proofs can be adduced that Euripides was not a sophistical trifler; but one glance at his bust is enough to assure anyone of unbiased judgment that he was a man of remarkable breadth of mind and intellectual gifts. The fact remains, however, that the extant plays of Euripides are of very unequal merit. The *Helena* is not a good play; it was

ridiculed by Aristophanes, but he did not succeed in making it much more absurd than it was already. The *Hecuba* and the *Heracleidæ* are not well constructed, and the *Electra* and *Orestes* challenge too directly the masterpieces of the earlier tragedians. In his greatest plays, however, Euripides can bear comparison with any poet. The *Medea* is a play which still never fails to please; the *Hippolytus* and the *Ion* are admirable dramas and admirably constructed; above all, the *Bacchæ* is a masterpiece, more picturesque than any other Greek tragedy, a play not unworthy to be set near *The Tempest* and *Cymbeline*.

Euripides has been accused by his detractors of degrading his art, because he opened his plays with a prologue and ended them with the intervention of a god. Both devices, if not desirable, are quite pardonable. Possible plots were becoming more and more scarce; Euripides did not wish to adopt trite themes, and so went into the by-ways of mythology, or adopted a less well-known alternative version of a well-known legend. He could not count on his audience already possessing enough knowledge of the story to enable them to understand his plays without a prologue. The *deus ex machina*, as the god who ends some of the plays is called, was often warranted or required by the plot which called for a conventional ending.

Euripides has also been accused, by Aristophanes and by many less entertaining writers, of taking away all the dignity of tragedy. It is quite true that he is a realist. Sophocles represented men as they ought to be, Euripides represented them as they were. This was an unforgiveable offence in the eyes of the 'men of Marathon' at Athens. The tragic heroes were not mere stage characters, they considered; they were often ancestors or national heroes, and it was impious to represent them as speaking ordinary language, or sharing the weaknesses of ordinary men. Euripides did do this, did it intentionally, and did it excellently. He came at an awkward transition period, and the lack of success of some of his work is owing to the impossibility of pouring new wine into old bottles.

The old tragedy was too tightly bound by convention to suit Euripides, who wished to portray living men and women, and to have an exciting plot. The new comedy—the romantic comedy of Menander—had not yet been invented. Had it been, Euripides would surely have written comedies. The comic poets of the next century turned to him for a model, and it was one of them, Philemon, who said that if he were quite sure that dead men retained their perception he would hang himself to see Euripides. Euripides is, in fact, the earliest writer of romantic plays, a fact well illustrated by his *Alcestis*, which is one of his best plays. In it tragedy and comedy are harmoniously blended, and it has a happy ending.

For better and for worse Euripides is a very modern poet, and makes a special appeal to the present generation. But his pathos, his wide sympathies, and his wonderful poetry have appealed to the best judges in all ages. Theocritus, Virgil, Ovid, Horace, Milton, and Browning have been among his admirers; his detractors include a few Teutonic professors, and a few who honour the memory of Æschylus and Sophocles on the other side idolatry.

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EURIPUS (ū-rī'pus), in ancient geography, the strait between the Island of Eubœa and Bœotia in Greece.

EUROC'LYDON, a tempestuous wind of the Levant, which was the occasion of the shipwreck of the vessel in which St. Paul sailed, as narrated in *Acts* xxvii 14–44. The north-east wind is the wind evidently meant in the narrative; and an alternative reading adopted in the revised version is *euraculon* (euraquilo) or north-easter.

EURO'PA, in Greek mythology, the daughter of Agēnor, King of the Phœnicians, and the sister of Cadmus. The fable relates that she was abducted by Jupiter, who for that occasion had assumed the form of a white bull, and swam with his prize to the Island of Crete. Here Europa bore to him Minos, Sarpēdon, and Rhadamanthus.

EUROPE, almost the smallest of the great continents, but the most important politically and in the history of civilization. It forms a huge peninsula projecting from Asia, and is bounded on the north by the Arctic Ocean; on the west by the Atlantic Ocean; on the south by the Mediterranean, the Black Sea, and the

Caucasus Range; on the east by the Caspian Sea, the Ural River, and the Ural Mountains. The most northerly point on the mainland is Cape Nordkyn, in Lapland, in lat. 71° 6′; the most southerly points are Punta da Tarifa, lat. 36° N., in the Strait of Gibraltar, and Cape Matapan, lat. 36° 17′, which terminates Greece. The most westerly point is Cape Roca in Portugal, in long. 9° 28′ W., while Ekaterinburg is in long. 60° 36′ E. From Cape Matapan to North Cape is a distance of 2,400 miles, from Cape St. Vincent to Ekaterinburg, (or Sverdlovsk) 3,400 miles; area of the continent, about 3,900,000 sq. miles. (*See* table on p. 256). Great Britain and Ireland, Iceland, Novaya Zemlya, Corsica, Sardinia, Sicily, Malta, Crete, the Ionian and the Belearic Islands are the chief islands of Europe. The shores are very much indented, giving Europe an immense length of coast-line (estimated at nearly 50,000 miles). The chief seas or arms of the sea are: the White Sea on the north; the North Sea on the west, from which branches off the great gulf or inland sea known as the Baltic; the English Channel, between England and France; the Mediterranean, communicating with the Atlantic by the Strait of Gibraltar (at one point only 19 miles wide); the Adriatic and Archipelago, branching off from the Mediterranean; and the Black Sea, connected with the Archipelago through the Hellespont, Sea of Marmara, and Bosporus.

Surface. The mountains form several distinct groups or systems of very different geological dates, the loftiest mountain masses being in the south central region. The Scandinavian mountains in the north-west, to which the great northern peninsula owes its form, extend above 900 miles from the Polar Sea to the south point of Norway. The highest summits are about 8000 feet. The Alps, the highest mountains in Europe (unless Mount Elbruz in the Caucasus is claimed as European), extend from the Mediterranean first in a northerly and then in an easterly direction, and attain their greatest elevation in Mont Blanc (15,781 feet), Monte Rosa, and other summits. Branching off from the Alps, though not geologically connected with them, are the Apennines, which run south-east through Italy, constituting the central ridge of the peninsula. The highest summit is Monte Corno (9,560 feet). Mount Vesuvius, the celebrated volcano in the south of the peninsula, is quite distinct from the Apennines. By south-eastern extensions the Alps are connected with the Balkan and the Despoto-Dagh of the south-eastern peninsula of Europe.

Among the mountains of South-Western Europe are several massive chains, the loftiest summits being in the Pyrenees, and in the Sierra Nevada in the south of the Iberian Peninsula. The highest point in the former, Pic de Netho, has an elevation of 11,168 feet; Mulahacen, in the latter, is 11,793 feet, and capped by perpetual snow. West and north-west of the Alps are the Cevennes, Jura, and Vosges; north and north-east, the Harz, the Thuringerwald Mountains, the Fichtelgebirge, the Erzgebirge and Bohmerwaldgebirge. Farther to the east the Carpathian chain encloses the great plain of Hungary, attaining an elevation of 8,000 or 8,500 feet. The Ural Mountains between Europe and Asia reach the height of 5,540 feet. Besides Vesuvius, other two volcanoes are Etna in Sicily, and Hecla in Iceland. A great part of Northern and Eastern Europe is level.

The **great plain** of North Europe occupies part of France, Western and Northern Belgium, Holland, the northern provinces of Germany, and the greater part of Russia. A large portion of this plain, extending through Holland and North Germany, is a low sandy level not infrequently protected from inroads of the sea only by means of strong dykes. The other great plains of Europe are the Plain of Lombardy (the most fertile district in Europe) and the Plain of Hungary. Part of Southern and South-Eastern Russia consists of steppes.

Rivers and Lakes. The main European watershed runs in a winding direction from south-west to north-east, at its north-eastern extremity being of very slight elevation. From the Alps descend some of the largest of the European rivers, the Rhine, the Rhône, and the Po, while the Danube, a still greater stream, rises in the Black Forest north of the Alps. The Volga, which enters the Caspian Sea, an inland sheet without outlet, is the longest of European rivers, having a direct length of nearly 1,700 miles, including windings 2,400 miles. Into the Mediterranean flow the Ebro, the Rhône, and the Po; into the Black Sea, the Danube, Dnieper, Dniester, and Don (through the Sea of Azov); into the Atlantic, the Guadalquivir, the Guadiana, the Tagus, and Loire; into the English Channel, the Seine; into the North Sea, the Rhine, Elbe; into the Baltic, the Oder, the Vistula, and the Duna; into the Arctic Ocean, the Dvina.

The lakes of Europe may be divided into two groups, the southern and the northern. The former run along both sides of the Alps, and among them, on the north side, are the lakes of Geneva, Neuchâtel, Thun, Lucerne,

Zürich, and Constance; on the south side, Lago Maggiore, and the lakes of Como, Lugano, Iseo, and Garda. The northern lakes extend across Sweden from west to east, and on the east side of the Baltic a number of lakes, stretching in the same direction across Finland on the borders of Russia, mark the continuation of the line of depression. It is in Russia that the largest European lakes are found—Lakes Ladoga and Onega.

Geology. The geological features of Europe are exceedingly varied. The older formations prevail in the northern part as compared with the southern half and the middle region. North of the latitude of Edinburgh and Moscow there is very little of the surface of more recent origin than the strata of the Upper Jura belonging to the Mesozoic period, and there are vast tracts occupied either by eruptive rocks or one or other of the older sedimentary formations. Denmark belongs to the Cretaceous period, as does also a large part of Russia between the Volga and the basin of the Dnieper. Middle and Eastern Germany, with Poland and the valley of the Dnieper, present on the surface Eocene formations of the Tertiary period. The remainder of Europe is remarkable for the great diversity of its superficial structure, rocks and deposits belonging to all periods being found within it, and having for the most part no great superficial extent.

Europe possesses abundant stores of those minerals which are of most importance to man, such as coal and iron, Britain being particularly favoured in this respect. Coal and iron are also obtained in France, Belgium, and Germany. Gold is found to an unimportant extent, and silver is widely spread in small quantities. The richest silver ores are in Norway, Spain, the Erzgebirge, and the Harz Mountains. Spain is also rich in quicksilver. Copper ores are abundant in the Ural Mountains, Thuringia, Cornwall, and Spain. Tin ores are found in Cornwall, the Erzgebirge, and Brittany.

Climate. Several circumstances concur to give Europe a climate peculiarly genial, such as its position almost wholly within the temperate zone, and the great extent of its maritime boundaries. Much benefit is also derived from the fact that its shores are exposed to the warm marine currents and warm winds from the south-west, which prevent the formation of ice on most of its northern shores. The eastern portion has a less favourable climate than the western. The extremes of temperature are greater, the summer being hotter and the winter colder, while the lines of equal mean temperature decline south as we go east. The same advantages of mild and genial temperature which western has over eastern Europe, the continent collectively has over the rest of the Old World. The diminution of mean temperature, as well as the intensity of the opposite seasons, increases as we go east. Peking, in lat. 40° N., has as severe a winter as Petrograd in lat. 60° N.

Vegetable Productions. With respect to the vegetable kingdom, Europe may be divided into four zones. The first, or most northern, is that of fir and birch. The birch reaches almost to North Cape; the fir ceases a degree farther south. The cultivation of grain extends farther north than might be supposed. Barley ripens even under the seventieth parallel of north latitude; wheat ceases at 64° in Norway, 62° in Sweden. Within this zone, the southern limit of which extends from lat. 64° in Norway to lat 62° in Russia, agriculture has little importance, its inhabitants being chiefly occupied with the care of reindeer or cattle, and in fishing. The next zone, which may be called that of the oak and beech, and cereal produce, extends from the limit above mentioned to the forty-eighth parallel. The Alps, though beyond the limit, by reason of their elevation belong to this zone, in the moister parts of which cattle husbandry has been brought to perfection. Next we find the zone of the chestnut and vine, occupying the space between the forty-eighth parallel and the mountain chains of Southern Europe. Here the oak still flourishes, but the pine species become rarer. Rye, which characterizes the preceding zone on the continent, gives way to wheat, and in the southern portion of it to maize also. The fourth zone, comprehending the southern peninsulas, is that of the olive and evergreen woods. The orange flourishes in the southern portion of it, and rice and even cotton are cultivated in some places in Italy and Spain.

Animals. As regards animals, the reindeer and polar-bears are peculiar to the north. In the forests of Poland and Lithuania the urus, a species of wild ox, is still occasionally met with. Bears and wolves still inhabit the forests and mountains; but, in general, cultivation and population have expelled wild animals. The domesticated animals are nearly the same throughout. The ass and mule lose their size and beauty north of the Pyrenees and Alps. The Mediterranean Sea has many species of fish, but no great fishery; the northern seas, on the other hand, are annually

filled with countless shoals of a few species, chiefly the herring, mackerel, cod, and salmon.

Inhabitants. Europe is occupied by several different peoples or races, in many parts now greatly intermingled. The Celts once possessed the west of Europe from the Alps to the British Islands. But the Celtic nationalities were broken by the wave of Roman conquest, and the succeeding invasions of the Germanic tribes completed their political ruin. At the present day the Celtic language is spoken only in the Scottish Highlands (Gaelic), in some parts of Ireland (Irish), in Wales (Cymric), and in Brittany (Armorican). Next to the Celtic comes the Teutonic race, comprehending the Germanic and Scandinavian branches. The former includes the Germans, the Dutch, and the English. The Scandinavians are divided into Danes, Swedes, and Norwegians. To the east, in general, of the Teutonic race, though sometimes mixed with it, come the Slavonians, that is, the Russians, the Poles, the Czechs or Bohemians, the Serbians, Croatians, &c. In the south and south-east of Europe are the Greek and Latin peoples, the latter comprising the Italians, French, Spanish, and Portuguese. All the above peoples are regarded as belonging to the Indo-European or Aryan stock. To the Mongolian stock belong the Turks, Finns, Lapps, and Magyars or Hungarians, all immigrants into Europe in comparatively recent times. The Basques at the western extremity of the Pyrenees are a people whose affinities have not yet been determined. The total population of Europe is about 400 millions; nine-tenths speak the languages of the Indo-European family, the Teutonic group, the Slavonic, and the Latin. The prevailing religion is the Christian, embracing the Roman Catholic Church, which is the most numerous, the various sects of Protestants (Lutheran, Calvinistic, Anglican, Baptists, Methodists, &c.), and the Greek Church. A part of the inhabitants profess the Jewish, a part (mainly in Turkey and the Balkans) the Mahommedan religion.

Political Divisions. The accompanying table shows the political divisions of Europe with their areas and populations, and also includes the forms of government in the various states (it is important to consult the separate articles on the various countries).

History. Europe was probably first peopled from Asia, but at what date we know not. The first authentic history begins in Greece at about 776 B.C. Greek civilization was at its most flourishing period about 430 B.C. After Greece came Rome, which by the early part of the Christian era had conquered Spain, Greece, Gaul, Helvetia, Germany between the Danube and the Alps, Illyria, and Dacia. Improved laws and superior arts of life spread with the Roman Empire throughout Europe, and the unity of government was also extremely favourable to the extension of Christianity. With the decline of the Roman Empire a great change in the political constitution of Europe was produced by the universal migration of the northern nations. The Ostrogoths and Lombards settled in Italy, the Franks in France, the Visigoths in Spain, and the Anglo-Saxons in South Britain, reducing the inhabitants to subjection, or becoming incorporated with them. Under Charlemagne (771–814) a great Germanic empire was established, so extensive that the kingdoms of France, Germany, Italy, Burgundy, Lorraine, and Navarre were afterwards formed out of it. About this time the northern and eastern nations of Europe began to exert an influence in the affairs of Europe. The Slavs, or Slavonians, founded kingdoms in Bohemia, Poland, Russia, and the north of Germany; the Magyars appeared in Hungary; and the Normans agitated all Europe, founding kingdoms and principalities in England, France, Sicily, and the East.

The Crusades and the growth of the Ottoman power are amongst the principal events which influenced Europe from the twelfth to the fifteenth century. The conquest of Constantinople by the Turks (1453), by driving the learned Greeks from this city, gave a new impulse to letters in Western Europe, which was carried onwards by the invention of printing and the Reformation. The discovery of America was followed by the temporary preponderance of Spain in Europe, and next of France. Subsequently Prussia and Russia gradually increased in territory and strength.

The French revolution (1789) and the Napoleonic wars had a profound effect on Europe, the dissolution of the old German Empire being one of the results. The most important events in European history from the revolution of 1789 to 1914, the beginning of the European War, were: the establishment of the independence of Greece; the disappearance of Poland as a separate state; the unification of Italy under Victor Emmanuel; the Franco-German War, resulting in the consolidation of Germany into an empire under the leadership of Prussia; and

the partial dismemberment of the Turkish Empire.

The European War, 1914–8 (q.v.), revolutionized the continent and altered the map of Europe. The chief results were the disintegration of the Dual Monarchy and of Russia, the abolition of the German Empire, and the deposition of hereditary rulers in the smaller German states, which instituted republican Governments. The following new states were formed from the constituent parts of Russia and Austria-Hungary: Albania, Armenia, Azerbaijan, Czechoslovakia, Estonia, Finland, Georgia, Latvia, Lithuania, Yugo Slavia, and Danzig. Poland, dissolved in the eighteenth century, was again reconstituted. France regained Alsace and Lorraine, Turkey lost almost all her possessions in Europe, whilst Belgium, Denmark, Greece, Italy, and Rumania were greatly enlarged, acquiring new territories. All these alterations of boundaries and additions of territories were based on ethnological grounds, the new states being inhabited by peoples belonging to the same ethnical group and speaking the same language. *See* articles on the various countries.—BIBLIOGRAPHY: E. A. Freeman, *General Sketch of European History*; A. Hassall (editor), *Periods of European History*; *European History Chronologically Arranged*; A. S. Rappoport, *History of European Nations*; O. Browning, *General History of the World*; H. S. Williams, *The Historian's History of the World.*

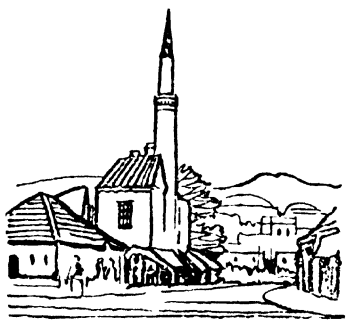
State.	Form of Government.	Area in Sq. Miles.	Population.
Albania	Became a kingdom in September, 1928	10,629	1,003,068
Andorra	Semi-independent state under suzerainty of Bishop of Urgel and President of France	191	5,231
Austria	Republic	32,369	6,732,625
Belgium	Kingdom	11,755	8,159,185
Bulgaria	Kingdom (Tzar)	39,814	5,478,741
Czechoslovakia	Republic	54,207	14,726,158
Danzig	Free city. The League of Nations appoints a Commissioner	754	407,517
Denmark	Kingdom	16,576	3,550,656
Estonia	Republic	18,353	1,120,000
Finland	Republic	132,589	3,667,067
France	Republic	212,659	41,834,923
Germany (with Saar District)	Federal Republic	181,723	65,594,000
Greece	Republic	50,257	6,480,000
Hungary	Kingdom ruled by a regent	35,875	8,688,349
Iceland	Kingdom	39,709	108,870
Italy	Kingdom	119,713	41,806,000
Latvia	Republic	24,440	1,900,045
Liechtenstein	Principality	65	10,213
Lithuania	Republic	55,670	2,392,983
Monaco	Principality	370 acres	24,927
Netherlands	Kingdom	12,579	8,061,571
Norway	Kingdom	124,588	2,814,194
Poland	Republic	149,960	32,132,936
Portugal	Republic	35,490	6,698,345
Rumania	Kingdom	122,282	18,025,037
Russia	Soviet Republic	8,241,921	161,006,200
San Marino	Republic ruled by two regents	38	13,948
Spain	Republic (including Canaries, etc.)	196,607	23,656,300
Sweden	Kingdom	173,356	6,162,446
Switzerland	Federal Republic	15,940	4,006,400
Turkey	Republic	294,416	13,648,270
United Kingdom	Kingdom	94,278	46,189,445
Irish Free State	British Dominion	26,601	2,971,992
Gibraltar	British Crown Colony	1¼	21,372
Malta	British Colony possessing responsible government	95	244,002
Vatican State	Under sovereignty of Pope	108·7 acres	1,025
Yugo Slavia	Kingdom	248,665 sq. km	13,930,918

EUROPEAN WAR, 1914-8. The European War, which began in Aug., 1914, and involved the greater part of the globe before the last shot was fired in Nov., 1918, had its ostensible origin in the assassination of the Austrian heir-apparent, the Archduke Franz Ferdinand, and his wife, at Serajevo, capital of Bosnia, once part of the ancient kingdom of Serbia. This crime was committed by a Bosnian student, but Austria-Hungary held Serbia responsible, and, inspired by Germany, sent an ultimatum on 23rd July, amounting to a demand that Serbia should surrender her independence. Two days later, notwithstanding that Serbia conceded every demand, with two reservations which she offered to submit to the Hague Tribunal, Austria-Hungary declared war on her. Germany, who had seen in the Serajevo tragedy a pretext for making her long-premeditated bid for world dominion, "knew very well what she was about in backing up Austria-Hungary in this matter," as the German Ambassador in Vienna frankly told the British representative at the time; and when Russia, as the traditional protector of the Slavs, mobilized her southern armies to save Serbian independence if necessary, she threatened instant mobilization on her own part unless Russia stopped these military measures within twelve hours. It was technically impossible for Russia to do anything of the kind, but her protest to this effect was unavailing.

Germany declared war on Russia on 3rd Aug., and as this inevitably involved war at the same time with Russia's ally France, she sent a note on the following day to Belgium demanding safe passage for German troops through Belgian territory, though Prussia as well as Great Britain, France, Russia, and Austria had guaranteed the neutrality and independence of Belgium by the treaty of 1839, repeatedly confirming this on subsequent occasions. When the British Ambassador in Berlin protested against the threatened violation of treaty rights, the German Chancellor, Bethmann-Hollweg, repudiated the treaty as a mere "scrap of paper."

On 3rd Aug., when Germany formally declared war on France—though her troops had already invaded French territory at various points—Belgium refused Germany's demands, and called on Great Britain and France for assistance. It was this call, and Germany's refusal on the following day to accede to the British demands that Belgian neutrality should be respected—declaring war on Belgium instead and violating her territory early that morning—which decided Great Britain to range herself wholly on the Franco-Russian side. The German Ambassador in London had already been warned (on 31st July) that we should be drawn into the struggle if Germany persisted in her threatened attack on France. Two days previously Germany had made the 'infamous bid' to Great Britain that if she would remain neutral no territory would be taken from France herself, though no undertaking could be given with regard to French colonies. British mobilization orders were issued on 4th Aug., and at 11 p.m. on that date Great Britain declared war on Germany.

Fortunately the British navy was ready for any emergency, with the



Serajevo

Grand Fleet—the command of which was given to Admiral Sir John Jellicoe—still assembled in full strength at Portland, after the manœuvres, the order for its dispersal having been countermanded on 27th July. Lord Kitchener, home on leave from Egypt, had also been stopped by a telegram from Mr. Asquith, then Prime Minister, as he was stepping on the Channel boat at Dover on his return journey (3rd Aug.), and two days later was appointed Secretary of State for War. Meantime the Austrians had already bombarded Belgrade (29th July); Italy had declined (1st Aug.) to be drawn into the conflict with her Austro-German partners of the Triple Alliance on the grounds that their war was an aggressive one; and German troops, as already mentioned, had invaded France at several points on 2nd Aug., before formally declaring war on that country.

Western Front, 1914. The struggle on the Western front began in

earnest on the following day, when war was declared on France and the Germans captured Trieux, near Briey, and Lunéville was bombarded by German aeroplanes. The German system of mobilization had been quicker than the French and Russian, but the opening moves filled the Allied commanders with too-confident hopes. Although slower to mobilize than the Germans, a Russian army under Rennenkampf succeeded in invading East Prussia in force; the Belgians made a magnificent stand for their frontier fortresses when the Germans, denied the right of way which they had demanded, endeavoured to force the great highway of Western Europe which passes through Liége; and the French, besides



General Leman

checking the enemy at Dinant, had already recovered part of the lost provinces of Alsace-Lorraine.

On 16th Aug. the First British Expeditionary Force, under General Sir John French, completed its landing at Boulogne, and four days later had arrived and concentrated on the line Avesnes-Le Cateau, on the left or exposed flank of the French Fifth Army under General de Lanrezac. It consisted of 50,000 infantry with its artillery, and five brigades of cavalry—some 70,000 troops altogether, a mere drop in the ocean compared with the millions of men who were marching to battle for the great military powers, but destined to play a part in the forthcoming struggle out of all proportion to its size.

The position at this juncture was, briefly, as follows: the Germans having at length captured the last forts of Liége, with its gallant commander General Leman, were overrunning Belgium. Brussels had just been evacuated (20th Aug.), and the main Belgian army, menaced by greatly superior forces of the enemy, and disappointed in its hope of effective support from the Franco-British troops, was retiring to seek the protection of the forts of Antwerp. Having occupied Brussels on the 20th, the German Higher Command appointed Baron von der Goltz as Governor. A reign of terror in Belgium had already been inaugurated as part of Germany's deliberate policy of 'frightfulness,' including the ruthless execution of civilians on unsubstantiated charges of shooting at the invaders.

The French armies, under the supreme command of General Joffre, who, like Lord Kitchener, had been an engineer student when the Franco-Prussian War broke out, and had been Chief of the General Staff since 1911, were now disposed for the double purpose of meeting the threatened German onslaught and preparing the counter-offensive on which French doctrines of strategy had been based. Starting from the Swiss frontier there were nine divisions forming the Alsace force, the main offensive group, consisting of the French First and Second Armies, being extended along the Lorraine frontier, and the Third Army about Verdun. The Fourth Army formed the mass of manœuvre held in reserve behind the centre, while the Fifth, whose left wing was now extended by the British Expeditionary Force, faced the Ardennes as far as the Belgian frontier.

Germany was not seriously alarmed by the spectacular advance of the French into their lost provinces. It suited the strategy of her War Staff to keep the French mass of manœuvre as far as possible from the point at which it would soon be sorely needed; and their feint attacks in the direction of Longwy, Lunéville, and Belfort were designed to strengthen the belief that their real offensive would come in the frontal assault which the French dispositions had assumed. Germany, however, had always intended to strike through Belgium when the time came to deliver the knock-out blow to France before Russia had time to mobilize her millions.

The German advance was proceeding according to the plan which had been worked out in detail as far back as 1904 by the soldier-scholar of the Garde-Ulanen, Count von Schlieffen, who died two years before his great scheme was put into execution. Based on the assumption that Germany and Austria-Hungary would have to fight France, Russia, Great Britain, and Belgium without the aid of Italy, it provided for an immediate attack by

the right wing of the German army of such weight and ferocity as to destroy the French left by a single blow, and then roll up the main French armies one after the other. The South and Russian fronts were meantime to be lightly held, everything being staked on the sudden, overwhelming blow in the north through Belgium. One of the bitter controversies in Germany, after the war, raged round the responsibility for the failure of this plan, the execution of which devolved on General von Moltke, nephew of the great strategist of the Franco-Prussian War. The Kaiser believed that the name of Moltke would strike terror into the hearts of Germany's enemies, but the second Moltke lacked the genius of his predecessor, and the course of events proved that he was not equal to the task of carrying out so prodigious a plan.

It was doubly necessary to strike at once with an immediate maximum of strength now that Britain had already ranged herself alongside the Allies. This maximum of strength was attained long before France had completed her mobilization, and enabled Germany to launch her unexpected blow with crushing effect. She had reckoned, however, without the stubborn defence of the Belgians in the opening moves of the game, a defence which clogged the wheels of her mighty war machine at the critical moment; and was wholly unprepared for Britain's great achievement in transporting her 'insignificant' but indomitable army, without a hitch, complete in every detail, and establishing it in its place in the line of battle, hundreds of miles from its base, in less than three weeks from the declaration of war. Clearly there was no time to be lost in solving the military problem on the Western front before the Russians could throw their full weight into the scales.

The secret of Germany's sudden attempt to overwhelm the Allied left by an outflanking movement was well kept. The position in Belgium was obviously grave; but Joffre still clung to the belief that if the Germans attacked the Allied left in force, they would leave their own position in front of the French Fifth Army so exposed as to give him an opening for a successful counter-stroke with de Lanrezac's troops in co-operation with the British. Up to the 22nd General French's preparations were all in the direction of offensive action on these lines; his two corps had taken up their positions through Binche and Mons and along the canal to Condé.

The German tide which now swept through the plains of Belgium entirely upset the Allied calculations. General French woke on 22nd Aug. to find the troops of the French Fifth Army on his right in unmistakeable retreat. The full force of the German blow, delivered by von Buelow's Second Army, had been felt by de Lanrezac's troops on the Sambre at daybreak, and had pressed them back from the river. The British position held by the 1st Corps (1st and 2nd Divisions) under General Sir Douglas Haig, the 2nd Corps (3rd and 5th Divisions) under General Sir H. Smith-Dorrien, and the Cavalry Division under General Allenby, became isolated by the retreat of de Lanrezac—"the most complete example," as Lord French long afterwards described him, "of the Staff College pedant whose 'superior education' had given him little idea of how to conduct war." De Lanrezac asked General French if he would attack the flank of the German columns which were pressing him back from the Sambre, but the British Commander, who had received definite instructions from Lord Kitchener that his command was to be an entirely independent one, "and that you will in no case come in any sense under the orders of any Allied general," replied that with his own position so seriously threatened by the retreat of de Lanrezac's troops such an operation was impracticable, but he agreed to retain his present position for the next twenty-four hours.

The British army fulfilled this pledge, and the barrier thus held and maintained during the subsequent retreat, though shattered in parts, saved the French left from being outflanked by the invading right wing of the Germans under von Kluck. The whole situation became extremely critical on the following day (23rd Aug.). Namur, the forts of which had been regarded as impregnable, fell before the crushing attack of the heavy Austrian howitzers brought up by the advancing Germans; the French thrust into Alsace-Lorraine had just been countered by the German Fifth Army under the Crown Prince Rupprecht of Bavaria, which compelled the French to retreat from all but a corner of Alsace; and the main German attack, launched at the other end of the line, forced the French back both from the Sambre and the Meuse. The French Fifth Army, the position of which was considerably weakened by the fall of Namur, was attacked both by von Buelow's army in front, and by a Saxon army under von Hausen on its right. It was forced back until von Hausen found a gap on its right flank through which he proceeded to pour his Saxons with the object of rolling up the French Third and Fourth Armies under Ruffey and Langle de Cary. These retreated in turn, to recover alignment with de Lanrezac's Fifth Army, which had re-

treated from the British right. The British army was thus left 'in the air,' outflanked not only on the right, where von Buelow was now advancing on it from Charleroi, but also on the left, where von Kluck's right wing was sweeping down in full force from the north-west.

The onslaught on the British front began shortly after noon with a bombardment of some 600 guns along the whole line of 25 miles; followed by a great frontal attack in mass formation. The British troops, all experts at musketry, used their rifles with such deadly effect that the frontal attack crumpled up. The line held; but with the German tide surging round on either flank the position became increasingly critical. Under the threatened turning movement General Smith-Dorrien withdrew from the Mons salient, and before nightfall took up a fresh line some 3 miles south of the canal. The advanced troops of the 1st Corps had not been seriously engaged, and held their ground. It was not until late that night that the desperate situation on his right was fully revealed to General French; and when news also arrived from Joffre that the British army would probably be attacked the next day by at least three German corps and two cavalry divisions, it became clear that a general and immediate retirement was inevitable. What actually happened was that the enemy attacked with no fewer than four corps, and at least two cavalry divisions.

The Retreat from Mons. The great retreat began shortly after dawn on the 24th with a feint attack by the 1st Division, under cover of which the 2nd Corps moved back 5 miles, and then stood in turn to protect the retirement of the 1st Corps. Further withdrawals were effected that day by alternate corps, covered by heavy rear-guard actions, until the 1st Corps had reached the line between Maubeuge and Bavai, with the 2nd Corps extending the line from Bavai to Bry. Von Kluck's army, though kept in check by the retreating troops, followed closely on their heels and round their left flank, their design apparently being to turn the British left and press them back on Maubeuge, the fortress close on their right rear, which, well fortified and provisioned as it was, offered, as General French afterwards pointed out (in 1914), a terrible temptation to an army seeking shelter against overwhelming odds. Bazaine's example at Metz in 1870, and a shrewd suspicion that the German move was deliberately planned with that end in view, proved sufficient reasons for avoiding the trap. A further retreat was accordingly ordered to the line Le Cateau-Cambrai, some miles farther back.

Tournai, which was held by a French Territorial brigade, fell that day. There was nothing apparently to prevent the German host at this juncture from continuing its course to the coast and seizing the Channel ports as far as the Seine. That, doubtless, would have been included in the programme had the Germans anticipated a campaign of any considerable duration. The Kaiser, however, had promised his troops that they should be home again "before the leaves fall"; and to bring this about it was necessary to settle with the Allied army once and for all. Where von Moltke failed, according to Ludendorff and other critics after the war, was in not striking farther to the north or north-west, and in not throwing still more weight into the scale from his left wing.

On the 25th the French were still retreating all along the line save at Maubeuge, the garrison of which held out until 7th Sept., and at Longwy, north of Verdun, which fell on 28th Aug. The British army, battle-worn and suffering severely from the heat, but resisting all the German efforts to turn its western flank, marched stubbornly back, gallantly assisted by Allenby's cavalry. The French were a day's march ahead of them when the British reached the Le Cateau position. General French decided, therefore, that, sorely as the troops needed rest, there was nothing for it but to resume the retreat at daybreak, and issued orders to that effect. The hardest fighting on the 25th had fallen to the 1st Corps at Landrecies, where Haig's weary troops were violently attacked at nightfall, before they could snatch any rest, by fresh enemy troops sent forward in pursuit in motors and lorries. The German infantry paid dearly for their temerity in advancing through the narrow streets of the town in close order, two or three British machine-guns mowing them down in hundreds. The attack was a disastrous failure.

The 2nd Corps did not reach Le Cateau until ten or eleven o'clock that night, thoroughly exhausted after a hard day's fighting and marching. Smith-Dorrien had lost heavily in the operations, and was so convinced that his troops were unfit to resume the march at daybreak that he elected to stand and abide by the result. 'The magnificent fight put up by his troops on the following day, assisted by Allenby and Sordet's cavalry, and two divisions of French Territorial troops under d'Amade, which had been detailed to guard the British left flank, saved the situation, and averted, in the considered opinion expressed by General French five years later, "a stupendous repetition of Sedan." The actual result was a total loss of some 14,000 officers and

men, about 80 guns, and numbers of machine-guns, as well as quantities of ammunition and material. According to General French, these losses heavily handicapped the British army in the subsequent stages of the retreat, and were felt throughout the first battle of the Marne and the early operations on the Aisne. In his dispatch of Sept., 1914, the British Commander-in-Chief had written of this battle in eulogistic terms. It was not till some time later, he explains, that he came to know the full details of the battle and to appreciate it in all its details. For General Smith-Dorrien it is urged that his stand at Le Cateau broke the full force of the German pursuit, and checked its course in time.

On the 27th the shattered 2nd Corps, having broken off the action, continued the retreat with the 1st Corps. On the 28th Gough, with the 3rd Cavalry Brigade at St. Quentin, and Chetwode, with the 5th at Cérizy, turned on the leading German cavalry at both these places and threw them back on their main bodies in confusion. For the first time since the retreat began the worn-out British infantry, having reached the line of the Oise between Noyon and La Fère, were able to rest and sleep in peace.

On the 29th the British troops reached the line Compiègne-Soissons, the Germans on the same day occupying La Fère and Amiens, as well as Rethel and other towns along the French front. Bapaume held out until the rolling-stock had been removed from Amiens, but the floodtide of invasion now seemed to be carrying everything before it. Uhlans threatened to cut Sir John French's communications with his base at Boulogne and Dieppe. The base was accordingly transferred to St. Nazaire, at the mouth of the Loire. Timely help came to the retiring British troops on the 29th by a brilliant counterstroke near Guise on the part of the French Fifth Army on their right; but neither the British nor the French troops on de Lanrezac's right were in a position to make a stand in support of that reaction. The Aisne was forced by the invaders on the 28–29th, and Rheims, Châlons, and Laon abandoned to them within the ensuing forty-eight hours. Falling back doggedly from the Aisne and the Oise, the British troops withdrew on 2nd Sept. to Chantilly-Nanteuil, the German advance having been checked on the previous day by the 4th (Guards) Brigade in a stiff rear-guard action at Villers-Cotterets.

The great retreat was coming to an end. Victory and Paris seemed within the enemy's grasp. He had—as he thought—so shattered the British army that it was now entirely negligible as a fighting force. He was ignorant of the real strength of the force that was gathering on the British left north of Paris—the new French Sixth Army under General Maunoury. It seemed both to von Kluck and the German Higher Command that they had only the shaken French Fifth Army seriously to reckon with on the Allied left, and, as von Kluck was considered more than strong enough for the task, von Moltke took the Garde Reserve Corps and 11th Army Corps from his right wing to East Prussia, where the Russians were now carrying the war well into the Fatherland.

The help rendered by the Russians at this critical phase of the war was invaluable, and played no small part in the approaching struggle on the Marne. In his fears for the safety of Paris, Joffre was naturally anxious to profit by this relief, and discussed with Sir John French the possibility of taking the offensive at the earliest possible moment. There appears to have been some misunderstanding as to Sir John's plans at this point. The British Commander-in-Chief declares that he had every intention of remaining in the line and filling the gap between the French Fifth and Sixth Armies, but the French Higher Command was apparently under the impression that he was determined not to fight any more until his troops had been given a week to reorganize and refit. Lord Kitchener himself hurried to Paris to clear the matter up, but "full accord," according to President Poincaré, long afterwards, "was not re-established without trouble." As soon, however, as the offensive was ordered, continued the same authority, the British Commander-in-Chief gave his assistance without reserve. "His army fought with magnificent courage, and Great Britain played a brilliant part in the common victory."

In the meantime the retreat continued, the British, on 2nd Sept., reaching the line of the Marne towards Lagny and Meaux, with the French Fifth Army, now under the command of Franchet d'Esperey, on their right, retiring on Château-Thierry, and Maunoury's new Sixth Army, on their left, retiring towards Paris. It was at this point that von Kluck made the fatal mistake of dismissing the British army as practically crushed and out of action. Diverting the advance of the German First Army, he left Paris on his right in order to deal what he hoped would be a decisive blow at the French Fifth Army south of the Marne. By 5th Sept. the British army had fallen back to the Forest of Crécy to bring it in line with the French Fifth Army.

Not only was the British army at length receiving sorely needed rein-

forcements, but the French army was every moment increasing in strength and numbers as it fell back on its reserves. Besides the French Sixth Army on the British left, another new French army had sprung into being behind the marshes of St. Gond—the Ninth, under Foch, who filled the gap between Franchet d'Esperey's Fifth and Langle de Cary's Fourth Army—behind Vitry. Eastward the line was continued by the French Third Army, now commanded by Sarrail in place of Ruffey; and Castelnau's Second Army, now fighting the battle of the Grand Couronné de Nancy which stemmed the German invasion at this point,



Von Kluck

and prevented the threatened envelopment on the Allies' right, where the Kaiser himself had gone to inspire the troops of Prince Rupprecht of Bavaria.

First Battles of Marne and Aisne. Secure on the right, Joffre was at last able to deliver the great counter-stroke on the left which the Germans had invited by their tremendous bid for swift and decisive victory. The retreat came to an end on 5th Sept., when Joffre gave Sir John French his final plans for the coming offensive, and von Kluck, ignorant of the recuperative powers of the British, as well as of the strength of the French Sixth Army on their left, marched across their front in pursuit of d'Esperey's Fifth. That night the Germans crossed the Marne, and the Grand and Petit Morin—two streams which branch off roughly parallel to one another south of the Marne—while some of their patrols reached the Seine, there catching a fleeting glimpse of the capital where they confidently hoped the French would soon be brought to terms.

When at last the retreat came to an end, the British army had been reinforced by the 4th Division, which, with the 19th Infantry Brigade—and subsequently the 6th Division—became the Third Army Corps under General Pulteney, who arrived in France to take command of it on 30th Aug. Deficiencies in armament and material had also been partially made good, but, most important of all, Sir John French bore witness, "the promise of an immediate advance against the enemy had sent a thrill of exultation and enthusiasm throughout the whole force."

The first battle of the Marne had scarcely opened on 6th Sept., 1914, when von Kluck, realizing that Maunoury's force on his extreme right was becoming dangerous, sent two army corps northwards to deal with it. Maunoury had already crossed the Marne and fought the first battle of the Ourcq on the 5th. The dispatch of the two German corps to keep him in check made a way now for the British troops, when, according to plan, they turned on the invaders with the object of assailing their flank with the French Sixth Army on their left; while the French Fifth Army, and the French armies to its right, made a simultaneous frontal attack.

Both Joffre and French were under the impression that the German thrust was still in full career when their counter-stroke was delivered. Already, however, the tide had begun to turn. Von Kluck, realizing too late—what should have been obvious from the first—that his communications were being seriously threatened on the Ourcq, saw that retreat was inevitable unless he could crush the forces gathering so ominously against his right flank. The opening of the battle of the Marne thus became on von Kluck's part an effort to overwhelm Maunoury on his right, while he kept the British army and French Fifth Army at bay with strong rear-guards and cavalry. The surprise of the day to the Germans was probably the remarkable part played by the British, who, instead of being practically wiped out, as the enemy fondly believed, attacked with an energy and dash which carried everything before them, and, but for filling their allotted rôle of maintaining alignment with the French armies on each flank, would doubtless have advanced farther than they did. As it was, the progress made was considerable. The Germans were driven back to the Grand Morin, and the line of that stream made good on the following day.

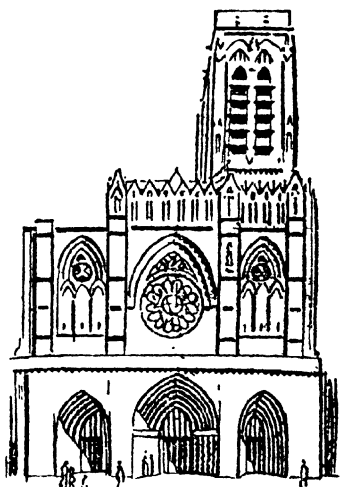
Meantime the French Fifth Army

on their right, materially helped by this success, had also recovered a good deal of ground, while Foch and Langle de Cary, farther east, held their own against the fierce assaults of the German centre. A last desperate effort was being made to hack a way through at this point, and Sarrail, on Langle de Cary's right, had to give way a little along the Meuse. That day the Germans reached the most southerly point of their advance, at Provins. The deciding phase of the battle, however, was developing with dramatic swiftness on von Kluck's right wing. Maunoury was hard pressed by the repeated onslaughts of the enemy, whose heavy reinforcements at this point held the issue in the balance for several days. General Gallieni, the Governor of Paris, hurried up fresh troops to Maunoury in motor-buses and taxis, and the French line held.

The British army helped matters considerably by driving the Germans across the Grand Morin at Coulommiers on the 7th, and on the following day from the Petit Morin, thus also helping d'Esperey with the French Fifth Army, on its right, to continue his advance farther east as far as Montmirail. On the 9th came the decisive blows which removed all doubts as to the issue of the battle. Von Kluck's retreat on his left flank exposed the right of von Buelow's Second Army, which was further jeopardized by a gap which appeared on its left, where it should have linked up with von Hausen's Third Army. This double opening gave Foch, facing von Buelow in the marshes of St. Gond, the opportunity which he sought of smashing the enemy's centre. He seized it by a series of lightning blows which drove the German centre back on the morning of the 10th in complete disorder, pursued by Foch's victorious infantry.

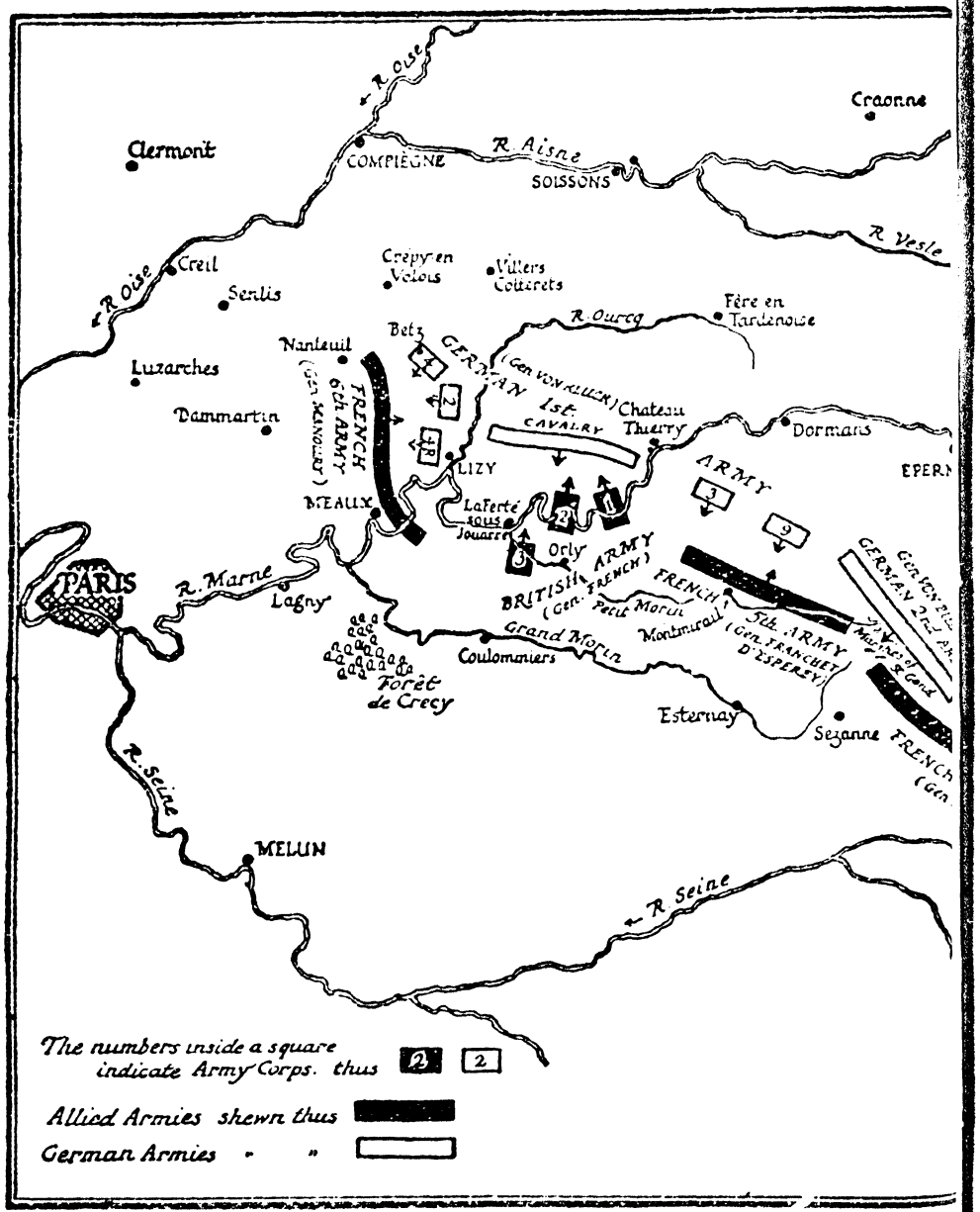
All the reinforcements sent to von Kluck were now of no avail against the French Sixth Army, which had been fighting against odds since 6th Sept., helped not a little by Pulteney's 3rd Corps on its right flank. Maunoury carried the Ourcq on the 9th, and Pulteney's corps was able to cross the Marne, after stiff fighting at La Ferté-sous-Jouarre, at dawn on the following day, when the German retreat became general. The left of the British 2nd Corps had crossed the Marne at Nanteuil, where the bridges were found unbroken and the enemy gone, on the morning of the 9th, but was ordered not to advance too far north until the 1st and 2nd Corps were firmly established on the northern bank. The 1st crossed later in the day at Charly-sur-Marne and Saulchéry, clearing the ground of the enemy and making many captures; but the 3rd Corps had a harder task at La Ferté-sous-Jouarre, and, as already mentioned, was not completely established on the other side until the following morning. The first battle of the Marne ended on the night of the 10th with the enemy in full retreat to the north and north-east and the Allies in hot pursuit. By the 12th he had been driven back from the Seine a distance of 65 miles, and the great German plan of a sudden crushing defeat of the Allies in the West had collapsed like a house of cards.

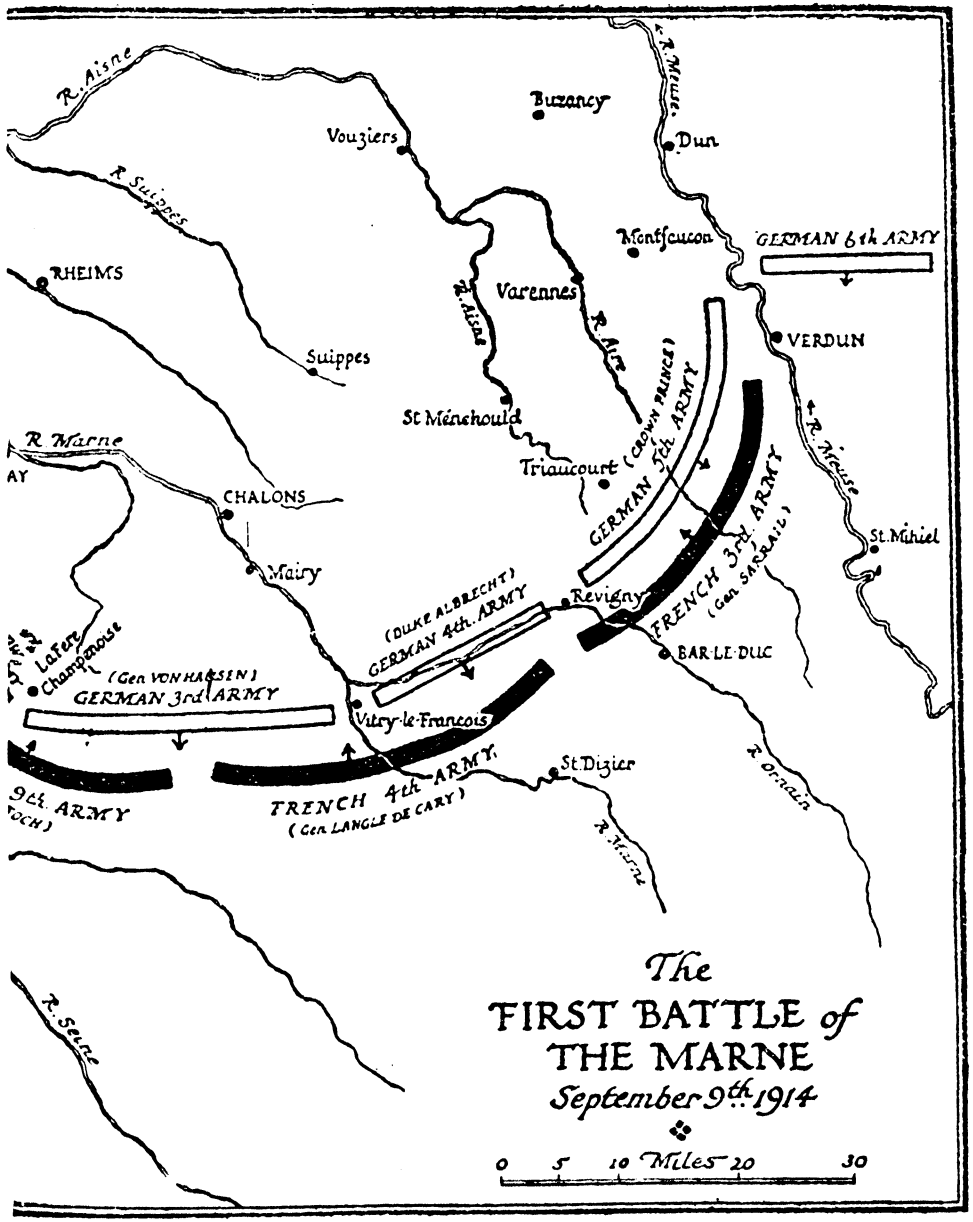
The hopes thus raised among the Allies of a speedy termination of the war in their favour were, on the other hand, equally illusory. Though the Germans lost heavily in officers and men, as well as in guns and other war material, their retreat was no disorderly flight. Many desperate rear-guard actions were fought all along the line, but the enemy retired steadily to prepared positions on the Aisne, where the eyes of all the commanders were to be opened to the possibilities of trench warfare under modern conditions. It needed many hard lessons before the truth was driven home.



The Cathedral of Soissons as it appeared before it was destroyed in the war

When the first battle of the Aisne opened on 13th Sept., the British army already had its outposts on that river, the main body being in positions somewhat to the south, between Soissons and Bourg. Throwing bridges across during the night, the advance was continued on the opposite bank on the fol-


R. Oise
Clermont
COMPIÈGNE
R. Aisne
SOISSONS
Craonne
R. Vesle
Creil
Crepy-en-Valois
Villers Cotterets
Senlis
Fère en Tardenoise
R. Ourcq
Betz
Nanteuil
Luzarches
Dammartin
GERMAN (Gen VON KLUCK) 1st CAVALRY
Chateau Thierry
Dormans
FRENCH 6th ARMY (Gen MANOURY)
LIZY
MEAUX
Laferte sous Jouarre
ARMY
PARIS
R. Marne
Lagny
Orly
BRITISH ARMY (Gen FRENCH)
Petit Morin
FRENCH
Montmirail
5th ARMY (Gen FRANCHET D'ESPEREY)
Grand Morin
Coulommiers
Forêt de Crecy
Esternay
Sezanne
R. Seine
MELUN
The numbers inside a square indicate Army Corps. thus
Allied Armies shewn thus
German Armies " "


R. Aisne
Buzancy
R. Meuse
Vouziers
Dun
R. Suippes
Montfaucon
GERMAN 6th ARMY
RHEIMS
Varennes
R. Aire
R. Aisne
VERDUN
Suippes
St Ménehould
GERMAN 5th ARMY (CROWN PRINCE)
R. Marne
Triaucourt
R. Meuse
CHALONS
GERMAN 3rd ARMY
FRENCH 3rd ARMY (Gen SARRAIL)
St. Mihiel
Mairy
Revigny
(DUKE ALBRECHT) GERMAN 4th ARMY
BAR-LE-DUC
Lafere Champenoise
(Gen VON HAUSEN) GERMAN 3rd ARMY
Vitry-le-François
9th ARMY (FOCH)
FRENCH 4th ARMY (Gen LANGLE DE CARY)
St Dizier
R. Ornain
R. Meuse
R. Seine
The FIRST BATTLE of THE MARNE
September 9th 1914
0 5 10 Miles 20 30

lowing day, though not without heavy British casualties, amounting to between 1,500 and 2,000, including 3 commanding officers. The 6th Division arrived from England at this stage, and joined its own 3rd Corps on the left. Further advance was stayed by the strength of the enemy's entrenched positions, in which he now determined to make his stand. Here he was backed by an overpowering superiority in artillery which, with fierce counter-attacks on the part of his infantry, gallantly repulsed though they were, caused such severe losses that the British Commander-in-Chief was forced to assume a defensive rôle, while Maunoury, de Castelnau, and Foch each made stupendous efforts to break the enemy's line and renew the war of movement and manœuvre on which



Von Moltke

their military principles had been based. All, however, ended in the same dreary deadlock of entrenchments.

Failing to shift the enemy from these impregnable positions, Joffre endeavoured to outflank the German right wing, already threatened by Maunoury's advance along the Oise. Two new French armies were formed from the reserves to extend the Allied left —the Seventh, entrusted to de Castelnau, whose Second Army was transferred to Dubail, and the Tenth, the command of which was given to Maud'huy. De Castelnau's Seventh Army, though it failed to turn the enemy's flank—the movement having been anticipated by him—succeeded in extending the pressure of Maunoury's left, which had swung round by the 20th until it ran north from Compiègne to west of Lassigny, and in building the first section of Joffre's great besieging wall which, gradually extending from the Alps to the sea, became the impenetrable barrier between the enemy and his main objectives. The Allies' line was continued by de Castelnau through Roye to Albert, and thence, by Maud'huy's Tenth Army, through Arras to Lens.

Von Moltke had now been superseded in the German Higher Command by Falkenhayn, who promptly countered Joffre's new strategy by similar extensions of the German front, thus beginning the outflanking race destined only to end in stalemate on the coast. While extending their right the Germans made a strenuous effort to regain the initiative by a blow with the army group nominally commanded by the German Crown Prince on Sarrail's flank on the Meuse. It was a blow aimed at Verdun and the whole of the Allied line, which it hoped to break through at this point and so take in the rear. Verdun, however, had been rendered impenetrable by miles of powerfully protected outer defences, and practically the only success which fell to the Crown Prince on this occasion was the capture of the Camp-des-Romains and St. Mihiel on the Meuse, thus creating the remarkable salient east of Verdun which was destined to remain until the Franco-American force flattened it out in the victorious advance of the Allies four years later. The German Crown Prince fared even worse a week later, when he attacked along the main road through the Argonne towards Verdun, only to be flung back. It was after this double failure that the Germans bombarded Rheims and shattered her noble cathedral.

The crucial phase of the struggle in the West had shifted towards the coast as the first battle of the Aisne died down on 28th Sept., and the campaigns began in Artois which led in due course to the fierce struggles for the Labyrinth, the Vimy Ridge, Lens and Loos. The extension of the French left placed the British army in an anomalous position. Even before Joffre had begun to build his barrier in this direction the British Commander-in-Chief had felt strongly that his proper sphere of action was on the Belgian frontier on the left flank of the French armies, for the two-fold purpose of defending the Channel ports and being in position to concert combined action with the British navy. He suggested this move to the north to Joffre on 29th Sept., pointing out its strategical advantages and the possibility of doing so now that the position of his force on the right bank of the Aisne had been thoroughly well entrenched. Joffre

agreed in principle to General French's proposal, but postponed the movement until 3rd Oct.

Retreat from Antwerp. By this time the critical situation of the Belgian Army at Antwerp had become hopeless, and the danger of a German descent on the Channel ports suddenly became acute. Since their retreat towards Antwerp after their evacuation of Brussels on 20th Aug., the Belgians had kept the Germans at bay by vigorous counter-attacks, and threatened their communications by sundry sorties from the fortress. These sorties and counter-attacks, calling for reinforcements at a time when every soldier was needed on the main fighting fronts, infuriated the Germans and led to the reign of terror which included the deliberate destruction of Louvain and similar outrages at Malines, Termonde, and elsewhere.

Having made his position secure on the Aisne, and brought up his heavy guns, the enemy began his bombardment of the outer forts of Antwerp on 28th Sept. By the 3rd of Oct. the Belgians were endangered not only by the besieging army, but also by the ever-lengthening German line which, having now been extended from Lassigny to Lille—only 38 miles from the sea—threatened to isolate the Belgian forces from the Franco-British armies. They accordingly decided that plans must be made at once to withdraw from Antwerp in the direction of Ghent, both to protect the coast-line and gain touch with the Allies. The British troops hurriedly sent to reinforce the Belgians—a brigade of Royal Marines and part of the recently formed Naval Division—had no influence on the fate of the fortress, but helped in protecting the flight of the citizens and in the final retreat of the Belgian army. Some 1,500 of the Royal Naval Division were forced across the Dutch frontier and interned, and about 800 were made prisoners. The remnants of the British force, and the bulk of the Belgian army, escaped westward, leaving the Germans on 9th Oct. in possession of the deserted city. A little more and the German commander (von Beseler) might have closed the gap beyond the Scheldt through which this retreat had been made. Luckily for the Allies, too, the German Higher Command failed, as Lord French long afterwards expressed it, to gather the richer harvest which had been put within its grasp by the capture of Antwerp. There was then apparently no insuperable obstacle to an immediate German advance on Dunkirk, Calais, and Boulogne, before the Allied troops could arrive from the main theatres to prevent it. "As on the Marne, so at Antwerp, they were not prepared to seize the psychological moment and to play boldly for the great stake."

General French, who had been given no voice in the Antwerp dispositions, was now in the midst of the British move from the Aisne front to the north, where he was to be reinforced by the 7th Infantry and 3rd Cavalry Divisions, which had been landed on the Belgian coast to defend Zeebrugge and Ostend under Rawlinson's command, and the Indian contingent, which had just arrived at Orleans under Willcocks.

First Battle of Ypres. The two corps under de Castelnau and de Maud'huy were now under the supreme command of General Foch, who had orders to control all the French armies operating in the northern theatre, and was confident that it was still possible to outflank the Germans and bend them back behind the Scheldt. At the end of a fortnight the British army had been successfully transported to the north from the Aisne—after successfully holding the line of that river for twenty-five days against many desperate efforts of the enemy to break through—and had taken up its position on the left of Maud'huy's corps, the Allies' line being extended thence into Flanders by the French 8th Corps (under d'Urbal), which had been called up by Joffre to this end, as well as to help the sorely tried Belgians. Meantime the Germans, besides pressing Maud'huy hard in front of Arras, and forcing his Territorials out of Lille, had driven the retreating Belgian army out of Houthulst Forest to the line of the Yser north of Ypres, whence it took refuge behind the Yser and completed the Allied line to the coast. Rawlinson's 4th Corps, covering the retreat of the Belgian army, had hard fighting most of the way before it succeeded in joining the main British army, the German forces from Antwerp concentrating westwards in ever increasing numbers. By the 15th Capper's 7th Division was east of Ypres, while Byng's 3rd Cavalry Division, a day earlier, had connected up with Gough's 2nd Cavalry Division in front of Kemmel and assisted in the capture of that position, a gain which proved of the utmost importance in the subsequent struggle for Ypres. Allenby's Cavalry Corps had greatly distinguished itself during the two previous days, driving the enemy back all the way in a magnificent sweep to the north and north-east.

A brilliant series of advances by Pulteney's 3rd Corps on 12–15th Oct., leading to the capture of Bailleul and Meteren, and the line Sailly-Nieppe, confirmed French in the belief which he shared with Foch that the enemy had exhausted his strength, and that the time was ripe for a strong offensive

eastwards. The advance had scarcely been started, however, before reports arrived of a powerful offensive on the part of the Germans towards Ypres and the Yser. The power and weight of the enemy's opposition on the British front increased each day. Armentières and the Bois Grenier were won by 15th Oct., but the failure of the 4th Corps in its advance on Menin was one of numerous indications that the Germans were being heavily reinforced. By the 21st all General French's worst forebodings were realized by the certainty established that the small German force which had been operating between Ostend and Menin on the 18th had been increased by no fewer than four corps. This discovery, in the British Commander-in-Chief's own words, "came like a veritable bolt from the blue." There was no longer any hope of continuing the offensive on the part of the comparatively weak British line, extended as it was on too long a front. It was a case of holding on now until relief arrived.

The threat was twofold. Not only were the Germans massing in tremendous strength in the north; they were also seriously threatening the British right. Maud'huy, round Arras, was fighting a battle which, like that which the British were waging round Ypres, was one of the landmarks of the war. He sent word on the 16th that the enemy was intent on driving in a wedge between Ypres and La Bassée—a threat which, had it matured, would have finally separated the Allies, and compelled the British either to surrender or be driven into the sea. Faced by this double threat, General French decided to risk the possible disaster on his right, and concentrate against the German tide in the north, which otherwise must gain the seaboard, with possibly fatal consequences to the whole British campaign.

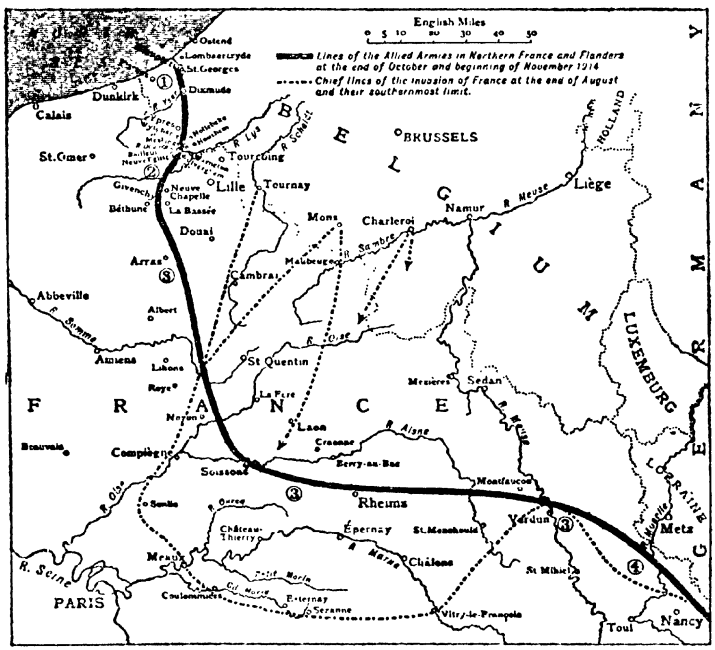
Fortunately the First Army under Haig had already been ordered in the direction best calculated to meet the new situation, though there was no longer any hope of its original orders—to turn the enemy's flank and drive him back to Ghent—being carried out. In this first phase of the battle of Ypres, which lasted until the night of 26th Oct., the northern portion of the British line, notwithstanding the enemy's immense reinforcements, progressed slowly but surely, and took heavy toll in killed, wounded, and prisoners. A certain amount of ground was lost to the south, between Zonnebeke and La Bassée—the commanders of both the 2nd and 3rd Corps being anxious about their positions on more than one occasion—but at no point was any serious break made in the line. Maud'huy at the same time was gallantly keeping the enemy in check in the Arras region, though he could not drive him from Lens and the Vimy Ridge; while on the left the French and Belgians were withstanding repeated assaults on the swaying front between Dixmude and the sea. The line held, and was now more or less firmly established.

The second phase of the battle of Ypres consisted in the repeated attempts of the Germans to break through this line at all costs. It began on 27th Oct., and lasted through five of the most momentous days in the history of the British army. On this day the French 9th Corps, which had been sent by Joffre to the assistance of the sorely tried British troops, took over the trenches in the northern part of the British salient. Capper's 7th Division, exhausted by incessant fighting and fearful losses, was temporarily attached to Haig's 1st Corps in the centre, and took over the ground south of the Ypres-Menin road. Byng's 3rd Cavalry Division was at the same time placed under Allenby. The 4th Corps was thus temporarily broken up, Rawlinson being sent home to supervise the preparation of the 8th Division for France.

The British line was further reduced in numbers during the opening days of this new phase of the battle by the repeated but unavailing attempt of the enemy to advance, the Germans meantime mounting up reserves of reinforcements for a decisive blow until, by the 30th, they outnumbered the battle-worn British by two to one. Then came the onslaught in full, almost overpowering strength. "October 31st and November 1st," afterwards wrote the British Commander-in-Chief in his story of 1914, "will remain for ever memorable in the history of our country, for during those two days, no more than one thin and straggling line of tired-out British soldiers stood between the Empire and its practical ruin as an independent first-class Power." The storm centre of the British battle-line was the Wytschaete-Messines ridge, where Allenby's Cavalry Corps and Shaw's 9th Brigade of the 3rd Division withstood for forty-eight hours the supreme efforts of two and a half German army corps to dislodge them. The honours of those heroic days were shared by the French 9th Corps and the British 1st Corps (with the 7th Division attached) in their continued defence of the Ypres salient; and the British 2nd Corps, which held a long line on the right in difficult country, and, though forced to give up Neuve Chapelle on the 28th, withstood repeated attacks by superior numbers until the Indian Corps took over their positions.

The culminating phase of the battle

began on the 29th, when overwhelming masses of the enemy stormed the centre of the Ypres salient, held by Haig's 1st Corps and the 7th Division, and forced our troops back on Gheluvelt. The ground was recovered before nightfall, but fighting of the fiercest character continued all round and beyond the salient, the critical sector of the 31st extending from Gheluvelt to Messines, on the south, where the Germans at their heels. "I felt," afterwards wrote General French, who was not more than a mile or so away at the time, "as if the last barrier between the Germans and the Channel seaboard was broken down," and he spent the worst half-hour his life had ever known. The situation was saved by Brigadier-General FitzClarence, V.C., commanding the 1st Guards Brigade of the 1st Division, who, on his own



Map showing lines of the Allied Armies in Northern France at the end of October and the beginning of November, 1914

1, Yser line, defended by Franco-Belgian forces. 2, Ypres to La Bassée line, guarded chiefly by British troops. 3, French lines to a point above Verdun. 4, French lines adjacent to the Alsace-Lorraine frontier.

1st Cavalry Division was heavily pressed, and the London Scottish received their costly baptism of fire. The Germans got into Messines that day, but were hurled out again, and the line in this sector was completely restored by nightfall. The climax of the crisis had been reached shortly after midday in the Gheluvelt area, when the 1st Corps, after doing more than could be expected of any men in their prolonged stand against the heaviest odds, was at last broken, part of the 1st Division falling back rapidly along the Ypres-Menin road, with the Germans in full possession of the Menin road and the Polygon Wood. Then, at the moment of their initiative, and in the nick of time, ordered the 2nd Worcesters to counter-attack. The Worcesters, who were in reserve to the 2nd Division, rushed up to fill the gap, and, saving the South Wales Borderers, drove the Germans out of Gheluvelt and re-established the line, which was completely restored before dark. FitzClarence was killed only a week or two later in the same part of the field.

The third phase of the battle of Ypres lasted from 1st Nov. to the 10th. Its most dangerous hours were at the very beginning, when both Messines

and Wytschaete were lost, and only the timely arrival of the French 16th Corps, which partially restored the situation, and the devoted bravery of Allenby's Cavalry Corps, staved off this new threat of disaster. It is impossible here to follow all the confused operations in the remainder of this phase, in which fighting continued with varying intensity, and mingled success, all along the line from La Bassée to the sea.

The outstanding feature of the fourth and final phase, which extended from 11th Nov. to the 21st, was the succession of heavy assaults by the pick of the Prussian Guard, ordered by the Kaiser personally to carry the Ypres salient at all hazards. It failed, but not before the Germans had pierced the front along the Menin road in the first clash of arms on the morning of the 11th, a battalion of Royal Fusiliers being practically wiped out in gallantly disputing their passage. Haig met the situation "with the same grim determination, steadfast courage, and skilful forethought"—the words are those of Lord French—"which had characterized his handling of the operations throughout." The line was re-established, but only after fearful losses on both sides. The 1st (Guards) Brigade mustered at night only 4 officers and 300 men.

The French and Belgians were also attacked all along their line between Ypres and the sea—where British monitors swept the coast with shells for 6 miles inland—but the enemy was held off, save at Dixmude, which he captured and held. Between Dixmude, which had been stubbornly defended by Admiral Ronarc'h and his French marines, and Nieuport the sluices of the Yser had been opened by the Belgians, and the low-lying country across which the Germans were striving to force a way so flooded as to render all their efforts futile.

It was during this final effort of the Germans to reach the Channel ports in 1914 that Lord Roberts arrived at the front to visit the Indian Corps, who had withstood some heavy assaults on the old line of the Second Army, between Armentières and La Bassée. Lord Roberts had scarcely fulfilled his mission, inspiring the troops with his presence at a critical time, when he was taken suddenly ill on 13th Oct. and died on the following day.

North of Armentières the British 3rd Corps under Pulteney, which held the line thence towards Messines, had its share of fighting on the left bank of the Lys, and though its deeds in maintaining its positions were overshadowed by the epic struggles in the salient, its minor battles played their part in the victory of First Ypres. The great battle died down with the failure of the supreme effort of the Prussian Guard. Rains and floods and mud combined to call a halt in the struggle for the Channel ports, and the Western front was now established for the winter. There were occasionally attacks by the Germans at Ypres and Festubert, and more than one attempt on their part to cross the flooded Yser on rafts; but all to no purpose; and before the end of the year (20th Dec.) a five days' battle between the Indian troops and the Germans round Givenchy left matters much as they were before, the British positions, with the aid of British troops, being held. The French also broke the monotony of trench warfare with encouraging advances in Alsace, towards Noyon, in the Argonne, and elsewhere, but no vital changes took place in the general situation.

Eastern Front, 1914. Foiled in their grandiose plans in the West, the Germans were forced to rest content with their valuable territorial gains in France and Belgium, and remain on the defensive there while they turned to the more threatening situation on the Eastern front. As already noted, the Germans had under-estimated the rapidity of the Russian mobilization. They had not anticipated an offensive on that front until they could spare as many reserves as necessary from the West, and the forces left to guard their vulnerable frontier of East Prussia were as inadequate to stay the unexpected advance which the Grand Duke Nicholas, who was in supreme command of the Russian armies, ordered under Generals Rennenkampf and Samsonoff, as were the Belgians to prevent the march of the Germans across their territory. By 25th Aug. the Russian armies, whose advance had begun as early as the 7th, had pushed so far ahead that all East Prussia seemed in danger of falling into their hands. General van François, commanding the German troops, had been driven into Königsberg, the cradle of the Prussian monarchy; Gumbinnen, Insterberg, Allenstein, Soldau, had all been captured; and the hopes of a flight to Berlin before the Russian 'steam-roller' —too often raised in the early stages of the war—seemed not unlikely to be realized.

Germany's hour of danger, however, produced the man who was destined to play a ruling part in the remaining phases of the struggle—Paul von Hindenburg, a veteran of the Franco-Prussian War, then on the retired list. Hindenburg knew the topography of East Prussia by heart, and had commanded army corps in manœuvres along that frontier for many years. Appointed at this critical moment to supersede General von François, he

collected 160,000 men from every available source, and by means of Germany's unequalled strategic railway system had concentrated them in a favourable position between Allenstein and Soldau for delivering the blow which would cut the communications of the southern army under Samsonoff, and smash it piecemeal in the treacherous marshes of the Masurian Lakes, the tracks through which, though well known to Hindenburg, were a veritable tangle to the Russians.

Tempted by their initial triumphs, the Russians had themselves courted disaster by placing themselves in precarious positions. Samsonoff's southern army had not only lost touch with the northern force under Rennenkampf, which had occupied Insterberg on the 23rd on its march on Königsberg, but had also failed to secure either Allenstein or Soldau. Hindenburg was quick to seize every advantage, and his lethal thrust on the 26th, when he retook Soldau and outflanked the Russian left, was followed by a similar enveloping movement on their right before they realized what had happened. Masses of German guns came up and completed the move. Too late the Russians fled along the only road left open to them—by way of Ortelsberg and Johannisberg, across a narrow slip of land between the marshes. Save for little more than one corps, which succeeded in escaping along this route before it was closed, practically the whole of Samsonoff's army was wiped out in this decisive battle of Tannenberg, as the victors named it. Samsonoff himself was killed by a shell on 31st Aug. Altogether the Russians lost in killed and wounded some 30,000; no fewer than 90,000 were taken prisoners.

Hindenburg, whose Chief of Staff was General von Ludendorff—already distinguished in the war as the leader in the assault on Liége—at once became a national hero throughout Germany. The Central Powers, however, had little further cause for rejoicing on the Eastern front in 1914, once Hindenburg had been enticed to the Niemen by the rapid retreat of Rennenkampf after the Tannenberg *débâcle*. The Grand Duke Nicholas had sent General Ruzsky from Galicia to retrieve the situation, and the new leader made as good use of the Niemen River—a formidable obstacle to cross with its width of some 200 yards—as Hindenburg had done of the Masurian Lakes. The operations, which ended in the failure of the Germans to cross the river, and their heavy defeat at Augustovo after a sanguinary nineteen days' battle beginning on 1st. Oct., restored confidence to the Russian army.

General Ruzsky had already made his mark in the opening campaign in Galicia, where the Austro-Hungarian armies, after invading Russian Poland at the opening of the war, were driven back in a series of mighty battles which left the Russians in possession of Lemberg and all Eastern Galicia. Brussiloff was meantime sweeping on towards the Carpathian passes, while Ivanoff, commanding the Russians in Poland, forced back the invading armies under Dankl and the Archduke Joseph Ferdinand beyond the Vistula and Cracow. Przemysl alone held out in Galicia, and this was invested by the Russians towards the end of September, when the Germans, far to the north on the Niemen, were rapidly losing the advantage and prestige they



General Samsonoff

had won at Tannenberg. Hence Germany's increasing need for help from the Western front.

In order to check the Russian advance on the key position of Cracow, Hindenburg was now called from the East Prussian front to take over the supreme command of the unified German and Austro-Hungarian armies in a crushing blow at the Russian centre in Poland. Hindenburg's advance on Warsaw was planned by his Chief of Staff, Ludendorff, to keep pace with a parallel advance of the Austro-German armies in the south, intended to raise the siege of Przemysl and turn the Russians out of Lemberg. The combined forces of the Central Powers amounted to some two million men, outnumbering the Russians by at least half a million, and outgunning them completely. It speaks volumes not only for the fighting spirit of the Russian armies at this period of the war, but also for the strategy inspired by the Grand Duke Nicholas, that in both

the first and second battles of Warsaw the combined Austro-German armies were both outfought and outmanœuvred. "The Grand Duke Nicholas," to quote from Lord French's tribute to his leadership some years later, "proved that he possessed that highest of military gifts—the power of renunciation, of 'cutting down,' of sacrificing the less essential for the more."

Foreseeing the danger of Hindenburg's march on Warsaw, the Grand Duke promptly recalled the first great Russian advance on Cracow, and the armies concerned were safely withdrawn behind the Vistula and the San before the enemy could cut the main line from Warsaw to Kiev. Ivanoff's



Market Place, Przemysl

army in Galicia conformed to the general movement. While thus suggesting the abandonment of Poland and a general retirement on Brest-Litovsk, the Grand Duke placed a field army in defence of Warsaw, assisted by Japanese heavy artillery, and prepared a great counter-offensive from the north-west, under cover of the guns of Novo Georgievsk.

Hindenburg's main blow was delivered at Josefov, higher up the Vistula, with the intention of taking Warsaw in the rear. Ruzsky had been brought down to take command at Josefov, and here repeated the disaster which he had recently inflicted on the Germans at Augustovo. This time he lured the enemy across the river before falling on him in difficult country, and cut him to pieces. Rennenkampf was equally successful with the counter-attack from Novo Georgievsk, striking so hard that the German left centre was forced back from the Vistula with heavy losses. With both flanks turned —for Ruzsky had followed up his victory by himself crossing the river at Novo Alexandriev, and driving the Germans back first to Radowa (15th Oct.) and then to Kielce (3rd Nov.)—Hindenburg had no alternative but to seek safety within the German frontier, and prepare another counter-stroke. The only success of the first advance on Warsaw was achieved by the Austrians under the Archduke Joseph Ferdinand and Generals Woyrsch and Dankl, who succeeded in temporarily relieving Przemysl and recovering Jaroslav. Hindenburg's retreat, however, compelled them to withdraw in conformity to that movement. Przemysl was again invested, the Austrians again fell back in Galicia, and the Russian advance on Cracow was renewed, the Grand Duke Nicholas having set his heart on reaching that convenient gateway both to Berlin and Vienna before the end of the year.

The second Russian advance on Cracow commenced with the second German advance on Warsaw, and both operations naturally reacted on each other. The Russians were at the very gates of Cracow by 5th Dec., but were then checked by an Austro-Hungarian counter-offensive which threatened both their flanks. The loss of the Dukla Pass (12th Dec.) forced a general retreat on this front, and was followed by the loss in turn of the Lupkow and Uszok Passes. By 20th Dec., however, the Russians, who had fallen back behind the River Nida, turned on their pursuers and drove them north again until they were once more in possession of the Carpathian passes.

The Germans were no more successful in their second advance on Warsaw than the Russians had been in their march on Cracow. Hindenburg's urgent call for reinforcements, which had helped to relieve the pressure on the Western front in those critical days round Ypres, enabled him to attack all along the line on 18th Nov. The main assault was delivered by von Mackensen on the line held by Ruzsky from Gombin, on the Vistula, to Uniejov, on the Warta. Ruzsky's retreat to the Bzura in face of Mackensen's terrific onrush was one of the brilliant episodes of the war. It continued, with an increasing bulge, until Mackensen, on 23rd Nov., burst right through this and split it in halves. The halves held, and began to close up, with two German army corps all but bottled up within. But for some blunder in timing, for which Rennenkampf was held responsible, their only way of escape would have been cut off. As it was, after three days of desperate fighting, the German corps fought their way out—but only in remnants.

The Russians themselves had suffered

heavy losses and were running short of ammunition, and when Hindenburg retaliated by blow upon blow in every sector, the Grand Duke Nicholas shortened his front, evacuated Lodz, and defended Warsaw from behind the Rawka and the Bzura. Here he sustained repeated onslaughts for nearly three weeks, the fiercest fighting taking place between the 19th Dec. and Christmas Eve against Bolimov and Sochaczew. In the end the Germans failed to hack a way through to Warsaw, just as they had failed a few weeks previously in their efforts to break through to Ypres and the Channel ports on the Western front. They were still 35 miles from the Polish capital at the close of 1914.

Opening Campaign in Serbia. In the meantime the Austro-Hungarian armies, which had somewhat atoned for their earlier failures by their successes in the recent advance which had temporarily relieved Przemysl, were making little headway in their campaign against Serbia. That heroic little nation, though sadly depleted in her manhood by two years of Balkan warfare, was more than a match for her mightier neighbours in the opening stages of the European War. Austria's first punitive expedition, heralded by the bombardment of Belgrade on 29th July, was easily checked, the main invading forces being withdrawn to meet the new situation on the Russian front. Serbia and Montenegro thereupon invaded Bosnia, and an unproductive campaign of withdrawals and advances led, towards the end of October, when Turkey threw in her lot with the Central Powers, to an Austrian invasion of Serbia in earnest. At first the Austrians, an army corps strong, and advancing in three columns, carried all before them. Valjevo fell on 29th Nov., and Belgrade ten days later. In withdrawing, however, the Serbians, ably led by the Crown Prince, Marshal Putnik, and General Mishitch, were falling back towards their bases and now supplies of ammunition; and in the battle of Rudnik, or 'Battle of the Ridges,' which followed, turned on their pursuers and practically destroyed them. The battle lasted three days, at the end of which the remnants of the Austrian army corps, with the victorious Serbians hard on their heels, were in full flight to the frontier, leaving behind them 15,000 prisoners and 19 guns. All told their casualties amounted to some 80,000 and the bulk of their guns before the survivors were back in their own country, across the Danube, the Drina, and the Save.

First Months of the War at Sea. At sea the first months of the war had seen the Germans very discreetly sheltering in Kiel and Wilhelmshaven, leaving it to submarines, mine-layers, raiders, and a few commerce-destroyers to do as much damage as possible and reduce the disparity between its own force and that of the Allied fleets.

The first naval action of any importance took place in the Bight of Heligoland, on 28th Aug., when a force of destroyers, led by Commander Tyrwhitt in the new light cruiser *Arethusa*, with another light cruiser, the *Fearless*, and a flotilla of submarines under Commodore Keyes, served as a lure to draw out the Germans. They drew first a German force of destroyers, and two cruisers (*Ariadne* and *Strasburg*) from Heligoland. The *Arethusa* greatly distinguished herself in the general engagement which followed, but, though she played the main part in driving the Germans back, she was so badly cut up that she had to be taken in tow at the end of the action. This was not until the Germans, deceived into the belief that the British ships were unsupported, sent out their heavier cruisers, the *Mainz*, *Köln*, and *Aurora*,



Heligoland

just in time for Beatty's battle-cruisers, which arrived at the critical moment, led by the *Lion*, to settle the issue by sinking the three enemy cruisers above mentioned, besides a number of their destroyers. No British units were lost.

Apart from this engagement the war in home waters for the next few months resolved itself into such isolated incidents as the sinking of the three old sister cruisers *Aboukir*, *Hogue*, and *Cressy* by the German submarine commanded by Otto Weddigen (22nd Sept.); the destruction of four German destroyers by the British light cruiser *Undaunted*, supported by destroyers, on 17th Oct.; and raids by fast German cruisers on Yarmouth (3rd Nov.), on Scarborough, Whitby, and the Hartlepools (16th Dec.), the first of which led to the loss of the German cruiser *Yorck* while crossing the minefield at Wilhelmshaven.

The scattered units of the German navy in other seas were gradually bottled up or destroyed. The Dreadnought *Goeben*, and the light cruiser *Breslau*, which were in the Mediterranean on the outbreak of hostilities, succeeded in evading the British fleet

and reached the Dardanelles, where they played no small part in persuading the pro-German Turks, a few months later, openly to side with the Central Powers. Other German warships caught by the war in more distant waters included the light cruiser *Emden*, on the China station. The *Emden* disappeared for six weeks and then turned up in the Bay of Bengal, bombarding Madras on 22nd Sept. and capturing some twenty British steamers in the same month. On 28th Oct. she sank a Russian cruiser in Penang Roads, as well as a French destroyer, but twelve days later (9th Nov.) ended her eventful cruise off Cocos (Keeling) Islands, where she called to destroy the cable and wireless station. The telegraphists on the island sent out a warning message which reached the *Sydney*, a British cruiser of the Australian squadron then escorting Australian and New Zealand troops to the war. Within three hours the *Sydney* arrived on the scene, and having the range of the *Emden* with 6-inch guns to 4·1-inch guns, forced the German cruiser ashore. After losing 7 officers and 104 men the *Emden*, burning and half-sunk, surrendered.

More dangerous than the *Emden* was the German cruiser squadron under Admiral Graf von Spee, which concentrated in the South Pacific from Kiao-Chau and elsewhere. The squadron consisted of the twin cruisers *Scharnhorst* and *Gneisenau*, each of 11,400 tons, 22 knots speed, and an armament which included eight 8·2-inch guns; and three smaller cruisers, *Dresden*, *Nürnberg*, and *Leipzig*, each of 3,500 tons, and carrying ten 4·1-inch guns. On 1st Nov. von Spee fell in with the weak British squadron under Admiral Cradock, who had been sent in August to protect the South Pacific trade, and was expecting reinforcements to cope with the German concentration. Cradock's squadron consisted of old ships like the cruisers *Good Hope* and *Monmouth*; the light cruiser *Glasgow*, and the armed liner *Otranto*; the pre-Dreadnought battleship *Canopus*, which had been left behind for repairs, being some twelve hours away. Outsteamed and outranged—though the *Good Hope* (14,000 tons) had two 9·2-inch guns on board—with the setting sun silhouetting their surfaces against the sky, they were no match for the Germans, who made the most of the added advantage which their inshore position gave them, obscuring their outlines when, as the light began to fail, they drew nearer to Cradock's ships and opened fire. The *Good Hope's* two 9·2-inch guns could not find their target in the fading light, and were soon put out of action by von Spee's flagship, the *Scharnhorst*, whose eight 8·2-inch guns, like those of the *Gneisenau*, which meantime was engaged in a similar duel with the *Monmouth*, now had the British at their mercy. The 6-inch guns of Cradock's ships, almost awash in the rolling seas, were useless. At 7.50 p.m. the *Good Hope* blew up, but not before Cradock had ordered the *Glasgow* to get away with all speed and warn the *Canopus*. The useless *Otranto* had been ordered away before the battle opened. The *Monmouth*, after being silenced and set on fire by the 8·2-inch guns of the *Gneisenau*, was finally sunk by the *Nürnberg*. No survivors were picked up by the Germans, either from the *Good Hope* or the *Monmouth*. With Cradock perished in this naval disaster off Coronel some 1,500 officers and men.

Meanwhile the *Glasgow*, making full use of her 25-knot speed, had warned the slow old *Canopus*, and together they made their way back to the Falkland Islands to await developments. Four days later Lord Fisher, who had just succeeded Prince Louis of Battenberg as First Lord of the Admiralty (20th Oct.), dispatched Admiral Sturdee with a squadron bent on avenging Cradock, and protecting the valuable base and coaling-station of the Falklands. Sturdee's squadron included the two first battle-cruisers built—the *Invincible* and *Inflexible*, each of 17,250 tonnage, with a speed of 27 knots, and eight 12-inch guns, besides sixteen 4-inch guns and five torpedo tubes. There were also four lighter cruisers—*Carnarvon*, *Kent*, *Cornwall*, and *Bristol*; and to these were added the *Canopus* when Sturdee reached the Falklands on 7th December. The *Glasgow* had already been picked up in the South Atlantic. The superiority both in number and weight of guns was now overwhelmingly on the side of the British.

Von Spee, who claimed to have suffered little loss in his victory off Coronel, had returned in the meanwhile to Valparaiso to refit, leaving again for the Falklands on 15th Nov. His programme apparently was to do as much damage as possible to the British base and coaling-station at Port Stanley; account for the *Canopus* and *Glasgow*, which he expected to find defending the port; and thence make for South Africa in support of the rebellion there. Only some twenty-four hours before he approached Port Stanley Admiral Sturdee had arrived, and the news sent by the signallers on the island at 8 a.m., that the unsuspecting enemy was approaching, found the crews grimy from coaling, but alert and ready. Von Spee sent the *Gneisenau* and *Nürnberg* ahead to shell the wireless station, but a salvo of

12-inch shells from the *Canopus* in the harbour at 9.20 a.m. caused them to change their course. It was not, however, until 9.45 a.m., when the *Invincible* and *Inflexible* put out to sea with the *Glasgow* and *Kent*, that the presence of the battle-cruisers was revealed to them. It was then too late to escape. The German ships were no match for the British battle-cruisers either in speed or gun-power. With the conditions of Coronel thus reversed, Von Spee, abandoning the attempt to run as hopeless, decided to die fighting, and met his death as gallantly as Cradock had done some five short weeks before. Both the *Scharnhorst* and her sister the *Gneisenau*, battered by the two British battle-cruisers, who were later joined by the *Carnarvon*, until they were mere helpless hulks, fought to the last before they capsized, the first at 4.15 p.m., the second just after six. Boats were ordered out to save survivors, and some 200 Germans were picked up from these and other ships that were sunk. The *Leipzig*, pursued by the *Glasgow* and *Cornwall*, kept up a running fight for three hours, and then, hammered to pieces, hauled her flag, but afterwards sank. The *Nürnberg*, after a longer chase, suffered a similar fate at the hands of the *Kent*, sinking an hour after surrendering. Only the *Dresden* escaped, seeking refuge at Juan Fernandez, but three months later she was called to account there by the *Kent* and *Glasgow* (14th March, 1915), when, after a five minutes' action, she was blown up by her commander.

With no enemy fleet at sea the task of the British navy was reduced to guarding British commerce from submarines and raiders, keeping watch and ward in the North Sea, and conveying troops to and from the widely scattered theatres of war. Every month added to Britain's commitments in various parts of the globe. All hope of an early peace had vanished by the end of 1914.

Mobilizing the Empire. Happily for the British Empire, Lord Kitchener had from the first anticipated a long-drawn struggle. His call for volunteers "for three years, or the duration of the war," showed how clearly he realized the gravity of the situation. One of his first demands had been for another half-million men to go on with, and history has recorded how nobly the young manhood of the nation responded to his call. All the Dominions and Overseas possessions rallied to the Motherland with equal enthusiasm. We have shown how Indian troops—fighting for the first time on European soil—had already stepped into the breach on the Western front. The Canadians, nearest at hand were the first of the Dominions to follow suit, but Australia and New Zealand, before their campaigns in Egypt and Gallipoli—and subsequently in France and Flanders—had already occupied Samoa, the Bismarck Archipelago, and other German islands in the Pacific.

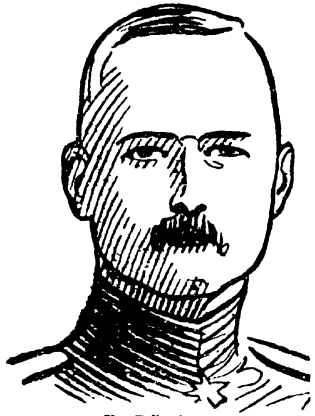
South Africa, 1914. South Africa, on the outbreak of hostilities, had offered to carry the war into the German territory of South-West Africa, but General Botha had first to crush a revolt of Colonel Maritz's force; and this was succeeded by a more formidable rising in the Orange River Colony under De Wet, and in the Transvaal under Beyers. The response to Botha's call to arms proved the striking loyalty of the rest of the Union, and with the force thus mustered the South African Prime Minister completely defeated the rebels before the end of November. De Wet was captured, and Beyers was drowned in attempting to escape. The colonial campaign which followed will be dealt with subsequently.

1915 on the European Fronts—The Russian Campaign. The heaviest burden of the war on the main fronts was now borne by Russia. Having failed to force a decision in the West, Germany looked to the Eastern front for compensating triumphs, confident that she could maintain her defensive positions against the Franco-British armies until such time as, with Austria-Hungary's help, she had brought Russia to her knees. It was also necessary to overawe Roumania and any other hesitating Balkan state that might be disposed to throw in its lot with Russia and her allies. Russia herself was provoking this reversal of German strategy by her renewed advances both on the Carpathian and East Prussian fronts.

Hindenburg made two attacks on Warsaw early in the year (February and March), one by way of the Narew and the other by that of the Niemen, but both failed, thanks chiefly to the indomitable spirit of the Russian infantrymen, ill-equipped though they were. It was not until Mackensen's great 'drive' began on the southern flank in Galicia that Germany's new strategy revealed itself. Russia had then reached the culminating point in her military career. Besides holding up the German offensive in Poland, she had made herself mistress of all East Galicia, Przemysl having fallen to General Selivanoff on 22nd March after an investment of five months, thus releasing 100,000 men to reinforce the armies under Ivanoff, Dmitrieff, and Brussiloff—then battling for the passes which led through the Carpathians into the Plain of Hungary. Przemysl alone yielded 126,000

Austrian prisoners, including the commander, General von Kusmanek, and 1,000 guns. Between that period and the middle of April, when the Russians claimed possession of all the Carpathian heights along a front of 70 miles from south of the Dukla Pass to north of the Uszok Pass, another 70,000 Austrian prisoners were taken.

It was a dazzling, but an illusory triumph. The Russians had been deliberately led by the Austrians—under instructions from the German Higher Command—into their hazardous Carpathian adventure as part of the secret preparations for Mackensen's mighty blow elsewhere. Von Falkenhayn, then Chief of Staff, afterwards gave the credit for the plan to the German General Head-quarters. Germany,



Von Falkenhayn

with all her factories turning out munitions of war far in excess of anything that the Allies could then muster, had been accumulating guns and ammunition for this purpose for months past, together with poison-gas and liquid-fire, and a total force of some 2,000,000 well-armed men. Russia, on the other hand, though she might oppose this force with fully as many men, was coming to the end of her resources, and her troops were ill-equipped to meet the massed guns of the artillery brought against them when the German phalanx, after minor thrusts to left and right to cloak the real designs of the German Higher Command, began its overpowering advance 1st May against the Dunajec lines, where Dmitrieff's Russian army believed itself securely entrenched. Mackensen's guns, opening up a way for the strongest army yet mustered under one general, blew the Dunajec lines to fragments. The Russian infantry clung to their positions to the last moment, but their rifles, often empty, were useless against high-explosive shells, or the waves of poison-gas which preceded the advance of Mackensen's shock troops.

On 5th May, with its front wholly turned, Dmitrieff's shattered army withdrew as best it could from the Dunajec lines to the San River. All Russia's gains in Galicia were destined to be sacrificed in similar fashion. Brussiloff's advance through the Carpathians was at once arrested; by 14th May, when Everts' army on the Nida had also fallen back, all the passes had been evacuated, though not without appalling losses. In the Bukovina, however, the Russian army under General Lechitsky maintained a stubborn resistance south of the Dniester until 27th June, when it fell back to the Gnila Lipa. It was high time to retreat. Przemysl had again fallen into Austro-German hands (2nd June) as the first outstanding result of Mackensen's advance; Lemberg followed suit on 22nd June; and Halicz, abandoned by Brussiloff, fell on the day on which Lechitsky's army retreated from the Dniester to the Gnila Lipa. The end of June saw these positions abandoned and a further retreat in progress towards the line of the Lublin-Cholm railway.

Not cheaply were these spectacular triumphs won by the advancing armies of Mackensen and the Archduke Joseph Ferdinand. Their troops had been twice thrown back on the Dniester before that river had been finally won—a passage which cost them, all told, some 150,000 men; and in the successive retreats which followed, the Russian infantrymen turned repeatedly on their pursuers to prove that they were still capable of enforcing a price for every yard of ceded territory.

Mackensen's 'drive' was only part of the German Higher Command's plan for destroying the Russian armies in 1915. While the Austro-German phalanx was thus thrusting its way towards the Lublin-Cholm railway line, a simultaneous movement was in progress in the north, which had for its first objectives the great fortresses of the Polish salient, and Warsaw itself. Here Hindenburg, who was still in supreme command of the Austro-German forces on the Eastern front, had no longer General Ruzsky opposing him, Ruzsky having handed over the Russian northern command to Alexieff owing to ill-health. No matter how bravely the Russian infantrymen fought, or how ably they were led, they could not stand up against the hurricane of shot and shell which now blasted a path for the fully

equipped armies of von Below, von Eichhorn, von Gallwitz, von Scholtz, Leopold of Bavaria, and von Woyrsch. Prasnysz was won by von Gallwitz after a fierce battle in the middle of July, the Russians retiring to the shelter of the Narew fortresses guarding Warsaw from the north-east.

Mackensen's advance to the south was resumed the next day, and the Grand Duke Nicholas, foreseeing the peril of this double threat, realized that his only hope lay in flattening the Warsaw salient and thus shortening his line. This sealed the fate of Warsaw, which was entered by Prince Leopold of Bavaria on 4th Aug. Ivangorod fell on the following day; Kovno on the 17th; Novo Georgievsk on the 19th. These losses, though deplorable, were not vital while the Russian armies still retained power to retaliate and recoup. Hindenburg strained every nerve to crush them once and for all. Ossowiec fell on 22nd Aug., the Russians resuming their retreat from the Niemen and Bobhr. Brest-Litovsk had already been threatened by the converging movement of Mackensen and Prince Leopold of Bavaria. Seeing no hope of saving it in the face of the continued pressure, the Grand Duke Nicholas evacuated this most easterly of the Polish quadrilateral of forts on the 25th, having previously stripped it, as in the case of the other evacuated fortresses, of all war material.

Hindenburg strove to complete the discomfiture of the main Russian armies by a fresh advance on his extreme left, where von Below was ordered to push through Courland towards Riga, with Petrograd as the ultimate goal in the following year. On this front the Russians had already been forced to relinquish Memel, just across the German frontier, as well as Libau. German naval forces had shared in the operations on the Riga coast-line, and when von Below, after carrying Mitau, some 30 miles from Riga itself, met with prolonged resistance, they made an ill-fated attempt to capture the port from the sea. This was on 18th Aug., when the Russian fleet appeared on the scene while the German naval contingents were attempting to land in flat-bottomed barges at Pernau. The landing forces were annihilated, and the German ships beaten off with a loss of two cruisers and eight torpedo-boats. The Russians only lost an old gunboat in this one-sided action.

The naval operations, however, had little effect on the main issue. Russian fortresses continued for another month to fall like ninepins before the Austro-German armies. Grodno was evacuated at the beginning of September, and though General Everts escaped from Brest-Litovsk with his supplies and guns, he could not hold up Mackensen's irresistible march on Pinsk, even in the Pripet marshes, which were dry at that season of the year. Pinsk was occupied on 16th Sept. Nowhere was the pressure relaxed. In the south, where the flood-tide of the Teutonic advance had never set so strongly, the attack on the Volhynian fortresses had been vigorously opposed by Ivanoff; but Boehm-Ermolli entered Lutsk on 1st Sept., and the Austrians recaptured Brody on the same day.

The vital blow at this stage was being delivered in the north, where von Below, bent on reaching Riga for his winter quarters, was marching on the Dvina lines with the immediate object of crossing that river and turning the whole Russian front as far as Dvinsk. The extreme left flank of the Germans fought desperately for the Dvina crossing at Friedrichstadt, but failed to make it good, and the danger-point shifted towards Vilna, the ten days' battle for which was decided at Meiszagowla on 12th Sept. Though two Russian divisions of the Imperial Guard were brought up to defend this key position, they were powerless to hold it against the great weight of German artillery. With its capture on 12th Sept., Vilna's fall became merely a matter of days. Before the Vilna armies could make good their escape, Hindenburg endeavoured to crown his triumph by outflanking them on both sides, von Eichhorn's cavalry sweeping round from Vilkomir in the north, and von Scholtz pressing forward, though less rapidly, on the southern side of the salient.

In this supreme crisis on the Eastern front, Ruzsky, recovered from his illness, returned to his command of the northern battlefields, and signalized his reappearance—not for the first time—by changing the whole complexion of affairs. Reinforcements enabled him in the first place methodically to evacuate the Vilna salient under their protection. Hindenburg endeavoured to counter this by rushing up cavalry reinforcements, with 140 guns, to support his outflanking thrust in the north, which, reaching Vidzy on the 16th and Vileika on the following day—this being well to the rear of the Vilna armies—threatened irremediable disaster to the retreating Russians. They were saved by the series of flank-guard battles securing their one avenue of retreat, and Ruzsky's counter-offensive from Dvinsk—a stroke so effective that the long German cavalry arm was in itself now in danger of being cut off. Vidzy was recaptured on the 20th; Smorgon, south of Novo Grodek, on the 21st; and Vileika before the end of the month.

On 15th Sept. Lord Kitchener had publicly declared that the Germans had "shot their bolt" on the Eastern front; and, so far as the immediate destruction of the Russian army as a force in being was concerned, this was true, though it was hard to believe while the wide sweep of the German advance was in full force. Ivanoff's reaction was equally marked in the south, where Brussiloff and Lechitsky took von Bothmer and Pflanzer-Baltin by surprise. Before the end of September the Austro-Germans had not only been pushed back to the Strypa, but had also lost both Dubno and Lutsk (23rd).

Germany's great summer offensive was over, but Hindenburg tried hard to secure good winter quarters in the north by a renewed advance on Dvinsk and Riga. A frontal attack was launched on Dvinsk on 3rd Oct. and was a costly failure. Ruzsky had defended Dvinsk with a semicircle of far-flung trenches on the Verdun model, against which the German shock-troops and guns could make practically no progress. After three weeks of vain endeavour Hindenburg shifted the attack to Riga, with no better success and heavy additional casualties. Thrust and counter-thrust succeeded one another with little change in the general situation until the end of November, when, after temporarily securing a crossing at Dahlend Island, south-east of Riga, in the River Dvina, Hindenburg was forced to abandon the attempt as futile. With the help of their fleet the Russians won their way back to Kemmern; and in their counter-offensive from Dvinsk in the same month recaptured Illutsk. All hope was then abandoned by the Germans of taking either Riga or Dvinsk that year. The German effort in the south, below the Pripet marshes, also slackened. Ivanoff not only maintained the ground he had won, but scored several notable victories in the Strypa sector; but both here and along the Styr, where Lechitsky was opposing Bothmer, there was both give and take and nothing decisive—apart from the fact that Roumania was saved by this evidence of Russia's recuperative powers from choosing the wrong side.

In order further to influence the dubious attitude of Roumania, a fresh Russian offensive in the Bukovina was begun in the last days of the year, with Czernowitz as the objective; but as this rightly belongs to 1916 it will be dealt with in our summary of the operations for that year. Though Russia had not succumbed as a military power under the staggering blows she had received in 1915, she had lost 2,000,000 of her best fighting men, and the *moral* of her army was never so high again. Falkenhayn has hinted in his *Memoirs* that the Germans knew that the blind faith of the Russians in their rulers was already shaken before they started Mackensen's 'drive.' It could not be expected to endure in face of the criminal neglect and corruption which every day added to their hardships and losses at the front.

The Russian court at that period has been described as a mixture of folly and intrigue, with 'dark forces' at work under pro-German influence, led by the impostor Rasputin. The Grand Duke Nicholas, who was above the treacherous influences now undermining all departments of the Russian system, had been transferred to the command in the Caucasus in the most critical hours of the Austro-Germanic advance, the supreme command of the Russian armies being taken over by the Tsar himself (5th Sept.), with Alexieff as Chief of Staff. The Tzar's motives were above suspicion; but he lacked the efficiency and generalship of the Grand Duke, and stood for a system which, under the searching test of war, was proving itself unworthy of the continued sacrifices of his subjects. The sacrifices were repeated in 1916, but the seeds were already sown of the red harvest which was to lead to Russia's downfall and the end of the Romanoffs.

The Balkans, 1915. The progress of German arms in 1915 had decided Bulgaria to throw in her lot with the Central Powers. Her price—fixed by secret treaty with Germany in July of that year—was the whole of Macedonia possessed by Serbia, and other valuable slices of territory. It was not until 12th Oct. that formal war was declared by Bulgaria against Serbia, five days after the fresh invasion of Serbia had begun under Mackensen's leadership, with two Austro-German armies, one under General Koevess, advancing west of Belgrade in a wide flanking movement along the old roads over the Save and the Drina, and the other, under General von Gallwitz, advancing east of Belgrade against the main Serbian forces. Against this new Mackensen 'drive,' with fully-equipped forces larger than the whole Serbian army, organized with all the Teutonic thoroughness which marked the same leader's Galician triumph, the Serbians had no chance, though they fought, as ever, with stoic resistance, and exacted a price for every inch of ceded territory. While they were thus stubbornly retreating, Bulgaria threw in two of her armies on the Eastern front, thus threatening, with the advancing Austro-German forces, to enclose them in a wide loop.

The tragedy of it was that Serbia's allies were powerless to save her; and

that Greece, who by the terms of her treaty with Serbia should have gone to her assistance as soon as Bulgaria attacked her, declined through King Constantine to do so, notwithstanding the insistent advice of his Prime Minister, M. Venizelos. Convinced, like King Ferdinand of Bulgaria, that Germany was winning the war, King Constantine maintained to the end an attitude which, though he chose to call it neutral, was never friendly towards the Allies. Russia had her hands too full to go to Serbia's aid, and though a Franco-British attempt was made as the net closed round the encircled Serbians, it was too late to save the situation.

The story of the Serbian disaster of 1915, when the fall of Monastir on 2nd Dec. robbed the Serbians of their last stronghold, is that of a desperate flight across the frontier and over the mountains of Albania and Montenegro to the Adriatic. Thanks to the Serbians' heroic efforts, the Austro-German armies had not been able to close the net tight, and though the Bulgarians followed hard on their heels, they could not quite complete their victory. All told, however, the Serbians lost some 50,000 men, killed, wounded, captured, or starved, in the retreat, together with their guns and equipment. Their aged monarch shared the retreat and succeeded in reaching Brindisi.

Meanwhile the Franco-British force, which, as already related, arrived too late to prevent this final act of the Serbian tragedy, had established a strong base at Saloníka, notwithstanding Greek protests on the grounds of neutrality. It was not until 14th Oct. that the combined force, under the leadership of General Sarrail—the British column being commanded by General Mahon—began to move up the Vardar valley, the British advancing on the right towards Lake Doiran, and the French towards Strumnitza. Both forces were soon in touch with the Bulgarians, and fought a number of minor engagements in their forlorn hope of effecting a junction with the hard-pressed Serbians. Besides being too late, however, the Franco-British forces were not strong enough to effect their purpose, and when the remnants of the Serbian army had been forced across the frontier towards the Adriatic, they were themselves attacked by powerful Bulgarian columns.

The object of his expedition having been eliminated, General Sarrail prepared for retreat to his base. The Bulgarians did their best to harry his retirement. They launched a determined attack, which he repulsed with heavy loss; and then endeavoured to isolate the two columns by an assault on the British force at Lake Doiran. Though some 1,300 casualties were sustained in defeating this attack, the British, acting as flank-guard to the French, enabled the retreat to be made jointly. By 13th Dec. the Allied troops, having administered a severe check to the pursuing Bulgarians two days previously, were across the Greek frontier in good order, and in due course had entrenched themselves about Saloníka.

With the fall of Serbia came the collapse of Montenegro, in circumstances considerably less heroic than those which marked the Serbian retreat. The key position of Mont Lovtchen was abandoned to the Austrians with little if any show of resistance, and Cettinje, the capital, similarly entered by the invaders. King Nicholas of Montenegro sought refuge in Paris; Prince Mirko of Montenegro in Vienna.

The Serbian soldiers who survived the great retreat, numbering some 100,000 in all, were met on the Adriatic coast by units of the Italian fleet and transferred to Corfu—to recoup and refit for the later campaigns which were to lead to the recovery of their country.

Italy, 1915. Italy, whose warships were thus instrumental in salving the Serbian army, had thrown in her lot with the Allies by declaring war against Austria-Hungary on 23rd May, 1915. Austria had refused to offer adequate 'compensation' for her disturbance of the Balkans; and, moreover, the time had obviously arrived to complete Italian unity. A few weeks previously Italy had signed the Treaty of London, under which the Allies agreed to satisfy most of her territorial ambitions when the time came to share the spoils of victory—an agreement which led to some of the most difficult problems in the final peace settlement. To Italy's honour be it added that she joined forces with the Allies when their prospects were none too bright, when they were able to report little or no progress either on the Western front or in Gallipoli, and Austro-German arms, on the other hand, were beginning to carry all before them in Mackensen's great drive in Galicia.

Italy was in no position to throw her whole weight into the struggle in 1915. Though her war strength was reckoned at a million men, her army was ill-equipped with guns, especially with modern heavy artillery and machine-guns, and her industrial resources were wholly inadequate to make good the deficiency. The mountainous frontier which she had to defend, too, gave every advantage to the Austrians. She succeeded in seizing three of the passes, the Stelvio, Tonale,

and Guidriari, on the east side of the Trentino, and in blocking others on the west side, as the opening moves of her campaign, the object being to secure her flank in the subsequent offensive operations which aimed at Trieste by an advance across the Isonzo. Though these operations succeeded in pinning to the Italian front considerable forces of Austro-Hungarian troops which might have been thrown into the Russian furnace, the Italian effort fell far short of its objectives.

General Cadorna, the Italian Commander-in-Chief, won a number of small successes in deploying his Third Army on the right bank of the Isonzo during June and July, securing the bridge-heads at Caporetto—the scene of Italian disaster two years later—



General Cadorna

Plava, Gradisca, and Monfalcone, thus holding the western bank of the river from Tolmino down to the sea. But the Italians were now faced with powerful defences, buttressed by the Carso Plateau in the south, which could only be carried at that time at prohibitive cost. All attempts to capture these strongholds broke down, and though a footing was gained on the Carso, and slight gains were constantly reported from the Trentino, the operations along the Italian front settled down before the year was out to the give-and-take fighting which characterized the siege operations in the West.

Western Front in 1915.—On the Western front neither France nor Great Britain was ready in 1915 to undertake any advance comparable with the great offensives of the Central Powers in the East. Russia in her agony complained that France was not doing enough, but all the Allies' efforts this year were crippled by their inability to supply the wholly unprecedented demands for munitions of war. Great Britain was still struggling months behind to catch up a foe who had been preparing for years. Mr. Lloyd George subsequently related how, in the month of May, 1915, when the Germans were turning out 250,000 shells a day, most of them high-explosives, Great Britain was producing a mere 2,500 a day in high-explosives, and 13,000 in shrapnel. The French, accustomed to supplying the demands of armies on a Continental scale, had naturally done considerably better than this, but even their most strenuous efforts were inadequate to cope with the enormous output of the German arsenals. Mr. Lloyd George retired from the Chancellorship of the Exchequer in order to assume control of the newly created Ministry of Munitions, which in due course more than made good all these defects. That, however, was not in 1915. Up to the end of that year, according to Lord French, "the scanty supply of munitions of war paralysed all our power of initiative, and at critical times menaced our defence with irretrievable disaster."

At the end of the first long winter of dreary trench warfare the British Commander-in-Chief deemed it necessary to undertake an offensive in order to prevent the *moral* of his army from deteriorating. Hence the battle of Neuve Chapelle, which, begun on 10th March, was fought with a small reserve of ammunition accumulated for the purpose, and had to be broken off after three days' struggle through lack of farther supplies. The troops chosen for the main assault were Rawlinson's Fourth Army Corps, with the Indian Corps on the right. Following the preliminary bombardment, they quickly overran Neuve Chapelle itself and made 1,000 yards progress on a 3-mile front. But to left and right the attacks were held up, and two further days' fighting failed to add to the gains—purchased at the excessive cost of 562 officers and 12,239 men. The total German losses, including 1,680 officers and men as prisoners, were estimated as rather higher than this, but the net result, though ranking as a British victory, was admittedly disappointing.

Earlier in the year Lord French had endeavoured to convince Joffre that the proper rôle for the British army to fulfil was an advance on the extreme north in co-operation with the British navy. Joffre was unsympathetic, though he held out hopes of co-operating in such an advance with the French army at a later date. His plan for the 1915 campaign was to break through the German line from the south at Rheims, and from the west at Arras. To do this he must mass as many French corps as possible behind

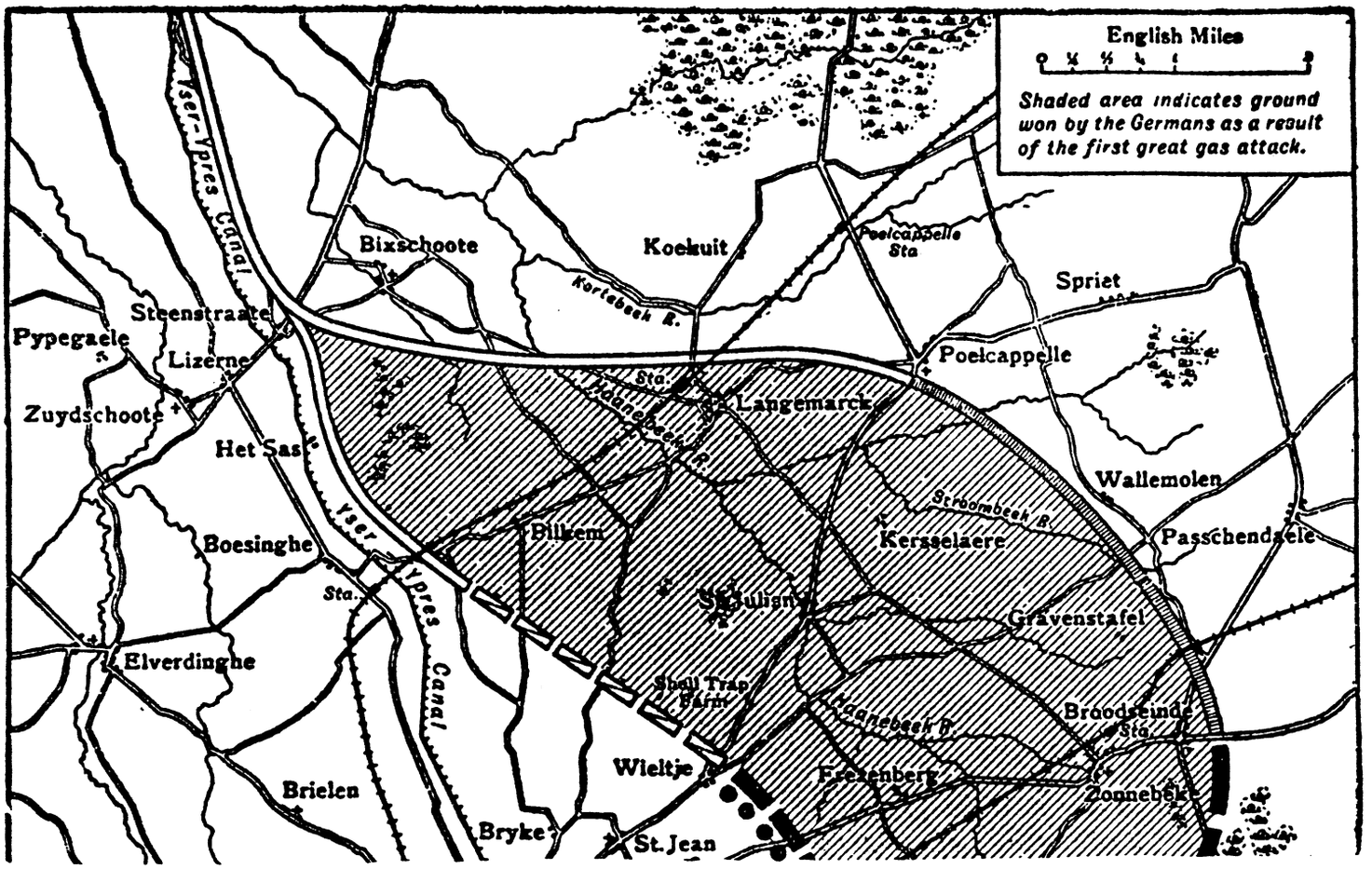
these points, meanwhile keeping the enemy busy elsewhere in order to prevent him from reinforcing the threatened positions. This general strategic idea, as Lord French has pointed out, was the foundation of all the Allied efforts in the West throughout 1915. It led to numerous local successes along many parts of the line, but no real advance was made towards the main objectives. These were not defined until the combined offensive was launched in September.

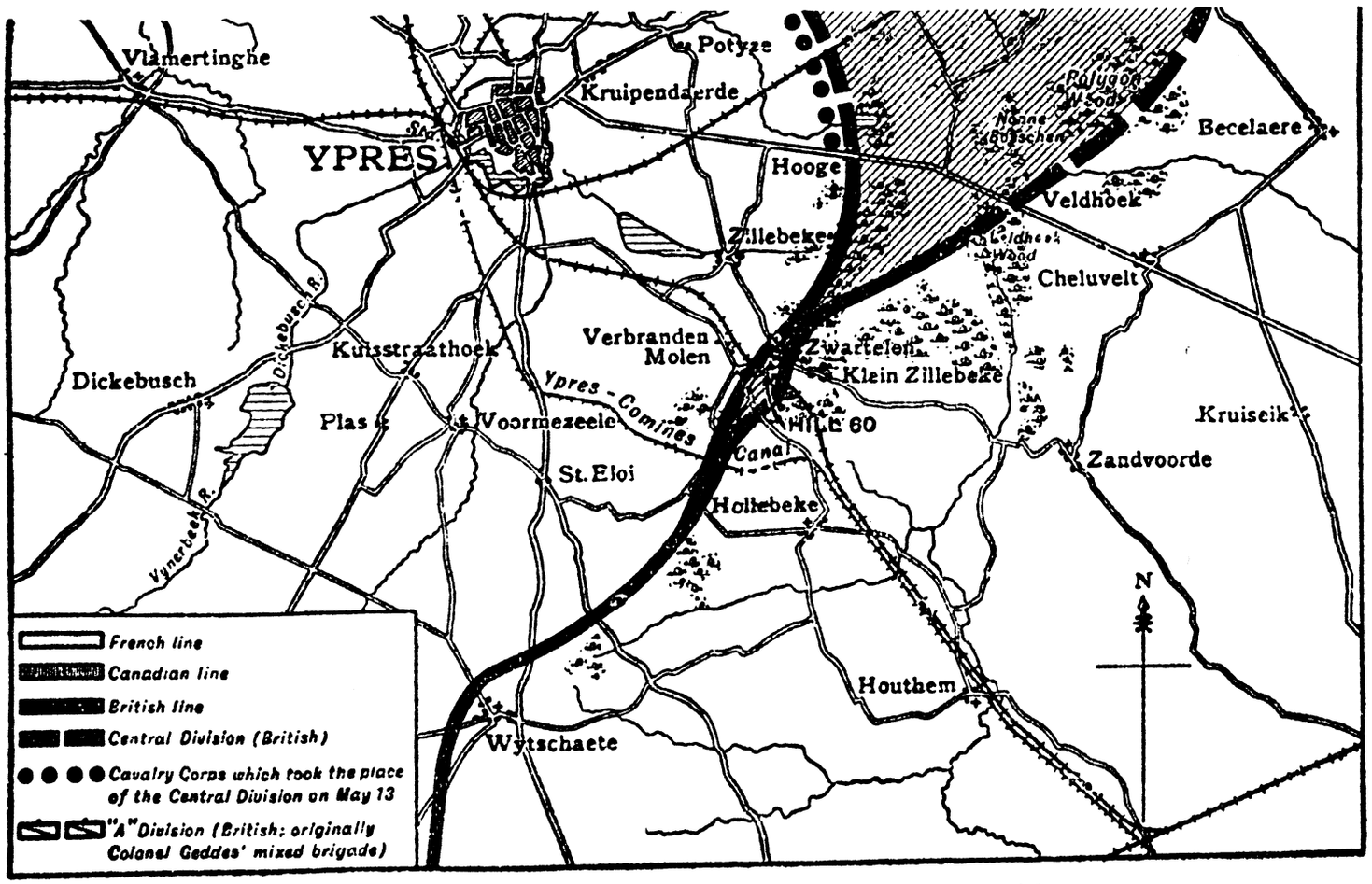
The Germans themselves, though content to leave to the Allies most of the attacking in the West in 1915, maintained a sufficiently active offensive-defensive. While the French in Alsace were making a fresh advance on Mulhouse at the beginning of the year, they counter-attacked at Soissons, after bombarding the cathedral on 9th Jan. It was only after a week's desperate fighting and heavy French losses—including a bridge-head on the Aisne—that they were checked. In Champagne the French managed to capture Perthes (8th Jan.), and strove valiantly but vainly to wipe out the St. Mihiel salient. The most ambitious effort of the opening months of the year was the British offensive at Neuve Chapelle, which, as already pointed out, failed largely through lack of ammunition. In his report on that battle the British Commander-in-Chief referred to the pressing need of "an almost unlimited supply of ammunition"; and the lack of it was the real explanation of the Allied failure in 1915.

Germany knew well enough how matters stood in this respect, and added ruthlessly to the handicap which their own superior supplies gave them by suddenly attacking with chlorine gas—the first use of poison-gas in the war. This was on 22nd April, following a grim struggle south-east of Ypres for Hill 60, the flattened remains of which, after five days' incessant fighting, remained in British possession. Having been careful beforehand to accuse the French of using poison-gas near Verdun on the 14th—a charge without justification—the Germans launched it in dense volumes from pipes previously laid down for the purpose north-east of Ypres. The attack was preceded by a heavy bombardment, the gas-clouds following at 5 p.m. on the 22nd. The Allied line was held at this point by French Colonial and Territorial troops, with the Canadian Division on their right. All unprotected as they were against this diabolical form of warfare, the French troops, gasping for breath, broke and fled. Many fell asphyxiated. With a gap in the Allied line 5 miles wide, the Canadians suddenly found their flank left in the air. Less affected by the gas than the French, they were chiefly instrumental in saving the situation by a valiant resistance until reinforcements could be sent to fill the gap.

The gap was evidently wider than the Germans either anticipated or realized; otherwise the disaster might have been irretrievable. As it was, the situation remained precarious until the 27th, when a counter-attack in conjunction with the French recovered some of the ground, and a large portion of the sorely tried Canadian Division was relieved by the Lahore Indian Division. Altogether seven British divisions were involved in this hard-fought battle, the net result of which was to bring the Germans 2 miles nearer to Ypres on a 5-mile front, and to give the Allies a worse line to hold. Eight batteries of French field-guns were lost and four British guns of position. These last were recaptured by the Canadians, but the enemy had already destroyed them. In all the Allied casualties amounted to nearly 25,000. The Germans estimated theirs at 16,000. In his report on the gas-attack Sir John French declared that protest against this form of warfare would probably be useless, and Lord Kitchener intimated in the House of Lords on 18th May that retaliation might be inevitable. Respirators more or less effective were supplied to the troops, and the use of poison-gas, followed by liquid-fire—another German innovation—became permanent additions to the horrors of modern warfare.

Before the new battle round Ypres died down—it lasted, indeed, until the end of May—the storm centre shifted to the southern end of the British line, where it joined hands with the French left. Here General French began the battle of Festubert, undertaken to relieve the intense pressure on the troops at Ypres, but also serving as part of Joffre's general plan of attack in the direction of Lens and Lille. British and French alike were launched against the German lines on 9th May, the British taking the offensive between Rougebanc and Givenchy, and the French between Neuville St. Vaast and Notre Dame de Lorette. The renewed struggle for Ypres, however, had drawn heavily on the scanty British reserves of ammunition, and the preliminary bombardment of forty minutes proved wholly inadequate to crush the resistance offered by the enemy's numerous fortified posts when the First Army advanced to the attack. This disastrous engagement, in which the greatest bravery was displayed against overwhelming odds, cost over 12,000 casualties. It achieved nothing





The Ypres Salient before and after the Second Battle of Ypres, 22nd April—13th May, 1915

in the field, but the lessons which it taught led to the formation of the Coalition Government, with Mr. Lloyd George as Minister of Munitions. The second stage of the battle of Festubert, which began at midnight on 15th May, was more successful, the enemy's front-line trenches being captured on a front of 3,000 yards; but the losses incurred in winning and holding the positions were disproportionately high.

The French effort began more auspiciously as a result of the longer and more intense bombardment which preceded their attack on the 9th, but the series of minor successes which they won round Souchez, after weeks of incessant fighting, made little real impression on the defences of Lens. The truth was that Germany had so expanded her war-material factories that, with the aid of the Austrians, she could turn out sufficient shells and guns for her main offensive on the Eastern front, and at the same time overweight the Allies in the West.

Throughout the summer the line, though never quiescent, and often breaking out in furious bombardments, minor attacks and counter-attacks, and raids on both sides, remained little altered. The hardest fighting of all was round the war-scarred salient of Ypres, still held, as in the first gas-attack, by the Second Army, to which some of 'Kitchener's Men' were now attached. It fell to this advance-guard of the New Army to bear the brunt of the first attack on the British with liquid-fire, the Germans, who had already used this new device of the *flammenwerfer* against the French, employing it in another desperate assault on the British lines round Hooge. The New Army units fought with almost incredible gallantry, but were blinded by the unexpected, burning sheets of flame, and while they were still blind the enemy charged and took the first-line trenches on a front of some 500 yards. The losses were avenged on 9th Aug., when the 6th Division recovered all the captured positions, and 400 yards of German trench into the bargain.

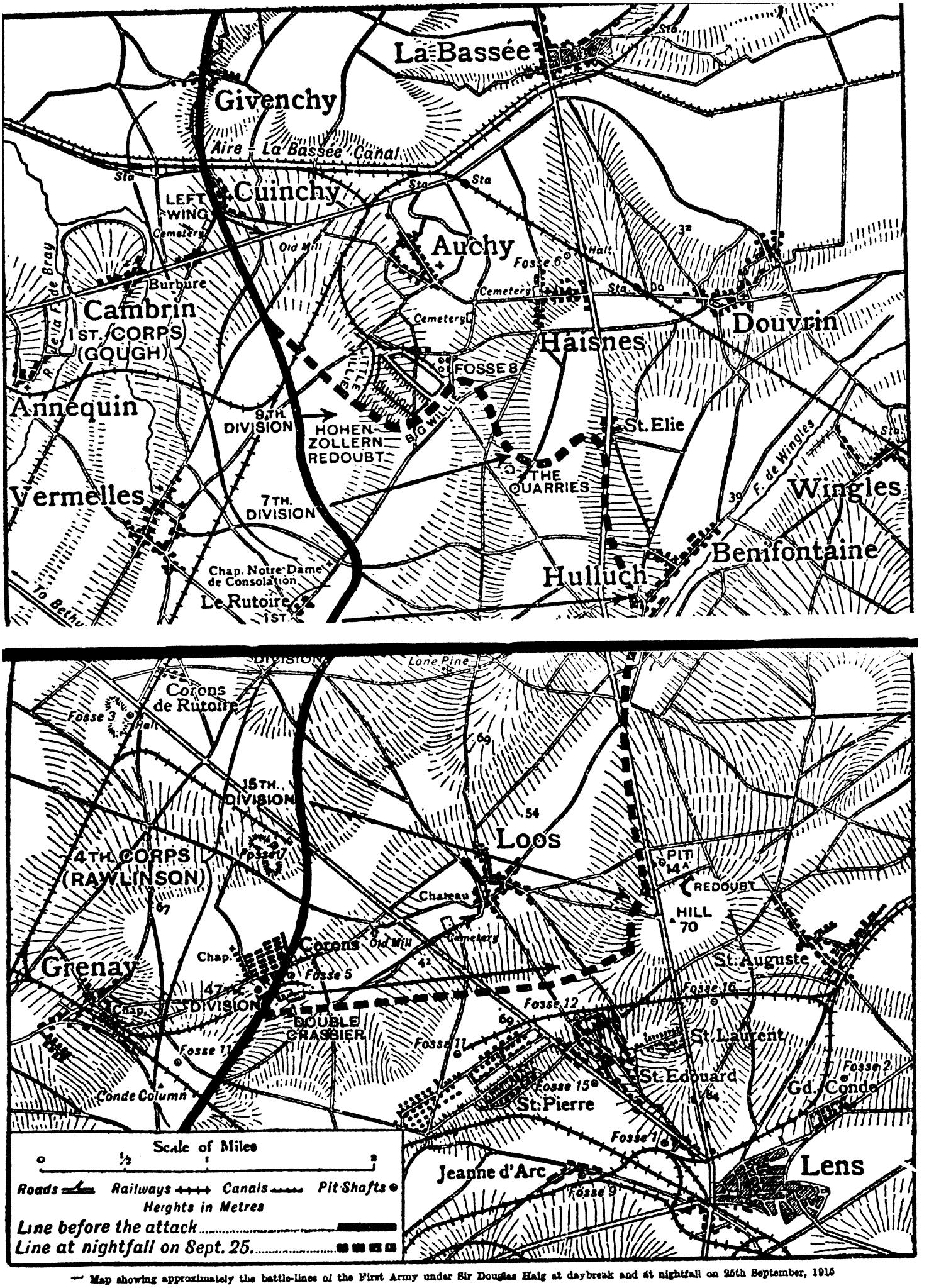
With the arrival of the reinforcing British divisions of the New Army, General French was able to take over some 17 miles of additional front, the British line thus extending over about 50 miles, with the Belgians on the left holding the remaining 18 miles to the sea. This still left the French army 500 miles to hold from the British right to the Alps.

The summer of 1915 passed away without any great offensive on either side. The Germans, now at the flood-tide of their sweeping advance against Russia, were content to continue their vigorous offensive-defensive in the West. Besides the fighting already referred to, there was incessant warfare in the Argonne Forest, where the German Crown Prince was noisily active throughout the summer, threatening Verdun, but making no serious advance. The French continued the deadly trench-to-trench warfare in the Souchez area and the 'Labyrinth' region nearer Arras, and steadily tightened their hold on the reconquered corner of Alsace, consolidating their positions on the Hartmannsweilerkopf, which had been the scene of continuous fighting in the renewed advance towards Mulhouse. For the most part, however, the French, like the British, were now storing up reserves of ammunition and completing their dispositions for the joint offensive planned for the autumn, when the main objects of Joffre's general strategic idea for 1915 were for the first time clearly defined, though unattained.

A great Allied offensive in the West had become increasingly necessary in view of the prestige gained by the Central Powers, not only by their tremendous advance into Russia, but also by the Allies' disastrous campaign in Gallipoli, where the failure of the Suvla Bay landing—subsequently dealt with in our account of the operations against Turkey—had just given the enemy additional cause for rejoicing. Joffre's plan of attack, designed "to drive the Germans out of France," was not ripe for execution until towards the end of September. Even then, though General French had for months been gradually accumulating troops and ammunition for the blow—the British army now numbering nearly a million men—full strength in both respects was still only half developed.

There were two main assaults in the combined offensive, launched on 25th Sept., 1915, the chief of which was in the French centre in Champagne, where de Castelnau, Joffre's right-hand man, attacked with Langle de Cary's Fourth Army on a 16-mile front between Auberive and Massiges, the object being to force the Germans back on the Aisne, and, if possible, cut off the army of the German Crown Prince in the Argonne.

Second in importance was the Franco-British advance on the same day in Artois, General French's object being to push through between Lens and La Bassée on the north, while Generals Foch and d'Urbal, on his right, stormed the Vimy heights and attacked Lens from the south. Secondary operations were carried out at various other points in order to distract the enemy's attention, feint attacks being made by Sir Herbert



— Map showing approximately the battle-lines of the First Army under Sir Douglas Haig at daybreak and at nightfall on 25th September, 1915

in the afternoon—the British attack had been launched at 6.30 a.m.—and then was forced to direct the corps operating on its left in a south-easterly direction. This involved a considerable gap on the British right, when Rawlinson's men made their victorious advance. The Londoners of the 47th Division, however, not only held on to Loos, but formed a strong defensive flank which averted what might have been a complete disaster. Apart from the captured positions, 57 German officers and 3,000 other prisoners had been taken during the day on the British front, together with 26 field-guns and 40 machine-guns.

On the following day the Germans counter-attacked in force and recovered Fosse 8, but on the 27th the Guards Division, under the Earl of Cavan, was sent forward and almost restored the earlier gains, including Chalk Pit Wood and the slopes of Hill 70. It cost the Guards 3,000 casualties to make good the restored British line. They continued to hold it until the end of the month, when they were relieved. The 15th (Scottish) Division had also been withdrawn, after suffering no fewer than 6,000 casualties. All told, the British losses in the battle of Loos amounted to 50,000 men and 2,000 officers, including three divisional commanders —Major-General Sir Thompson Capper (7th Division), Major-General G. H. Thesiger (9th Division), and Major-General F. D. V. Wing (12th Division) —each of whom was killed.

A series of costly counter-attacks on the enemy's part failed to make much impression on the new British line, and mounted up the German casualties until they were estimated at many more than those of the British. The battle died down; the gains were consolidated; but the murderous struggle at close quarters for the Hohenzollern Redoubt and its adjoining entrenchments continued for weeks and months, an outstanding feature of which was the attempt of the 46th (North Midland Territorial) Division to carry the redoubt by storm on 13th Oct. The Midlanders' task was handicapped, like so many British operations at this period, by inadequate artillery preparation, and though they fought like veterans they could only win the western side of the stronghold at a cost of 4,000 casualties.

The advance of the 10th French Army on the right of the British was held up in front of Souchez on the opening day of the combined offensive, but made better progress on 26th Sept., when d'Urbal's troops made themselves masters not only of long-contested Souchez, but also of Thelus, La Folie Farm, and most of the Givenchy Wood. But the Vimy heights, notwithstanding that some progress was made along their slopes, still barred the road to Lens from the south. On the 28th the French 9th Corps, at the British Commander-in-Chief's request, took over the defence of Loos, and the British line was rearranged.

The main French effort in 1915, as already pointed out, was in Champagne, where a solid week's bombardment paved the way for the great advance on 25th Sept. Inspired by Joffre's stirring Order of the Day, "Remember the Marne: Conquer or Die!" the French troops carried all before them on the greater part of the front. General Marchand's Colonial Division broke clean through 2 miles of the main German defences, Marchand himself falling severely wounded at the head of his men. The greatest advance was made on Marchand's right, from Navarin Farm to the Butte de Tahure, where an advance of 2½ miles was made before the day closed. But the troops in the centre were robbed of decisive victory by a double check on the wings. On the right the two German strongholds at the Butte de Mesnil and the Main de Massiges—comparable with the Hohenzollern Redoubt in their strength—held out stubbornly until, after days and nights of ceaseless combat, both fell into the attackers' hands. On the extreme left the assailants could make practically no headway.

Thenceforward the French advance made little progress towards the main objectives, though a breach was made in the enemy's second line in a fresh attack on the 29th; and a third advance (6th Oct.) won the village and Butte de Tahure. On 20th Oct. the Germans recovered the Butte de Tahure, and in other counter-attacks prevented the French from developing their first initial advance into the greater victory which Joffre had hoped for it. The battle had yielded an impressive list of captures—the total number of German prisoners being over 23,000 before the end of September, and the captured guns 80—but the Allies' long line had not materially altered before the autumn offensive gave place to another winter of tedious siege warfare.

The year closed with the appointment of Joffre as Commander-in-Chief of all the French forces, General de Castelnau taking over the immediate command of the French troops in France; and the resignation of Sir John French—now created a Viscount of the United Kingdom, and appointed to the Home Command—after more than sixteen months of severe and incessant strain at the front. Lord

French was succeeded by General Sir Douglas Haig, who had been singled out for promotion by his brilliant achievements since the British army first landed in France.

The Naval War in 1915. Throughout 1915 the operations at sea contained no movements so striking as some of those which marked the opening months of the war. The careers of all the scattered German cruisers were over, the last of them, the *Königsberg*, being finally destroyed in the Rufigi River, German East Africa, by the shallow-draught monitors *Severn* and *Mersey*, sent out for the purpose from Great Britain. The German High Seas Fleet remained in harbour, waiting for Lord Jellicoe to be tempted or goaded into some imprudent disposition of his forces. Hence the sudden raids on the British East Coast, begun in the closing months of 1914. They repeated them once too often, on 24th Jan., 1915, when the raiders, consisting of 4 battle-cruisers, 6 light cruisers, and a force of destroyers, were encountered off the Dogger Bank by the British battle-cruiser squadron under Admiral Beatty, consisting of the *Lion*, *Tiger*, and *Princess Royal*, as well as the *New Zealand* and *Indomitable*, and the light cruisers *Southampton*, *Nottingham*, *Birmingham*, and *Lowestoft*, together with the *Arethusa*, *Aurora*, and *Undaunted*. Outmatched by the 13·5-inch guns of Beatty's 'Cat' Squadron of battle-cruisers, the Germans made for home.

In the hot chase which followed, the *Blucher*, last in line of the German battle-cruisers, was hit repeatedly, fell behind, and was eventually sunk by a torpedo from the destroyer *Meteor*. Her survivors were picked up by the *Arethusa*. Beatty's flagship, the *Lion*, which was leading the pursuit, was partly disabled by a chance shot and had to be towed home, Beatty himself following the chase at some distance in a destroyer. Before he could pick up his place in the pursuit he met his three battle-cruisers returning, these having broken off the action owing to the increasing risk of straying into an enemy mine-field or of falling foul of the mines which the retreating Germans were strewing in their path. Two other German battle-cruisers had been set on fire by the British shells, the *Seydlitz* and the *Derflinger*, but, with the rest of the German ships, they made good their escape. Taught by this experience, the Germans made no further naval raids on the East Coast.

In the following month (4th Feb.) Vice-Admiral von Pohl, Chief of the German Admiralty Staff, proclaimed a submarine blockade of the whole of the British Isles, declaring all the waters round Great Britain and Ireland a military area in which Allied merchant-ships were to be destroyed and neutral ships would incur danger of running the same risk. If the Germans thought they could scare British shipping away by these means, they were soon undeceived. They took heavy toll of peaceful shipping from the first, and shocked the rest of the world by the lengths to which they were prepared to go in developing this ruthless policy, but all their efforts failed to paralyse British trade as they anticipated. The crowning tragedy of this submarine campaign was the sinking of the Cunard liner *Lusitania* off the south coast of Ireland on 7th May, 1915, with its loss of upwards of 1,000 non-combatants, including over 100 Americans. It was one of the German crimes against humanity in general and Americans in particular which brought the United States into the war on the side of the Allies in 1917.

1916 on the European Fronts.—The Western Campaign. During the year 1916 the unity of command which was postulated as an indispensable preliminary to the victory of the Allies so long before it became a fact was achieved neither as between Britain and France in the West and Russia in the East, nor even as between Britain and France along the Western front. The most that can be said of the co-ordination between the forces under the British and French Commanders-in-Chief is that liaison was established between them, and that as far as was possible each endeavoured to help the other by diverting to itself the energies of the German forces. The Western fighting embraced two main episodes: the powerful German attacks on Verdun, eventually unsuccessful; and the Allied offensive on the Somme, in which by far the greater share was borne by the British.

The year began with numerous German attacks widely separated in locality, and intended to mask the main offensive while keeping the French and British occupied. Hartmannsweilerkopf, in Alsace (2nd to 8th Jan.); Champagne (9th Jan.); Givenchy, Arras, Neuville, Loos (14th Jan. to 6th Feb.); Vimy Ridge, Frise, Soissons, Ypres-Comines area, and Tahure (9th to 20th Feb.) were among them.

On 21st Feb. the new battle of Verdun began. This enterprise, though officially accredited to the German Crown Prince, was the design of General von Falkenhayn. Verdun was one of the four fortresses, of which the other three were Belfort, Toul, and

Épinal, on which French armies defending the capital and the country from an invasion from the east would base themselves. The town lies sunk in the Meuse valley, and the German invasion in 1914 flowed past it along the heights of the Meuse down to St. Mihiel.

At the beginning of the war Verdun was protected by an outer line of forts, with batteries pushed out in a circuit of 30 miles. The forts were not, however, strong enough in 1914, nor the perimeter of defence extended enough, to withstand the new artillery that had reduced Liége and Namur, and a fierce struggle went on during 1915 along the Meuse heights on the east of Verdun and beyond the low hill, on the western side of the town and rivers with a view to pushing out the defences all round. As previously pointed out, much had been done in this direction by General Sarrail, but



Verdun

not enough to deter von Falkenhayn and the German General Staff from selecting Verdun as a point for an attack which, if successful, would disorganize seriously the continuity of the French defences. In 1916, as for two years more, the problem of either combatant was to break through a line of trenches which extended continuously from the sea to Switzerland; and failing a complete break-through, comparable to that which had crippled Russia in 1915, to effect a fracture or a deep dent which would compel the loser to reconstruct his system of communications. At the best such a thrust might disclose a fatal weakness in the assailed; at the next best it would disastrously hamper his future activities.

Verdun as a fortress had strong and modern defences. West of the Meuse, north of the town, are low hills the chief of which is the Charny Ridge with dominating strategic points beyond known as Hill 304, Hill 295, Hill 265. The French lines were pushed beyond these into the woods of Avocourt and Forges, but below the heights of Montfaucon, which were the Crown Prince's head-quarters. On the east of the Meuse the heights rise to a tableland severed by wooded ravines and overlooking the plain of the Woevre. The line of French trenches embraced all this tableland and a good deal of the plain beyond. Its outer line ran in a bold convex curve from Forges and Consenvoye on the Meuse to Fresnes on the Woevre, but it did not penetrate the woods of Forges or Spincourt, and it was below the gun positions on the hills of Ornes. Inside this outer circle was the inner line of Samogneux, Beaumont, Fosses Wood, and Bezonvaux. Inside that again the line of Bras, Douaumont Fort, Hardaumont Wood, Vaux Fort, and Eix.

The multiple defences were most elaborate between these two inner lines. A weak point was that though such defences would be very exacting of life and effort, yet the outer ones were not pushed out far enough to place the bridges of the Meuse out of reach of long-range gun-fire; and an overwhelming attack might have jammed a defending army on the east of the Meuse against the river. The French had provided against the possibility by the multiplication of transport, as well as of inner defences. The Germans hoped by the weight, volume, and suddenness of their attack to bring about the not impossible catastrophe. They massed an amount of artillery which, though surpassed afterwards in the war, was at that time the greatest assemblage that had ever been seen together, and accumulated a supply of ammunition exceeding the quantity which all previous experience prescribed. The heavier guns were placed at Ornes, Spincourt, and Forges. The woods below afforded cover for a concentration of men; and this concentration, amounting to fourteen divisions, with others in immediate reserve, was at first thrown at the 7-mile sector from Brabant-sur-Meuse to Herbebois, which was held by three French divisions under General Humbert.

The attack began on the morning of 21st Feb. with an artillery bombardment lasting four hours. The great weight of shell demolished the French first-line defences, so that the German troops had little to do but walk over them, while a remnant of the defenders fell back to their supporting positions. These were not sufficiently strong or well constructed to enable weak forces to hold them long against the force of three army corps (18th, 3rd, and 10th, with a Bavarian Division) which the Germans sent in after the guns had done their

work. The effectiveness of the German artillery was due in part to its weight, and in part to the fact that French counter-battery work effected little, owing to the thick weather.

The trench systems in the Haumont and Caures Woods were carried, but the resistance of parts of the first line at Brabant, Herbebois, and elsewhere was even at this dangerous moment reducing the speed of the German advance, though the momentum was far from exhausted. It was not till next day that the first line was definitely abandoned by the French; and on 23rd Feb. the line Samogneux-Herbebois was temporarily held. Before the morning of 24th Feb. the French contracted their line still further by drawing in their outposts from the Woevre. It seemed a matter for surprise at the time that no flank attack was made by the Germans in the Woevre; it had been perhaps thought an unnecessary extension of their general scheme, though the weather, which was bitter and snowy, was unfavourable for operations in that sodden plain.

But the German second wave of attack was now rising in fury, and General Pétain, who had undertaken the command of operations on the French side, was still awaiting reinforcements. The character of von Falkenhayn's attack had become clear, and while to the French the need for holding on was imperative, the Germans had a need no less urgent for hastening operations and exploiting their preliminary success to a point at which General Pétain could not repair the breach. They had, in fact, two days in which to achieve their aim—24th and 25th Feb. On the 24th they flowed round the Beaumont Woods and came close to the Talou Ridge, the Poivre Ridge, and the rest of the French line where it ran past Haudremont and Douaumont to Vaux. On the 25th they attacked the Poivre Ridge without much success, but pressed the more important sector of their attack close to Douaumont.

Next day, 26th Feb., brought the fateful hour of the struggle. Pétain's reinforcements were at hand. The Germans made their supreme effort on a 2-mile front at Douaumont, and the picked 24th Brandenburger Regiment was the spear-head of an assault which at one moment burst its way into the Fort Douaumont trenches between the village and redoubt—a fine feat of arms which evoked this telegram from the Crown Prince's head-quarters: "Douaumont, the eastern pillar of the Verdun defences, is solidly in German hands." The adverb alone was misplaced. The position was not held solidly, for Pétain's reserves, thrown in at the exact moment, flung back the Germans and prevented the leak in the defences from being widened by any further inrush.

This counter-attack, made by men of Balfourier's 20th Corps, marked, indeed, the turn of the struggle, for though Douaumont, and Vaux after it, were subsequently to be lost, together with many other historic redoubts and shell-battered points of vantage on either side of the Meuse, and though many thousands of lives were to be swept away in attack and counter-attack on the barren hills about Verdun, yet henceforward the assaults were no different, except in weight, from others which in 1916 and 1917 were projected by the Germans or the Allies on the amplifying complexities of the armoured defence lines. Von Falkenhayn's subsequent comment on the operations, which marked the beginning of the creeping paralysis of his plan, was that violent French counter-attacks began, and the German forward movement on the heights was stayed.

Though the crisis was over there were many great moments of sleepless effort, of anxiety, and heroism in the months to come, for the last purposeful German assaults on the fortress were made on 15th June, and on 14th July the Germans were still occupying the French with assaults developing from the Thiaumont redoubts, which marked the farthest point southwards to which their long-sustained efforts had taken them. Following on these attacks was a considerable pause, during which the Germans were fully occupied elsewhere in dealing with the British attacks on the Somme. The last phase at Verdun in 1916 was that in which the French, inspired by the methods of General Nivelle, thrust the Germans out of all the positions so painfully won, and re-occupied by mid-December very much the same lines as those from which the great push of the last week in February had ejected them. The story of Verdun cannot here be told in detail; its principal events are dated as follows:

27th Feb.—Germans take Talou Ridge.
3rd March.—Germans enter Douaumont village.
7th March.—Germans, transferring their efforts to the west of the Meuse, capture Hills 360 and 265.
11th March.—Germans penetrate west of Verdun the line Béthincourt-Mort Homme.
20th March.—Germans enter Avocourt Wood.

29th March.—French recover Avocourt Redoubt.
1st April.—Germans, renewing their attacks east of Verdun, capture part of Vaux village.
10th April.—Germans make extended attack on both sides of the Meuse, failing at the Mort Homme, but gaining at Poivre Ridge.
5th May.—Germans, renewing westerly attacks, gain a footing on Hill 304.
20th May.—Germans in a great attack on Mort Homme capture summit of Hill 295. The attack next day enlarged the gains.
24th May.—Cumières and Fort Douaumont captured by Germans.
1st June.—Fresh German attack at Fort Vaux east of Verdun.
7th June.—Fort Vaux captured after six days' fighting.
17th June.—Attack renewed at Mort Homme. The attacks on both sides of the Meuse were prosecuted with increasing vigour till 28th, during which period the Germans took Hills 321 and 320, as well as Thiaumont Fort (23rd June) and Fleury (24th June). Fleury marked the point of their farthest advance towards the inner line of defences east of the Meuse at Forts Souville and Tavannes. The tide now paused, and on 30th June, a day before the British attack on the Somme, the French retook Thiaumont. The fighting went on in a restricted but incessant way through the rest of June and July, the French gradually improving their position. In August activity was renewed at Thiaumont and Fleury.
18th Aug.—French retake whole of Fleury.
9th Sept.—French retake trenches between Fleury and Douaumont.
24th Oct.—The French, after a long pause for readjustment, and now under the direction of General Nivelle, recapture village and fort of Douaumont, Haudremont quarries, and 4,500 prisoners. They thus advanced to lines held in May.
3rd Nov.—Vaux recaptured. On 30th Nov. the German Crown Prince resigned the command of the Verdun front.
15th to 16th Dec.—General Nivelle (who succeeded General Joffre as French Commander-in-Chief on 12th Dec.) orders new attack at Verdun. Vacherauville, Poivre Ridge, Bezonvaux, Hardaumont recaptured with 11,000 prisoners.

In early 1916 the British army was still finding itself, and its new Commander-in-Chief, Sir Douglas Haig, regarded it as insufficiently trained and equipped for the great tasks which lay before it. As an instrument of war it was still not yet ready. It also remained, if not in a water-tight compartment in respect of the French armies at its side, yet with a separate command and in separate control. This may have been merely the necessary consequence of its state of training; but it is certain that in 1916 there was no one with authority to compel that unity of action and command which in 1918, but not till then, directed the Franco-British armies as one force. Fortunately, perhaps, the German High Command elected to attack the French at Verdun instead of throwing their whole weight on the British, though there were numerous smaller actions along the worn and dangerous Ypres front and elsewhere in the first half of the year.

On 14th Feb. the enemy captured some 600 yards of 'International Trench,' south-east of Ypres, but they were regained on 17th March, when a bitter and protracted struggle also began for the mine craters at St. Eloi. These were lost and recovered more than once, with heavy casualties on both sides. The Canadians, who had their full share of these costly operations, were again sorely tried at the beginning of June, when the Germans penetrated their front trenches in a surprise attack on the 2nd of that month. Major-General Mercer was killed in this assault, and General Williams captured. Eleven days later the Canadians atoned for this set-back by completely re-establishing their broken line.

Throughout the first half of 1916 the enemy, not only round Ypres, but also round Loos, at Ploegsteert, Givenchy, and elsewhere, persevered in similar local attempts to keep the British occupied and upset their plans, while he was concentrating his chief efforts towards beating down the French defences at Verdun. The attack on Verdun, as already related, ultimately broke down, and the period in which it was at its height was utilized by Sir Douglas Haig to bring his forces as near as possible to the point at which they could undertake with success an attack of the first magnitude against the entrenched German lines. The date of the attack was premature, and was hurried on in order to take some weight off the harassed French armies at Verdun.

It began on 1st July; the chosen *terrain* was the River Somme, and the great offensive, in which the French joined, was over a 28-mile front from Gommecourt, north of the Somme, to Dompierre, south of that river.

First Battle of the Somme. The German position in the Somme area was situated on the high ground which is the water-shed between the Scheldt and the Somme. The ground runs east-south-east, and its hills fall into long irregular spurs divided by wide valleys. On the forward slopes of the hills the German first-line defences ran from the Somme at Curlu to Fricourt; at Fricourt the defence line turned north, crossing the Ancre, thence passing over the summit of the watershed near Hébuterne and Gommecourt to Arras. Between the Somme and the Ancre a second line of defence had been constructed 2 miles behind the first, and on it had been lavished all the ingenuities of fortification which the German engineers afterwards developed in the so-called Hindenburg lines. South of the Somme, where the French were to co-operate with Sir Douglas Haig, the defences were not so elaborate; it was not here that the Germans, who were fully aware of the impending British attack, expected the blow to fall. They expected the greatest weight to be felt towards the Ancre.

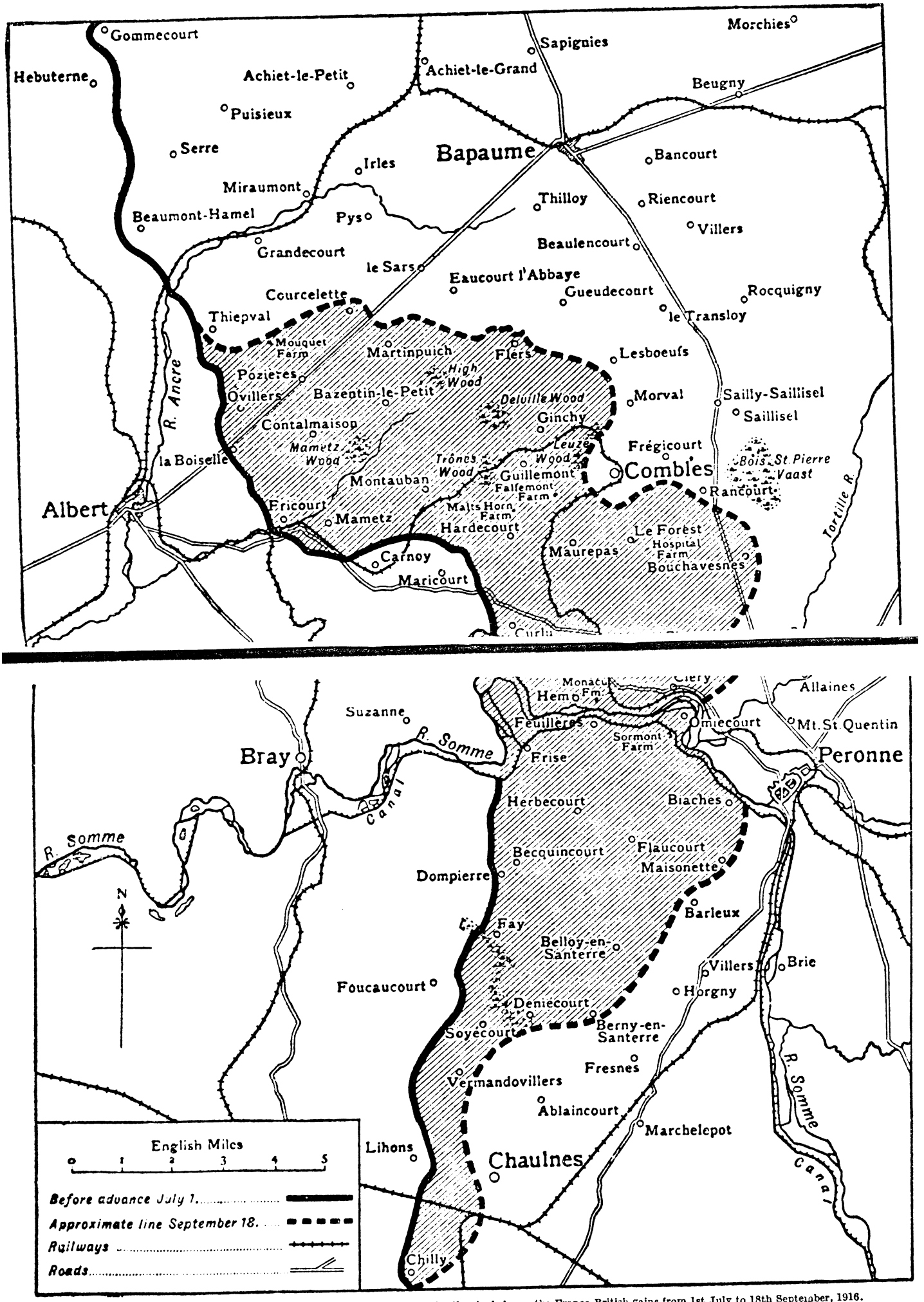
The British preparatory bombardment, delivered by a force of artillery far greater than any British army had heretofore possessed, began on 24th June, and deluged the German positions with shells for a week. It was aided by the efforts of the Royal Flying Corps, which, at this time, had a decided superiority over that of the Germans. The British attack on 1st July began in broad daylight, and was delivered principally by Rawlinson's Fourth Army of five corps, with a subsidiary attack by the Third Army (Allenby) opposite Gommecourt, where one corps only was sent forward. The sectors attacked, beside that at Gommecourt, may be designated: Beaumont-Hamel; River Ancre, including Thiepval; La Boisselle and Contalmaison; Fricourt; River Somme at Montauban. The French attack, designed by Foch and delivered by the French Sixth Army (Fayolle), and Tenth Army (Micheler), was delivered along an 8-mile front, taking in a sector on either side of the Somme from Maricourt, through Frise and Dompierre, to Fay.

Severe as were the British preparatory and final bombardments, they did not succeed in demolishing the German systems of defences, and had left machine-gun nests intact. The efficacy of the machine-gun was one of the bitterest lessons to be learnt by the flower of the British armies of 1916, and the great losses of 1st July were largely due to the German handling of this weapon. Taking the British and French attack as a whole, it may be said to have failed towards the north and succeeded towards the south.

The heaviest rebuff was inflicted on the corps of Allenby's Third Army which operated opposite Gommecourt. From Thiepval, across the Ancre, the Germans had massed their best fighting material and the greatest weight of their artillery. The 10th Corps (Morland), which included the famous 36th (Ulster) Division, Highlanders, and North Countrymen, did wonders, and actually penetrated the Thiepval Redoubt but could not hold on to its gains. Hunter-Weston's 8th Corps of picked troops, including the 29th Division from Gallipoli, found the task of assaulting Beaumont-Hamel too strong for them. Farther south there were successes which increased in value towards the Somme. The 13th Corps (Congreve) carried Montauban and Mametz; the 15th Corps (Horne) surrounded Fricourt; the 3rd Corps (Pulteney) forced its way at great cost into La Boisselle.

The French armies, well handled, and aided by the advantage of finding the Germans less on their guard, made ground on either side of the Somme. Three corps participated in the assault—the 20th (Balfourier) from Maricourt to the Somme, where the hardest fighting was at Curlu and Hardicourt; the 1st Corps (Brandelat); and the 35th Corps (Allonier). The last two walked through the Germans, and the French losses were light. As the result of the day's fighting along the whole extent of the front, the British captured 3,500, and the French 6,000 prisoners; but the casualties of the assailants were close on 50,000. The second day's fighting, though it emphasized the certainty that no great German defeat had been inflicted, enabled both the French and British commanders to enlarge the ground they had won, and the advantage was further exploited in the few days that followed. By the 5th of July over a front of 6 miles the Germans had been pushed back a mile; the British had captured 6,000, the French 8,000 prisoners.

This was the first blow in the Somme battle. Its results, compared with those of the German attack at Verdun, do not afford warrant for regarding it as a great victory. It became clear that there was no precedent to follow other than that set by the Germans at Verdun, namely that of systematically reducing the enemy's position. This



The Allied Battlefield on the Somme: map showing approximately by the shaded area the Franco-British gains from 1st July to 18th September, 1916.

heavy task was entered on by the British forces with unbroken determination; and the effort relaxed scarcely any of its vigour till 18th Sept., while the last big British attack on the Ancre began on 13th Nov. The principal events in this protracted struggle for positions and fortified strongholds after the opening phase already described were:

14th to 15th July.—British attack German second line, capturing Longueval, Trônes Wood, Delville Wood, and 2,000 prisoners.
23rd July.—Second phase of Somme battle begun. Pozières captured 26th July.
16th Aug.—French take Belloy near the Somme; 1,300 prisoners.
29th Aug.—Total British captures on Somme to date: 266 officers, 15,203 men, 86 guns.
15th Sept.—British advance (third phase of Somme battle) using tanks for the first time: Martinpuich and High Wood taken. Lesbœufs and Morval captured 25th Sept. Combles and Thiepval captured 26th Sept.
30th Sept.—Thiepval Ridge captured.
10th Oct.—French take Ablaincourt, south of Somme, and 1,300 prisoners.
21st to 23rd Oct.—British take 1,018 prisoners.
12th Nov.—French take Saillisel.
13th Nov.—Battle of the Ancre (fourth phase of Somme battle). British take 4,000 prisoners.
29th Dec.—Sir D. Haig's dispatches relating to Somme battle. During the period 1st July to 18th Nov. were captured 38,000 prisoners, 125 guns, 514 machine-guns. The number of casualties inflicted on the Germans has not been made known. Those of the British amounted to 22,923 officers and 476,553 men. A number of these were, of course, not permanent casualties.

Russian Campaign, 1916. During the winter 1915–6 the Russian armies were reorganized by General Alexieff under the nominal command of the Tsar. The Grand Duke Nicholas, as already stated, went to the Caucasus in 1915, and while Viceroy there the successful advance of General Yudenitch to Erzerum (captured 16th Feb.) was made. The Russian armies of the north were placed under General Kuropatkin (Riga to Dvinsk) and General Everts (Vilna to the Pripet), and the commands embraced respectively the Twelfth, Fifth, and First; and the Second, Tenth, Fourth, and Third Armies. In the southern group of armies, commanded by General Ivanoff till April, and by General Brussiloff afterwards, were included the Eighth Army (Kaledin) in the Rovno sector, Eleventh Army of Volhynia (Sakharoff), Seventh Army of Eastern Galicia (Scherbatcheff), and Ninth Army of the Dniester (Lechitsky). Facing the northern group of armies were German forces directed nominally by General Hindenburg, actually by General Ludendorff. The local commanders were von Below and von Scholtz (Riga to Dvinsk), von Eichhorn (Lake Narotch), von Fabeck and von Woyrsch with an Austrian army corps. A force under the nominal command of Prince Leopold of Bavaria connected these German armies with those which faced General Brussiloff (successor to Ivanoff).

The Volhynian sector (Third Austro-Hungarian Army) was under von Brlog; Rovno sector (Fourth Army) under the Archduke Joseph Ferdinand, stiffened by a reserve under von Linsingen. Farther south were General Boehm-Ermolli's army (Second), and the two armies of Bothmer and Pflanzer-Baltin. The Russians, who had been recruiting far larger numbers than they could feed or employ, were much more numerous. The Germans were well entrenched and superior in artillery.

The German effort in 1916 was diverted to the West. The Russians, who were now better supplied in guns and ammunition than heretofore, seized the opportunity to take and keep the initiative in the East. They began before the end of 1915 with an offensive in Galicia on the Styr and Strypa, and continued their attacks through January; while in February there was severe fighting on the Dniester, in the Bukovina, and in Volhynia. The first full-dress attack was made, however, in the northern sector, where General Everts began the battle of Lake Narotch on 18th March. Fighting here was renewed eight times before 14th April, and the Russian gain on the Vilna road did not warrant the heavy losses (12,000), which were increased by a German counter-attack on 28th April.

The important part of the Russian campaign took place in the southern group of armies commanded by Brussiloff, who used his superiority of numbers against the Austrian generals and their very mixed troops with brilliant effect. On 4th June the Russian armies from the Pripet to the Bukovina were set in motion simultaneously against the long unequally guarded Austrian front, seeking the

weak places. Generals Kaledin and Sakharoff, in the sectors nearest the Pripet, engaged the armies of von Brlog and the Archduke Joseph Ferdinand; and the Russian columns, though held up in the marshes supporting von Brlog near Kolki, swept through the archduke's defences like paper. They marched swiftly forward over rolling country to the Styr, driving the Austro-Hungarian levies before them. By 16th June the leading Russian columns were 12 miles from Vladimir Volhynok. North of this apex Kolki and Svidniki, on the Stokhod, were captured; south of the so-called Lutsk salient thus created Sakharoff captured Dubno, and was outside Brody on the 16th. In twelve days this most damaging attack captured 70,000 men, 83 guns, and created a salient which, at its greatest depth, was 50 miles from the 80-foot base from which it had been started. Von Linsingen's reserves were sent in, and Ludendorff took matters in hand.

General Scherbatcheff had simultaneously attacked von Bothmer from Kozlov to the Dniester. The Russian general reached Bucacz (8th June) and crossed the Strypa. He also captured 17,000 prisoners and 30 guns, but von Bothmer, athwart a good line of railway, could not be enveloped, and fell back sullenly and without disaster.

General Lechitsky, in the most southerly sector, struck with fury at Pflanzer-Baltin, and cut through his centre on the hills between the Dniester and the Pruth while turning his flank at the Dniester bridge-heads at Zaleszczyki and Biskupie. The net result was the wreck of Pflanzer-Baltin's army, which was forced to retreat across the Pruth to the Carpathians. Lechitsky captured 39,000 men; and Brussiloff's great attack had succeeded triumphantly on both wings. It had made less headway in the centre. There were two lines of subsequent pressure or advance open to him, one, the more northerly, towards Kovel; the other, with, as object, the further destruction of the southern Austro-Hungarian armies, towards Halicz.

Ludendorff, however, had by this time formed his plans for the restoration of equilibrium; and Linsingen, with his reserves, was employed to make amplification of the Russian success at the most northerly portion of the salient impracticable. Linsingen struck at the Stokhod River crossings. Brussiloff countered by bringing up a fresh army under General Lesch with the object of outflanking Linsingen in his turn; and another army, under General Rogoza, was ordered to occupy General Woyrsch's attention farther north. These manœuvres had considerable success, Lesch and Rogoza capturing 17,000 men. But though in these and subsequent engagements the largest numbers of captures fell to the Russians, and though in the extreme south they were again able to advance to the Carpathian passes, no disaster on the largest scale was inflicted. The Germans were able to withdraw their allies and to allow the Russian attack to wear itself out.

Nevertheless, the Russian victories were of immense service to the Allies, and by the autumn of 1916 it seemed that the prospects of the Central Empires were darker than at any period of the war. The Russian advance, in its resolution and generalship, need not shrink from a comparison with that with which Foch ended the war two years later. By the middle of September, Generals Kaledin, Lesch, Sakharoff, Scherbatcheff, with Bezobrazoff and Lechitsky in the south, had captured 370,000 prisoners, 450 guns, and an amount of supplies as great as that which fell into Ludendorff's hands at St. Quentin in 1918.

Balkan Campaign, 1916. After the conclusion of Brussiloff's triumphant dissipation of the Austro-Hungarian armies in the early autumn of 1916, the way was open for Rumanian co-operation with the Allies, and Rumania, though neither united nor completely ready, was urged to enter the war. This she did on 28th Aug., when Germany declared war on her, and Italy made a belated declaration of war on Germany. On 29th Aug. von Hindenburg was appointed Chief of the German General Staff in succession to von Falkenhayn, to whom was relegated the task of dealing with Rumania.

The Russians during the rest of the year advanced towards the foot of the Carpathian passes and to the junctions of the knot of railways in South-Eastern Galicia, in order to gain complete contact with the Rumanians through the Bukovina. Meanwhile the Rumanians, instead of concentrating on their southern front, where a mixed force of Bulgarians, Turks, and Germans under the command of von Mackensen was preparing to take them in the flank, pressed forward through the easterly passes of the Carpathians into Transylvania. They advanced here some distance, practically striking a blow in the air, but neither raising the Transylvanian population nor capturing any strategic points.

On 2nd Sept. Russian forces in aid of Rumania crossed the Danube into

the Dobrudja, while on 3rd Sept. Brussiloff's troops won a considerable victory in South-East Galicia, and on 7th Sept. took Halicz. But this success was more than offset by the loss to the Rumanians on their southern front of Tutrakan, on the Danube, with 20,000 prisoners. Occurrences were symptomatic of what was to come; and again, on the Eastern, as on the Western front, the Allies suffered from the lack of unity of command. The Russians and Rumanians joined hands on 10th Sept., but never concerted their strategy. Mackensen continued to advance along the Danube towards the vital Cernavoda Bridge, and so to threaten the whole of Southern Rumania, while the Russian forces which, on the east, had ventured into Rumania, found themselves by 18th and 19th Sept. faced with the new forces concentrated by the Germans against their eastern Transylvanian front.

The rest of the Rumanian campaign is the history of the stages by which the two arms of these German-made 'nut-crackers' closed on the Rumanian armies, which had been placed in a false strategical position and were badly led. On neither front did the Rumanian soldiery, who fought well under very trying conditions, with inferior artillery and a poor medical service, give way without a struggle. Mackensen was stoutly held up on 20th Sept. in the Dobrudja, and on the Transylvanian side the Rumanians had a success on 27th Sept. But on 30th Sept. Falkenhayn developed his eastern attack near the Roter Turm Pass, and by 7th Oct. the whole Rumanian front in Transylvania was retiring by the way it had come. A week later it was out of Transylvania and defending the not very defensible passes.

On 20th Oct. Mackensen attacked on the whole line in the Dobrudja, and five days later he was on the vital Cernavoda Bridge. Constanza, the Rumanian Black Sea port, had fallen, and so far from ever being in a position to take Turkey or Bulgaria in the flank, the Rumanians were now themselves on the verge of being outflanked on the Danube. Meanwhile, on the other arm of the nut-crackers, von Falkenhayn, despite trifling setbacks, was pressing on. The Torzburg Pass (21st Oct.), Predeal Pass (23rd Oct.), Vulkan Pass (25th Oct.), Roter Turm Pass (31st Oct.) were all scenes of Rumanian reverses, and by 15th Nov. the bulletins were bringing the daily news that the Rumanian retreat continued. On 23rd Nov. Falkenhayn was advancing on Bucharest; Mackensen had crossed the Danube at Islatz and Simnitza; and farther west Orsova and Turnu-Severin had fallen. All the German composite forces could now be deployed in Rumania, and the end followed swiftly. Mackensen and Falkenhayn were in touch on 26th Nov.; Campolung was captured 29th Nov.; Bucharest, Ploeshti, and Sinaia fell on 6th Dec.; and with them went the Rumanian oil-fields, the wells of which had, however, been very thoroughly damaged by Captain Norton Griffiths and a small British party in order to prevent their use by the Germans. (They were restored in some eight months.)

On 8th Dec. the Germans estimated their Rumanian captures as 70,000 men and 184 guns; and it is true that only a portion, though a considerable one, of the Rumanian armies was able to effect a retreat with the Russians to the line of the Sereth defences. Fighting went on till the end of the year, and was continued into 1917 until the Rumanians were forced to sign the Treaty of Bucharest—revoked by the Allies at the end of the war.

Rumania's fate, following the tragedy of Serbia and the Allies' withdrawal from Gallipoli, strengthened the Greek military party round King Constantine, which was now openly pro-German. Against these influences M. Venizelos proved powerless, though Greek volunteers were at the same time joining the Venizelos party, and ready to fight with the Allies. This division of opinion in Greece was illustrated in the middle of August (1916), when two divisions of the 4th Greek Army Corps surrendered to the Bulgarians, who had advanced to the Greek port of Kavalla, while the 3rd Division of the same corps joined the Allies at Salonika. The pro-Germans had carried all before them at the last Greek elections (Dec. 1915), when the Venizelists declined to poll; and the danger of finding themselves suddenly attacked in the rear discouraged an Allied offensive against the Bulgarians until the autumn of 1916, when the newly equipped Serbian army arrived from Corfu, ready and eager to fight its way home, joining the force under General Sarrail, which already included Russian, Italian, and Portuguese contingents, besides French and British.

Following pro-German riots against the Allied embassies in Athens, too, a 'pacific blockade' of the Greek coast had been enforced, and a firm Note presented to the Greek Government demanding the demobilization of the Greek army and a new general election, to be freely conducted. When these demands had been

accepted and a new Government formed—though the king's pro-German sympathies remained as marked as ever—General Sarrail resumed, in September, the offensive against the Bulgarians. The main advance was undertaken by the French and Serbian divisions, with a Russian contingent, in the direction of Monastir, General Milne's British column meantime pushing the Bulgarians back from the Struma line. Two months' fighting saw the Serbians, who had borne the brunt of the attack at this point, marching back into Monastir in triumph, having turned the Bulgar-German forces out of it on 18th–19th Nov. The British, at the same time, kept the enemy busy at the other end of the line, occupying a number of villages, and pushing the Bulgarians back beyond the railway between Seres and Demir-Hissar. With their heavy commitments elsewhere the Allies were for the time being unwilling to extend their military operations beyond Monastir.

Italian Campaign, 1916. Italy, who for political as well as military reasons had declined further assistance in the Balkans, had her share of hard fighting within her own frontiers in 1916. Before she could resume her advance on Gorizia and Trieste (held up in the early winter of 1915) the Austrians attacked in turn from the Trentino under General Conrad von Hoetzendorff, who, planning a drive on the Mackensen scale, aimed a blow at the tempting Venetian plains. The grand attack, supported by upwards of 2,000 heavy guns on a 30-mile front between Val Sugana and Val Lagarina, and delivered on 14th May by some 350,000 first-class troops, smashed a way through in the centre. Though the flanks held firmly, and the Italians, roused to fury by the invasion, fought magnificently among the mountain heights, General Cadorna ordered the line to be withdrawn from its untenable positions until it was south of Asiago. Pressing their advantage with every means at their disposal, the Austrians announced in an Army Order on 1st June that only one mountain intervened between their troops and the Venetian plains. Cadorna, however, had now been reinforced, and two days later was able to reply that the Austrian offensive had been checked. For the rest of the month he was content, in this sector, to sustain the continued but unavailing assaults of the enemy, while he prepared his own great counter-attack on the Isonzo front, with Gorizia, the gateway to the plateau of the Carso which led to Trieste, as his immediate objective.

This dramatic move, heralded by an intense bombardment on 6th Aug., was entrusted to the Duke of Aosta, whose Third Army, after three days' fighting of the fiercest description, carried the last heights defending the town and entered Gorizia in triumph. Following the retreating enemy across the Carso, the Italians, whose enthusiasm for the war had been greatly stimulated by this fine feat of arms—Italy's belated declaration of war on Germany followed upon the Gorizia victory—continued their advance across the northern end of that formidable plateau, winning a number of considerable battles, and capturing before the end of the year between 30,000 and 40,000 prisoners, but never succeeding in mastering the Carso as a whole.

Naval War in 1916.—Battle of Jutland. The battle of Jutland, which took place on 31st May, 1916, overshadows all other naval operations in that year; nevertheless, there were several other events of importance which preceded it, or were in some way related to its occurrence afterwards. For example, in the earlier months of the year the German raider *Moewe* was at large, and inflicted considerable damage on British shipping before returning safely to a German port; the mercantile submarine *Deutschland* left Germany for the United States and returned in safety; and another German submarine, U 53, also crossed the Atlantic with more belligerent intent, and sank several merchant vessels off Rhode Island on 8th Oct.

The new development of the submarine war, in which Germany declared her intention of sinking merchant ships at sight, began on 1st March, and one of its most important consequences was the dispatch of a United States Note by President Wilson to Germany (18th April) in respect of the sinking without warning of the *Sussex* and other unarmed vessels. Another outcome of the German submarine warfare was the sinking of British hospital ships in the Mediterranean. Furthermore, following the battle of Jutland, and related in some respects to its only partially decisive character, the *Hampshire*, with Lord Kitchener and his Staff on board, was sunk off the north of Scotland (5th June) by striking a mine that is said by the Germans to have been laid by one of their submarines; and on 19th Aug. the German High Seas Fleet was able to come out again, though it sought no action, but avoided one. Two British light cruisers, the *Nottingham* and *Falmouth*, were sunk in the search for its whereabouts.

The 'partially decisive,' or 'indecisive,' character of the battle of Jutland are relative terms, and their exact implication has been, and must continue to be for a long time, a matter of controversy. On the one hand, the aim of Admiral von Scheer, the Commander-in-Chief of the German High Seas Fleet—to catch a portion of the British Grand Fleet and attack it while isolated and unsupported—was frustrated, and in that respect the German admiral failed. On the other hand, Admiral Sir John Jellicoe's purpose of destroying the German Fleet, if and when he succeeded in engaging it, also failed, as may be understood from its subsequent emergence from its harbour in August, and the later development of the German submarine campaign, which could not have taken place had not the German possessed the framework of a fleet to support the underwater vessels. Sir John Jellicoe justifiably claimed that his action preserved intact the main forces of the British Grand Fleet, and left them as before in command of the outer seas, while demonstrating to the Germans that they could not again engage in a naval battle on a large scale with any hope of success. Admiral von Scheer was entitled to claim that he had engaged a superior British force, had inflicted on it more material damage than he had sustained, and had withdrawn the bulk of his forces to remain, as before, a menace, not to British safety, but to British unfettered control of the seas. The details, in outline, of the battle of Jutland are as follows.

On 30th May the Grand Fleet under Sir John Jellicoe left its three Scottish bases for a sweep of the North Sea, Sir David Beatty, with the battle-cruiser squadron, *Lion, Queen Mary, Princess Royal, Tiger, Indefatigable,* and *New Zealand,* and Sir Evan Thomas, with the four battleships of the *Queen Elizabeth* class, *Barham, Malaya, Warspite,* and *Valiant,* setting out from the most southerly of these bases, Rosyth. At 2 p.m. on 31st May Sir John Jellicoe, with the Battle Fleet in 6 divisions, was steaming line-ahead between Aberdeen and the north end of Jutland, in order to meet Sir David Beatty at an appointed rendezvous in the North Sea. Sir John Jellicoe's 6 divisions were, lined east to west, 1st Division (Jerram), *King George V, Ajax, Centurion, Erin;* 2nd Division (Leveson), *Orion, Monarch, Conqueror, Thunderer;* 3rd Division (Jellicoe), *Iron Duke, Royal Oak, Superb, Canada;* 4th Division (Sturdee), *Benbow, Bellerophon, Temeraire, Vanguard;* 5th Division (Gaunt), *Colossus, Collingwood, Neptune, St. Vincent;* 6th Division (Burney), *Marlborough, Revenge, Hercules, Agincourt.*

Both Jellicoe's and Beatty's forces had their attendant suites of destroyers, light cruisers, and other cruisers. The British Grand Fleet in all was constituted of 41 'capital ships,' made up of 28 battleships, 9 battle-cruisers, and 4 armoured cruisers. It had also 103 'ancillary craft,' made up of 25 light cruisers and 78 destroyers. The German fleet consisted of 20 battleships and 5 battle-cruisers, or 28 'capital ships'; there were also 11 light cruisers and 88 destroyers. In gun power and weight of projectile the Grand Fleet had a striking superiority over the German fleet, and Admiral Jellicoe had apparently a valuable superiority in speed. In his own account of the battle he observes that the speed of some of the German ships had been underestimated.

There was no clear expectation on the British side of meeting the Germans when the Grand Fleet set out for its sweep on a line drawn from Wick to the opposite coast of Norway, with Beatty's 6 battle-cruisers and Evan Thomas's 4 battleships as advance-guard; and when von Scheer set out for the north from Heligoland Bight at daybreak, with an advance-guard of 5 cruisers, supported, 50 miles behind, by 16 Dreadnoughts and 6 slow pre-Dreadnoughts, he had no intention of seeking a general action.

The meeting of the advance squadrons began when both were on a level with the northern end of Jutland. Admiral Hipper, who commanded the German cruisers, turned round from north to south to rejoin his main fleet; he was then east of Admiral Beatty. Beatty followed him, at some disadvantage from smoke and haze. Evan Thomas's battleships were too far behind at this stage to join in the engagement. Hipper fended off Beatty with destroyers as best he could in the hour before the German main fleet could come up, and in that hour *Queen Mary* and *Indefatigable* blew up, shells from the German ships, on which the system of fire control appeared to be more accurate than the British, reaching their magazines.

When the German main fleet was seen to be approaching in support, Beatty turned with his 4 remaining cruisers, and Evan Thomas's 4 battleships fell in behind. These 8 were stronger than the German advance 5, and swifter, so that Beatty did not execute a mere retreat but pressed on Hipper, making him turn east, and thereafter placing the British ships on the German line of retreat to Heligo-

land—'crossing the T,' as the manœuvre is called.

Meanwhile Jellicoe's 6 battle divisions were coming on in an oblong of 6 lines of 4 ships each—the long sides of the oblong north and south, the short, east and west. Thus steaming, Jellicoe came into contact with Beatty and Evan Thomas engaged on the east side of the German line, whose head they had faced round and were themselves going south. Beatty and Thomas were thus between Jellicoe and the Germans, and it behoved the British Commander-in-Chief to see that his ships did not hurt one another with their fire. Jellicoe effected the necessary deployment, not in the manner that he had premeditated, but in that which circumstances forced him to employ. It was the less simple way, and the Grand Fleet was not in line till half-past six.

The Germans had no prudent course but to retreat, which they did in the haze and chemically-created smoke—both fleets going to the south-west, curving to west. The fleets were hammering each other as hard as they could; but when darkness came down the German fleet, badly damaged but not seriously diminished in numbers, was still fighting in retreat. Admiral Jellicoe, in his own account of the battle, remarks: "At 9 p.m. the enemy was entirely out of sight, and the threat of torpedo-boat destroyer attacks during the rapidly approaching darkness made it necessary for me to dispose the fleet for the night with a view to its safety from such attacks, whilst providing for a renewal of action at daylight."

The opportunity for renewal at daybreak did not come; nor was it likely to have come, since von Scheer's first preoccupation was naturally not to fight a superior force under conditions least favourable to himself. It is therefore proper to state that the British Commander-in-Chief thought it wiser to break off action with his main fleet lest it should suffer too greatly in the turmoil and confusion of a night attack. The arguments in favour of this decision are several; the chief of them being that Admiral Jellicoe kept the British fleet and naval power intact, and another being those which the British admiral himself advanced, namely that he was not completely aware of how his own fleet and that of the enemy lay to one another, and that "the result of night actions between heavy ships must always be a matter of chance." Admiral Jellicoe did not feel justified in gambling on such a chance. He did what he told the Admiralty he should do in such circumstances, as recorded in a dispatch written on 30th Oct., 1914, and published at the end of the official *Battle of Jutland* in justification of his action: "If the enemy battle fleet were to turn away from an advancing fleet," he wrote on that occasion "I should assume that the intention was to lead us over mines and submarines, *and should decline to be so drawn.*" The italics are Lord Jellicoe's own.

1917 on the European Fronts.—The Russian Campaign. On the Eastern front fighting on the grand scale had died down by the beginning of 1917, the Germans having exhausted the momentum of their advance under Mackensen, and accomplished their main purpose of putting Rumania out of account as a serious adversary. Along the line of the Sereth, and in the Bukovina, deadlock was reached in the spring of 1917. By that time the creeping paralysis which was seizing the Russian armies was making itself felt in this, their most distant tendon. Throughout April, May, and June the daily record of occurrences on the Eastern front is blank except for one attack by the Germans on the Stokhod (3rd April).

For the explanation of their quiescence the record of political events has to be scanned. It was well known on the Continent, though it was kept hidden from the British public during the winter of 1916–7, that the integrity of the Russian armies was crumbling, that soldiers were fraternizing with the enemy, and that a general revolution was being prepared by those forces of socialism and anarchy which had been thrust under, but had never lacked exponents, since the abortive revolution of 1905. The mismanagement, the corruption, and the bitter hardships of the war had given them their opportunity, and these were the 'Dark Forces,' more than the rogue Rasputin, the parasite of the Russian Court, which undermined the influence of the monarchy, and extinguished Tsar and Court, bureaucracy, aristocracy, and army in a common ruin. It was said in Europe during the winter of 1916–7 that the Allies would have to choose between the Russian monarchy and the Russian people; but neither the inertia of the Russian army nor the postponement of the re-opening of the Russian Duma acquainted the British public with the depth of the mischief that was working.

The first inkling came on 12th March, 1917, when, following food riots in Petrograd, the Tsar ordered the suspension of the Duma. The Russian Revolution was the reply.

Three Guard Regiments joined the people—the army had failed the monarchy. A Provisional Government was formed. Petrograd, Moscow, Kharkov, and Odessa joined it; and on 15th March the Tsar abdicated under compulsion. Several figures emerged from the crisis. M. Miliukoff, of the Constitutional Party, and Kerensky, a link with the Socialists, but the real forces at work did not at first show themselves.

On 24th March the army declared its loyalty to the Provisional Government, which two days before had been recognized by the Allies. For a time hopes were entertained that under this Provisional Government Russia would carry out her obligations to the Allies, and that her armies would fight; and every sort of device, including interchange of visits with representatives of British Labour and French Socialism, was employed to foster cordiality. The first sign of the essential futility of such hopes appeared on 4th May, when it was evident that the Russian Provisional Government was failing. A new coalition was formed, with Kerensky at its head, and loyalty to the Allies was urged and asserted. French and American missions visited Petrograd and Moscow, but no real consolidation was effected, though in the latter end of May and the beginning of June there was a remarkably deceptive appearance of it.

Under the spur of great efforts by M. Kerensky the army was stimulated into action once more, and a new offensive prepared. On such an offensive the Allies had placed high hopes, for the Russian armies in the spring of 1917 were better equipped and better provided with guns and ammunition than ever before. At first some of these hopes seemed destined to be realized. General Brussiloff, who had succeeded General Alexieff as Commander-in-Chief of the Russian armies, consented rather reluctantly, under the insistence of Kerensky—at that time engaged in a life-and-death struggle with the forces of the Bolshevik party led by Lenin and Trotsky—to organize an attack on the Austro-Hungarian front south of the Pripet. It was believed that the soldiers of these southern armies were less tainted by Bolshevism than those in the northern armies, and that a success here might rally the country to its older standards of patriotism. Brussiloff entrusted the offensive to General Gutor, who had in his favour the facts that the Austro-Hungarian armies were as war-weary as the Russian, and that the German Headquarters Staff, who were well acquainted with the extent of Russian disaffection, and had indeed been instrumental in inspiring and organizing it, were sceptical about the possibility of such an attack. Furthermore, in the sectors from Brody to the Dniester and beyond, where Lechitsky had halted in 1916, the Russians had a considerable numerical superiority—54 divisions to 30 composite Austro-Hungarian, Turkish, and German divisions, and were well equipped, well posted, and well supplied.

General Gutor directed three armies. The Eleventh, under General Erdelli, was to act along an 11-mile front from a point north-west of Tarnopol, and to get astride the railway which leads from Tarnopol through Zloczow to Lemberg. The Seventh Army, under General Belkovitch, facing Brzezany, was to cross the Zlota Lipa River, where von Bothmer had made his stand, and was then to wheel north-eastward in the same direction as Erdelli's army, with which it was to get in touch. If this movement succeeded, the combined armies were to advance towards Bobrka and the railway from Halicz to Lemberg. The whole of this task was through difficult country. Far to the south General Korniloff, with the Eighth Army, was entrusted with the turning movement. He was to overrun the Halicz region and to obtain control of the railway thence to Lemberg. If this wide turning movement succeeded, and if Belkovitch also did well, the Austro-Hungarian armies would be outflanked and in danger of being rolled up, while pinned down in the north by Erdelli.

The venture was audacious, and the Russian commanders scarce dare trust their men. The Seventh Army's task in assaulting the Zlota Lipa line was such as would have tried the bravest and most loyal troops. The attack began on 1st July, and Belkovitch's men advanced bravely enough, protected by good artillery. In the first assault they took the river line and 2,000 prisoners. But between the Zlota Lipa and its tributary Tseniow was a death-trap, and the Russians were caught in a murderous cross-fire. The day was not lost; but at this critical moment occurred an incident which was symptomatic of Russia's disorders, and was the death sentence of Russia's continuance as a combatant. A division which might have turned the scale refused to advance.

The ground won was with difficulty held, and in the days that followed, the Germans, awakened to an unexpected danger, steadily reinforced the weak point, while Russian battalions were refusing to stay in the front line. The situation reacted on Erdelli's

troops farther north, where the Eleventh Army had done well at very little cost, and had captured 6,000 prisoners by 3rd July. It became less difficult each day for the German directing staff to hold this attack in check, and it was stopped by 6th July. On the Dniester, Korniloff's army began to advance on this day—on which, according to plan, the enemy should have had all their attention concentrated on Erdelli and Belkovitch. Korniloff did very well. On 6th to 7th July he felt his way forward from Stanislau to Dolina, and on 8th July, joining battle with von Bothmer, broke down resistance at Jezupol with ease, and sent forward his best arm, his cavalry, to the River Lukwa, 8 miles behind von Bothmer's first-line defences. Realizing his danger, von Bothmer counter-attacked, but was again borne down, and Korniloff's van reached the Lukwa. In two days' fighting Korniloff had broken through on a 30-mile front, and his main body, in the wake of General Chermiroff's fighting division, poured into the plains of the Dniester. Theoretically a decisive victory had been won. It was in fact indecisive, because the leader's shock troops had been used up, and the situation was crumbling from within. His troops got intoxicated, mutinied, and he could use them no further.

But the rot now became dangerous to the point of mortality in the Eleventh Army of Erdelli. On 20th July, following a strong German counter-attack between Pienaki and Batkow, which was nearly the most northerly point of the advance, the 607th Mlynoff Regiment left the trenches voluntarily. They ran away, leaving the other regiments to bear the brunt of the attack. The breach widened as the Russians opened the gate. The German-Austrian attack, spreading to Zborow, found a Russian division ready to throw down its arms, and in a day the German-Austrian wedge was thrust in between the Eleventh and Seventh Russian Armies. The disaster was complete and irreparable. The command of the army group was hastily transferred from Gutor to Korniloff, but neither Korniloff's ruthless discipline nor Brussiloff's genius could alter the essentials of the situation, which were that the Russian armies would not fight, and were fleeing in panic.

All attempts to stop the flight were useless. On the night of 20th July the breach was 20 miles wide; on 21st July German guns were shelling Brussiloff's head-quarters at Tarnopol; on 23rd July the remnants of the Russian armies were retreating to the Sereth amid scenes of drunken brutality as disgraceful as any that the war has recorded, and only to be compared with those that were to become common in Russia and Siberia in the struggle to establish Bolshevism. Farther north the Russian front imitated the cowardice and treachery at Tarnopol. On 25th July whole Russian army corps deserted the Dvinsk front, on which depended the safety of Riga. On the same day Korniloff was compelled to begin the relinquishment of the ground he had won with the Eighth Army. Stanislau was abandoned; Kolomea followed on 27th July; Czernowitz went on 31st July; and the loss of the Bukovina followed that of Galicia.

For a time Korniloff seemed to have a chance of restoring coherence to some part of the Russian armies. He succeeded in wringing permission from Kerensky to enforce discipline. But the military-political understanding between these two, though it appeared to fail because of Kerensky's suspicions of Korniloff, whose arrest he ordered (on the 11th Sept.), was never a possibility. Russia was sick unto death. Her soldiers demanded peace; her peasants and townspeople asked for bread, and turned to Lenin and Trotsky, who promised both.

During the summer there were many attacks by the Germans on the Riga front, which they used as a training-ground for their troops; and fighting of a similar character took place on the Russo-Rumanian front. But on 16th Oct. the Germans, capturing Oesel Island in the Dvina, took the first step to the subjugation of the northern armies, and continued to take numbers of willing prisoners on the Riga front during the rest of that month. The bulletins of the fighting are contradictory and obscure, but by 3rd Nov. Russians and Germans were fraternizing on the Riga front, and on 20th Nov. hostilities ceased. Lenin demanded (1st Dec.) the surrender of General Dukhonin, the then Commander-in-Chief, who was murdered two days later—the day after the negotiations between the Bolsheviks and the German peace delegation began at Brest-Litovsk.

British Front in the West, 1917. On the Western front it had been expected that the heavy hammering to which the Germans had been subjected during the battle of the Somme would be carried on in concert under the direction of Sir Douglas Haig and General Foch. But a change was made in the French High Command, General Joffre retiring, and his place being taken by General Nivelle, who had done so well at Verdun, while

Foch was relegated to the task of preparing against a possible thrust of the Germans through Switzerland. Unity of command was not achieved, except in appearance. Nivelle's plan was to strike at the German centre; Haig was to aid him by simultaneous attack, though Haig's own prepossessions were in favour of freeing the Channel ports by a burst from the Ypres salient. In the result, neither plan succeeded. Nivelle failed because neither the French Government nor a section of the French soldiery would bear a repetition of the losses incurred in his thrust at the Chemin-des-Dames; Haig failed because he had neither the time nor the weather in which to drive his last blows home in the autumn of the year.

A contributory cause of the comparative failure of the Franco-British plan of campaign in 1917 was the want of perception of the intention of the Germans to withdraw from the positions in the Somme area which they had defended so stubbornly in 1916, and which the Allies were preparing to render untenable or to batter down. The want of perception was not complete, but both British and French plans were upset by the suddenness and extent of the withdrawal, which the Germans effected with much less loss than they should have been forced to sustain.

The first symptom of the general withdrawal was discovered in March, when portions of St. Pierre Vaast Wood, near the junction of the French and British lines, were found to be evacuated. By 17th March the German voluntary retirement was in full swing, and their forces ruined everything as they retreated. By 17th March, also, the British front from Roye to Arras was moving forward, and on 2nd April the Fifth Army was within two miles of St. Quentin, while the Fourth Army on 5th and 6th April was at Ronssoy and Lempire. While the British armies were pushing towards the Cambrai-St. Quentin line the French were pushing on a 30-mile front from the north of the Upper Somme, towards the new German line from St. Quentin, behind Soissons, in front of the St. Gobain plateau, the Forest of Coucy, and the Chemin-des-Dames. Behind the new line Nivelle matured reconstructed plans for the great French attack towards Laon.

Of the new fortress line (the Hindenburg and Drocourt-Quéant line) which the Germans had constructed and continued to improve, the La Fère-Laon position and the Chemin-des-Dames were the southern bastion, and the Vimy Ridge the north-western pillar. Sir Douglas Haig's preconcerted plan had been to attack the Arras front, not in order to assault this line, but as preliminary to the Ypres salient thrust farther north. Nevertheless, the plan could be adapted and it was prosecuted. Preparations on a large scale, equivalent to building a counter-fortress front, had been made for the Arras operations, and the greatest precautions were taken to lend the attack all the support which mines and artillery could give.

Two armies, the First (General Horne) and Third (General Allenby), were prepared for this action. Horne's army made its attack on the Vimy Ridge, with the Canadian Corps as shock troops, on 9th April, and the attack was extended on a 12-mile front from Hénin-sur-Cojeul, south-east of Arras, to Givenchy-en-Gohelle, north of Arras. The Canadians took the whole of Vimy Ridge, except its northern end, the conquest of which was completed next day. Five villages fell into British hands and 6,000 prisoners. Subsequent days saw the extension of the victory, but though Vimy village, Givenchy-en-Gohelle, and other important points were taken, the fortified villages of Héninel and Wancourt held out by dint of machine-guns, and prevented the possibility of the Third Army's joining hands with the Fifth Army beyond the third line of the German defences until it was too late. The whole of the expected gains were therefore not realized, but the possession of the Vimy Ridge was invaluable, and became a most important factor in stemming Ludendorff's rush in 1918, when he attacked the Third Army after destroying the Fifth.

The British attacks did not end on 11th April, as they should have done, but were continued here, as well as at other portions of the British line to its junction with the French armies, in order to lend assistance to Nivelle while his attack in Champagne was in progress. It was a very costly procedure, and its scope may be inferred from the statement that on 23rd April a "second phase of the battle of Arras" began; another 12-mile front east of Arras was launched on 3rd May; and there were bloody encounters about Bullecourt or Fontaine-les-Croiselles on 7th and 12th, 15th and 16th, and 21st May. Some 20,000 German prisoners were captured in these preliminary spring operations, but the drainage in casualties to the British armies was heavy, and more damaging still was the loss of time by the postponement of Field-Marshal Haig's major plan farther north.

This, however, was at last begun on 7th June by the assault on the Messines-Wytschaete Ridge, which, under the name of the 'Battle of Messines' denotes one of the most completely successful actions fought in that year. It was undertaken by the Second Army (General Plumer), and the preparation for it, including the mining of the ridge, had been as near perfection as possible. The attack was launched; the mines which blew the German front line to pieces were exploded on the morning of 7th June at ten minutes past three. Nine miles of front were stormed and 6,400 prisoners taken. In the next week the number of prisoners was considerably augmented; German counter-attacks were beaten off; and the captured position enlarged and firmly consolidated.

From this time forward the operations of the British armies may be envisaged as an attempt to enlarge the great bulge of the Ypres salient by fighting their way up to and along the ridges which enclosed it, so as to force the Germans to relinquish their hold on the coast near Nieuport, Zeebrugge, and Ostend. One very awkward spoke was put in the British wheel by an attack (10th July) on the extreme coastal sector of Lombaertzyde and the mouth of the Yser, by which any combined sea and land attack that might have been projected by the British was discounted. Most of the positions were recovered, but the amphibious plan had perforce to be postponed.

The putting into effect of Sir Douglas Haig's major plan, after the preliminary step of the capture of the Messines Ridge had been taken, did not operate till 31st July, when the 'Third Battle of Ypres' began, with a combined British and French attack on a 15-mile front beyond Boesinghe, on the Yser-Ypres Canal, to Zillebeke. The attack was conducted by the First French Army (General Anthoine); the bulk of the fighting fell on the Fifth British Army (General Gough). Twelve villages were taken and 5,000 prisoners. There was, and could be, no break-through. The Germans rallied to a counter-attack, and were able to do so because their defences, their concrete pill-boxes, and their machine-gun effectiveness could, and did, hold up attacks before they progressed too far.

The rest of the British campaign in 1917 till it was arrested by the torrential rains of a wet October, and by the mud of the impossible declivities, may be summed up as a series of desperate forward thrusts which exacted each its toll of prisoners, ground, and positions, but none of which succeeded in its object of inflicting a lethal injury on the German resistance. In the end these attacks had to cease while the last fragment of coveted ridge, the Passchendaele spur, was still not won, because on that ridge, as elsewhere, though blood had been poured out like water, and losses endured with unflinching fortitude, flesh and blood could do no more. The chief actions were as follows:

15th Aug.—British attack on wide front from north-west of Lens to Bois Hugo, north-east of Loos. Enemy's position penetrated to 1 mile depth.

16th Aug.—Franco-British attack on 9-mile front north of Ypres-Menin road. British carry Langemarck.

15th to 21st Sept.—Second phase of third battle of Ypres. 3,000 Germans captured.

4th Oct.—British advance on 8-mile front, anticipating German attack east of Ypres. 3,000 German prisoners.

9th Oct.—Third phase of third battle of Ypres. One mile advance on Passchendaele Ridge. 2,000 prisoners.

6th Nov.—British attack on Ypres Ridges. Canadians capture Passchendaele.

These attacks were interspersed with costly minor encounters, and by the repulse or endurance of counter-attacks. The battle may be said to have closed by stress of weather in mid-November.

It was followed on 20th Nov. by a British attack of an altogether different kind, in an unexpected quarter—at Cambrai. Here the Third Army, under General Byng, made an attack on a 10-mile front between St. Quentin and the River Scarpe—tanks being employed for the first time in large numbers to lead the advance without a preliminary bombardment. It was a complete surprise, and all but a complete success. The 'Hindenburg Line' was broken, numerous villages and 8,000 prisoners were taken. If the cavalry had been up, as they ought to have been, a first-class disaster might have been inflicted on the Germans, and their railway communications at this point broken. But the cavalry were late; the next few days were spent in consolidation by peculiarly hard fighting; and on 30th Nov. the Germans counter-attacked and subjected the British defences of the newly-created salient at Bourlon Wood and Mocuvres to almost as severe a surprise as they had sustained ten days before. The British lost a number of prisoners, and had eventually to evacuate most of their hard-won positions.

French Front in the West, 1917. The history of the French armies in 1917 is largely the history of Nivelle's

frustrated attempt to pierce the German centre between Soissons and Rheims in April; the pause necessitated by the fact that it was felt impossible to press the French armies too hard or too soon after the disappointment of the attenuated success at the Chemin-des-Dames, where the chief sacrifices of the attack took place; and the efforts on a more moderate scale by General Pétain, who succeeded Nivelle, to win tactical victories at a moderate cost on the terrain acquired in the April adventure. The second battle of the Aisne, as Nivelle's offensive was called, was planned over a length of 50 miles from La Fère, on the Oise, round the edges of the Forest of Gobain and Coucy, to Laffaux, thence below the line of the Chemin-des-Dames ridge and behind the Aisne to the crossing of the river at Berry-au-Bac, and Brimont, near Nogent-l'Abbesse, to the Moronvilliers heights on the other side of Rheims.

The attack on the larger part of this line began on 16th April; that on the Moronvilliers sector on 17th April. The attack on the 16th was extremely costly; it succeeded in only part of its objectives, but it captured 11,000 prisoners. The next day, one of pouring rain, improved on the positions won, especially at the western end of the Chemin-des-Dames, and on the 18th and 19th Nivelle so far enlarged his successes as almost to give them the appearance of a great victory. But the French bolt had been shot, and, to put it plainly, Nivelle was not encouraged to go on. By the 28th he had taken 28,000 prisoners, 175 guns, and some of the strongest points on the heights of the Aisne; but everywhere the positions had been only half-won, and the temper of the French army as a whole had suffered too severe a test. Nivelle was succeeded by Pétain and his plan was abandoned. The rest of the year was occupied by General Pétain in very skilled attempts, named limited offensives, to repel the Germans from disputing some of the positions won and to enlarge the French gains at other points. The chief engagements were as follows:

5th May.—The French, co-operating with the British on a 20-mile front north of the Aisne, take Craonne and 6,000 prisoners.

20th Aug.—French carry enemy defences north of Verdun on 11-mile front; 6,000 prisoners. By 28th Aug. the French were back at their original Verdun positions.

23rd Oct.—French advance on the Aisne north-east of Soissons on 6-mile front; 8,000 prisoners. By 25th Oct. further 3,000 prisoners and 160 guns were taken.

The Balkans, 1917. In the Balkans the military situation during 1917 remained much as the end of 1916 had left it, the Germans, as already mentioned, completing their conquest of Rumania, and the Allies remaining comparatively inactive in the field while they cleared up the extremely unsatisfactory situation in Greece. The chief operations consisted of a Franco-Serbian attack north of Monastir, and attacks by General Milne on the British front in the Struma valley; but though the situation remained in the field virtually unchanged, the political situation was vitally affected in 1917 by the deposition of King Constantine in favour of his second son, Alexander—the king being induced to abdicate on 12th June—and the formation of a new Government under M. Venizelos. From 30th June, Greece, having formally severed diplomatic relations with Germany, was at length added to the list of countries fighting on the Allies' side.

Italian Campaign, 1917. Italy, who, meantime, had proclaimed Albania an independent state under Italian protection, and occupied Yanina in June, 1917, had committed herself wholly to the Allies' cause in 1916 by declaring war on Germany on 28th Aug. It was in Aug., 1917, that Ludendorff began his preparations for the terrific blow which was to lead to the Italian disaster at Caporetto in October. During the earlier months of the year the initiative had remained with the Italians, and Cadorna had used it in a series of offensives which, while carrying him farther across the Carso towards Trieste, and winning seemingly impregnable positions in the Trentino, together with upwards of 30,000 prisoners and 140 guns, were indecisive, and left his exhausted troops—reduced by some 150,000 casualties—ripe for the blow which Ludendorff had prepared for them. The Russian Revolution and the collapse of Rumania freed Austria-Hungary at the same time from any anxieties on her Galicia front, so that she could concentrate all her energies and the bulk of her armies against the Italians.

When the enemy's great counter-stroke was delivered on 24th Oct., the control of the campaign was taken over by the German High Command. Ludendorff had been training picked troops in special tactics—to be developed at their full strength on the Western front in the following year—and von Below was transferred from the French front to take command. Following an intense bombardment, the Austro-German troops were launched against the Second Italian Army between Zaga and Auzza, in deep formations so closely packed

that the way could not be lost amid the prevailing snow and rain. Taken by surprise, and seriously demoralized in parts by Bolshevist propaganda and enemy intrigue, the Second Italian Army, which had hitherto distinguished itself by its splendid courage, found the whole of its left wing giving way before the impact, thus opening a gap for the enemy 20 miles wide over the Julian and Carnic Passes. Having shattered both the first and second Italian lines at Caporetto and Vodil Vrh, the Germans and Austrians surged forward from the Tolmino bridge-head until the retreating Italians, becoming entangled with their own reserves, broke in disorder.

Although the right wing of the Second Army held, and many heroic efforts were made by isolated units, General Cadorna decided that it was impossible to save the situation from irretrievable disaster except by a general retreat to the Piave line. This was ordered on 26th Oct., when the broken fragments of the Second Army, as well as the Italian Third Army, began the great retreat which will be remembered as one of the finest achievements in Italian military history. The territorial gains of over two years' fighting had already been lost, and the conquering invaders reached within 15 miles of Venice, but they never succeeded in making the disaster irremediable. General Cadorna's scathing Order of the Day denouncing the units of the Second Army which had let the enemy through, and the new sense of national unity inspired by the military crisis, did their work. By 8th Nov. the bulk of the Italian armies, now in orderly retreat, were across the Piave, and two days later were ready to turn on their pursuers. The danger was not yet over; the enemy succeeded in carrying several further heights dominating the Venetian plain between the Piave and the Brenta; but by 21st Nov., when a last German attack was made on the Monfenara Ridge, and defeated, the invaders were for the time being held. They claimed some 250,000 prisoners and 1,800 guns of every calibre, besides immense quantities of munitions. They had also succeeded in diverting French and British divisions from the Western front, the Allies sending what assistance they could to stave off the defeat of Italy.

The French and British troops arrived in time for the winter struggle, which began on 4th Dec., by which time General von Below had returned to France—being succeeded in command of the Austro-German operations by General Krobatin—and General Cadorna had been transferred to the Allied War Council, his place as Italian Commander-in-Chief being taken by General Diaz. Two British divisions, under Cavan, took up their positions in the Italian line at Montella; the French divisions at Monte Tomba; and they served to relieve the pressure while the enemy was making his last efforts to break through before the long-delayed snows put an end to the struggle for the year.

Naval War in 1917. At sea, where the British Grand Fleet was now commanded by Sir David Beatty in place of Sir John Jellicoe, who had succeeded Sir Henry Jackson as First Sea Lord in the previous November, the year 1917 passed without a single outstanding engagement. Since Jutland, the German High Seas Fleet had run no risk above water of again seriously challenging Britain's sovereignty of the sea, though her submarine campaign was pursued with ever-increasing vindictiveness. Risking rupture with the United States and other neutrals whose shipping and subjects were thus exposed to wanton attack, she inaugurated 'unrestricted' U-boat war on 1st Feb. "Give us two months of this," said the German Foreign Secretary to the American Ambassador in Berlin, "and we shall end the war and make peace." The argument was that the Allies' losses in tonnage, already more than they could bear, would increase to such an extent that they would be starved into submission.

The United States, with President Wilson as spokesman, replied by severing diplomatic relations with Germany, but it was not until 5th April that she formally declared war against her. Cuba followed suit on 5th April; Panama three days later; Brazil on 2nd June. Germany could afford the risk of offending the smaller American republics, but her defiance of the United States was a fatal blunder. She relied on her submarines to prevent the transport of American troops across the Atlantic—at least until they were too late to affect the issue.

The first American contingents crossed unharmed and arrived in France on 26th June. It was not until the following year, however, that the new American army was ready to throw its weight into the scales on the Western front. The naval resources of the United States were at once placed at the Allies' disposal, the American destroyer squadron in particular being of great service in helping in the protection of trade off the Irish coast, Proof of the closeness of co-operation between the British and United States navies was afforded in June, 1917, when Vice-Admiral Sims, commanding the United States Naval Forces in European Waters, was given the com-

mand of the Irish station during the absence of Vice-Admiral Bayley on sick leave. No foreign naval officer had ever previously held the command of British ships, as well as his own, off the British coast.

Apart from the relentless submarine campaign, which every week exacted heavy toll yet never brought the Allies within measurable distance of the starvation-point to which the Germans had been so sure of reducing them, the enemy's operations at sea were restricted to destroyer and torpedo-boat raids in the Channel from Zeebrugge. Some of these did a certain amount of damage to patrol boats, and bombarded Ramsgate, Broadstairs, and Margate (27th Feb. and 26th April) with little effect save the death of women and children. One memorable incident in these minor operations in 1917 was the raid on Dover on the night of 20th–21st April, when 6 German destroyers, after firing a number of rounds inland, were caught on their way back by the British destroyers *Broke* (Commander R. G. E. Evans) and *Swift* (Commander A. M. Peck)—the advance ships of the British destroyer guard in the Straits of Dover. The *Swift*, which was leading, dashed between two of the retreating destroyers and, turning, sent one of them to the bottom with a torpedo. The *Broke* rammed the third vessel, and while the two ships were locked, an old-fashioned hand-to-hand fight took place on the *Broke's* forecastle, in which the German crew were beaten back. Two minutes later the *Broke* wrenched herself free and the German destroyer sank. Ten German officers and 108 men were rescued at the close of this dashing affair.

1918 on the European Fronts.—First Phase of Ludendorff's Offensive. The Bolshevist betrayal of the Allies at Brest-Litovsk, the treaty of which took Russia irrevocably out of the conflict, and released Germany's Eastern forces for a concentrated assault in the West, gave the Central Powers their greatest opportunity of winning the war since their first hopes were shattered on the Marne in 1914. The crushing defeat of Italy at Caporetto afforded them further grounds for confidence. America, it was true, had thrown in her lot on the side of the Allies, but Germany counted on striking her decisive blow before the American troops could arrive in sufficient numbers to matter; and she had not yet lost faith in her submarines. All through the winter of 1917–8 Ludendorff, the German Commander-in-Chief, was secretly training his troops in the new tactics which were to bring open warfare into full play again, equipping them with Teutonic completeness, and massing guns and ammunition proportionate to the task in view.

The Allies on the Western front were meantime forced to remain on the defensive until such time as the American reinforcements should arrive in sufficient numbers to enable them to regain the initiative. Since April, 1917, the British army had borne the chief burden of the war in the West, and "the bloody struggles to conquer the Flanders ridges"—the words are those of Sir Douglas Haig himself—as well as the prolonged fight at Cambrai, "had left the army at low ebb in regard both to training and numbers." In view of the expected German offensive, it became imperative to fill up the ranks as rapidly as possible, and place the line in a sound state of defence.

Late in Jan., 1918, Sir Douglas Haig took over a new stretch of French line, extending the front of the Fifth Army to cover the village of Barisis, 7 miles south of the Oise. The additional line, taken over somewhat against Haig's judgment, and giving the Fifth Army, which stretched on the left as far as Gouzeaucourt, no less than 42 miles to guard, extending the British front, all told, to 125 miles. The whole of this had to be greatly strengthened and supported by prepared positions to which the troops could retreat when the expected German drive took place, for it was regarded as inevitable that some dent must result in the Allies' line where the colossal blow was dealt. This constructional work called for every man who could be spared for the task, and seriously interfered with the necessary training of the troops in new tactics of defence.

The months preceding the 'hammer blow' were marked by intense raiding activity on both sides, chiefly undertaken to procure information, but sometimes to secure useful positions for subsequent events. The most important of these included the sanguinary struggles for Bullecourt in the early days of January, in which the Australians greatly distinguished themselves, and Germans attacks at Dixmude (6th March), and in the region of Houthulst Forest and the Menin road (8th March), for positions destined to play their part in the new attempt to reach the Channel ports. By the middle of February, when 28 additional German divisions had arrived from the Russian front, and 6 from Italy, and great supply-dumps were springing up in all directions behind the German lines—but particularly opposite the British Third Army at Cambrai and the British Fifth Army to the south of it—Sir Douglas Haig had no doubt as to what was to come.

The only questions were "Where?" and "When?"

All strategical considerations pointed to an attack on the Fifth Army south of Arras, with the object of separating the British and French armies and seizing the centre of communications at Amiens. Neither the British nor the French Head-quarters Staff, therefore, was taken unawares when the great offensive began on 21st March. Both had worked out plans to meet it. More than half Sir Douglas Haig's infantry and the whole of his cavalry were allocated to this sector's defence, and General Pétain had arranged to send a French army corps to their assistance in case of need. The final dispositions of the Germans were carried out with the utmost secrecy: sunken roads, bivouacs, and every device of camouflage being employed to conceal their last stages of concentration. Even so, Sir Douglas Haig learnt from his Intelligence Department on 19th March that the enemy was putting the finishing touches to his impending attack, and that it would be launched by the 21st, if not before.

It was heralded, in fact, at 5 a.m. on the 21st by an intense bombardment in a thick mist which made it impossible for the British batteries to render effective aid to the battered first-line trenches. The onslaught was organized in two parts, the northern advance being directed against Byng's Third Army from the Sensée River to the Cambrai road, and the southern attack from the Flesquières salient opposite Cambrai to St. Quentin. No fewer than 40 German divisions—nearly half a million men—specially trained for the new offensive, were launched against this southern half, and of these more than half were directed against the 16,500 yards of front held by Gough's Fifth Army nearest St. Quentin. All told, the German drive consisted of 64 divisions on the opening day of the offensive. To meet it the British had but 19 infantry divisions in line and 10 in reserve, with cavalry. From first to last the Germans employed in this attack some 78 divisions—exceeding in numbers the total fighting strength of the whole of the British armies in France. By the 9th of April, when the Germans, foiled in the opening move of their supreme offensive, had shifted the spear-head of their assault to Flanders, the total number of British divisions employed both in cavalry and infantry did not exceed 46.

Some part of the line was bound to give before the terrific impact of the infantry attack which followed the bombardment on 21st March. The plans made for repairing the breach in co-operation with the French broke down for a time because the British Fifth Army, attacked by a far greater force than had been anticipated—23 German divisions having been massed as secretly as possible in order to bring them into position at the critical hour—had been forced back sooner than was expected. There was no time either for the British reserves or the French reinforcements to repair the breach before the assaulting divisions under von Hutier, who had established his reputation for this form of operation on the Eastern front, were through it and extending it in all directions.

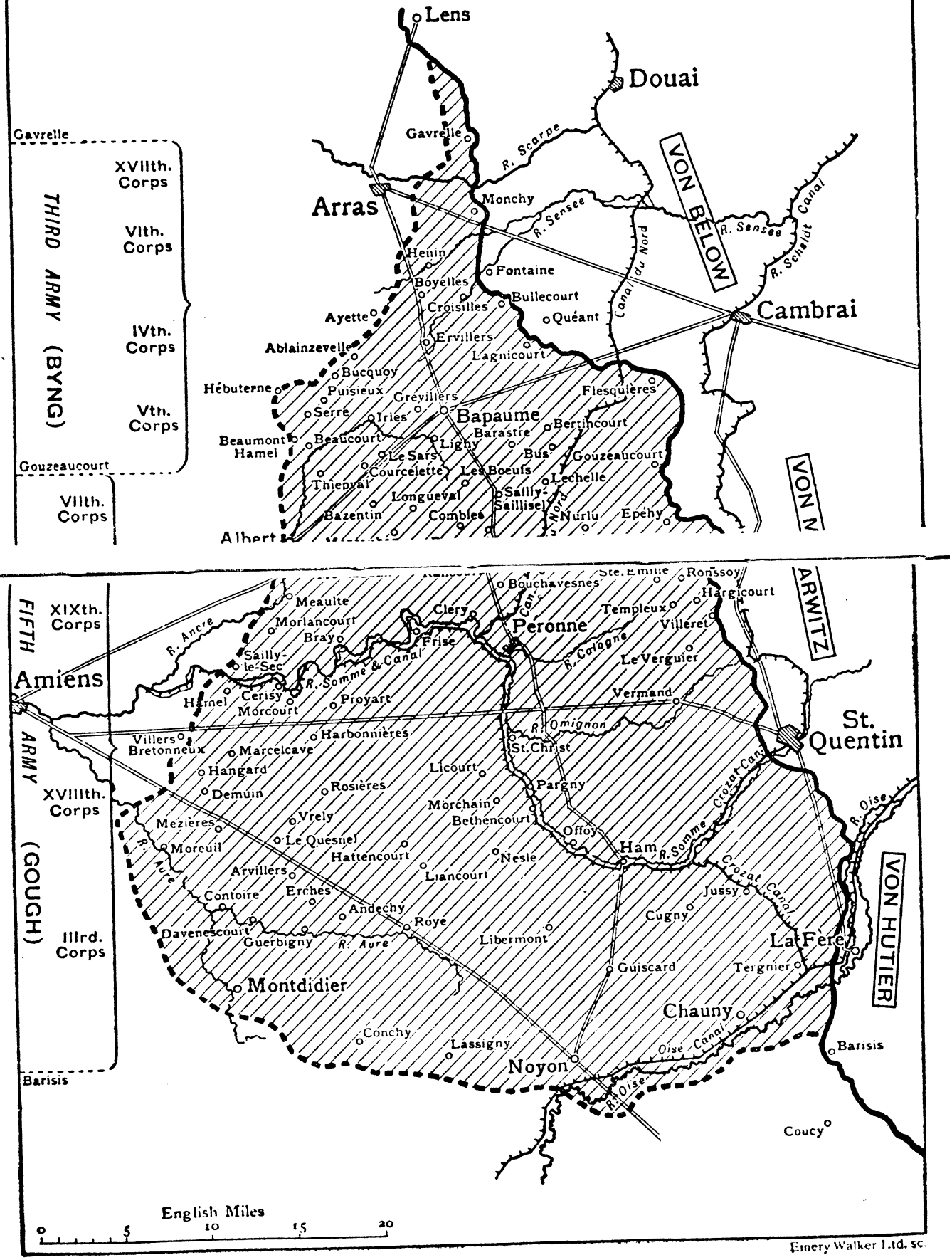
There were, in point of fact, two serious breaches along the 42-mile front held by the Fifth Army. One, the less dangerous of the two, was south of the Oise, where the line was held more lightly than elsewhere, owing to the marshes, which had been relied on to make any considerable attack at this point unlikely. As ill luck would have it, a long spell of dry weather had made the ground easily passable, and the Germans, well aware of the position, swept across it in overwhelming force, like a tidal wave. Heroic stands were made for the forward redoubts and battle positions, but the whole of the ground south of the St. Crozat Canal was so submerged in the flood that by nightfall there was nothing for it but to withdraw the divisions of the 3rd Corps, which had been defending it, to the line of the Somme Canal. Nevertheless, though the Germans made their greatest progress on the 21st at this point, it was not their most dangerous thrust, being nearest to French reinforcements.

The chief danger-point was farther north, on the Fifth Army's left, below the Flesquières salient. By noon, with the fog still so thick that it was impossible to see 50 yards ahead, the Germans had advanced as far as Ronssoy, inside the second zone of the British defensive positions, together with Hargicourt and Villeret to the south. This opened a gate to the third line 3 miles wide, and before the day was over the enemy had pushed towards this as far as Templeux-le-Gerard. But for the stubborn defence of Epéhy, to the north, and Le Verguier, to the south, the breach would have been perilously widened on the following day, but at both these points the German advance was temporarily checked. It could not be stayed long. Supplied with an overpowering weight of men to crush through anywhere, von Hutier was ready to pay the price exacted for every success by British artillery-fire at short range, and British machine-gun posts held to the last; and when St. Émilie and Hervilly finally fell on the 21st, Epéhy and Le Verguier could only hold out long

Map showing the GERMAN ADVANCE and the BRITISH RETREAT

between March 21st. & March 28th. and the line finally re-established on April 4th. & 5th. 1918

Line of March 21st. ..... *Line of April 5th.* .....



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enough for the general line of defence to be withdrawn from them. The retreat thence, hard-pressed as it was, left the Fifth Army's centre with a sagging flank to the south, of which the on-coming Germans did not fail to take full advantage.

Thenceforward the tide swept on for days in ever-increasing volume, all the reinforcements that Sir Douglas Haig or Pétain could send serving only to stop gaps here and there. Ham, Bapaume, and Péronne had fallen by the 24th, and about two-thirds of the territory wrested from the Germans in 1916 regained by them. Germany was announcing to all the world that the 'Kaiser's Battle,' as the emperor himself had caused it to be named, had already been won. To drive the news home, the enemy, on 23rd March, began bombarding Paris with long-range guns capable of firing 70 miles. Nesle and Noyon were the next to go, and by 26th March—save at Albert, which held out until the following day—the Allies were back beyond the line from which they started in 1916.

Elsewhere the enemy's progress along the 60-mile battle front had been slow and costly. He had least success in the north against the British Third Army, partly because the positions held were stronger, partly because his heaviest and most persistent blows had been reserved for the Fifth Army. Some isolated gaps were made on this front, but nothing beyond repair, and the ground lost was not vital. It is impossible in the space at our command to follow all the complications of attack and counter-attack in the fateful days which followed, until, by 26th March, the Germans were within a dozen miles or so of Amiens, with the British Fifth Army still retiring before them in a state of disintegration. At this critical juncture, when the reserves had all been thrown in, General Gough adopted a suggestion made by General Grant, Chief Engineer of the Fifth Army, that a last line of defence—a forlorn hope to save Amiens—should be formed from stragglers, army school personnel, tunnelling companies, Canadian and American engineers, anyone in short, who could be roped in. The command of this heterogeneous force, after being organized by General Grant and posted according to General Gough's instructions, was handed over to General Sandeman Carey. 'Carey's force,' as it came to be called, aided by the 1st Cavalry Division, which was rushed across the Somme from the north at the same time, earned a special tribute from Mr. Lloyd George in the House of Commons for the magnificent fight which it put up in this last line of defence.

The German effort was becoming spent, though by broadening out the salient the enemy continued to press back the French as well as the British. The French Third Army, sent to the assistance of the British Fifth Army, played a lion's part in preventing him from extending his gains too dangerously in the south. On the 28th he concentrated his main energy against the stubborn British Third Army which, conforming to the retreating line of the Fifth Army on its right, had fallen back to new battle positions but in good order. Fresh shock divisions were brought up to break this northern pivot of the British defence, and, after the usual full-dress bombardment, were launched as before in continual waves of assault. This time, however, there was no fog to handicap the British gunners, who were given the opportunity of a lifetime when they opened fire from hidden positions on serried ranks of German infantrymen, marching shoulder to shoulder at point-blank range. Six times the advance was renewed, and as many times mowed down, and when a final attempt was made, after a second bombardment in the afternoon it met with similar failure. The Germans had shot their bolt. Their appalling losses on the 28th told on all their subsequent efforts in this first and greatest of Ludendorff's offensives in 1918.

It was on the 28th that General Gough relinquished the command of the British Fifth Army, General Rawlinson (Fourth Army) succeeding to the task of extricating its shattered divisions. Two days earlier the long needed decision had been made by which the command of the Allied armies passed into the hands of General Foch as Generalissimo, who thence forward, until the end of the war, held supreme control. Though severe anxious days were to pass before the Allies could breathe freely again in the Amiens area, the position hourly improved as reinforcements, French and British, arrived on the scene. Counter attacks recovered some of the ground on 30th March, and when the Germans resumed their advance toward Amiens on a more limited scale on 4th and 5th April, their losses were out of all proportion to their gains.

Second Phase of Ludendorff' Offensive. It is probable that the operations of 4th and 5th April were designed chiefly to pin the British armies to the southern area, while Ludendorff, finding his road barred to Amiens, prepared to strike a fresh blow in the north in a decisive bid for the Channel ports. Though well aware of a possible thrust in this direction Sir Douglas Haig had been compelled to draw heavily on his Flanders front

for reinforcements during the exhausting battle for Amiens, in which as many as 46 out of his total 58 divisions had been engaged. By the end of the first week in April the bulk of the British troops holding the Flanders line had passed through the furnace of the southern battlefield and were sadly in need of rest and reinforcement. Had the ground been in its usual condition of slush and mire at this season of the year they could have been relied upon to hold up any advance, but a dry spring had prepared the path for a German advance, and as soon as this was seen to be imminent it was reluctantly decided voluntarily to evacuate the Passchendaele salient, won at such frightful cost in the closing months of the previous year. Steps were also taken to relieve the Portuguese troops[1] who, though not seriously engaged, had been too long in the trenches south of the salient. Before either of these plans could mature the Germans upset both by launching their great attack at 4 a.m. on 9th April.

As in the opening move against the Fifth Army on 21st March, the assault —launched by the army of General von Quast in the direction of Festubert-Armentières against the northern portion of the front held by the British First Army (General Horne)—was favoured by an impenetrable early-morning fog. Through it came five columns of troops like the prongs of a fork, with an army corps as the central point to thrust into the weak spot where the Portuguese were sandwiched in between the British 40th and 55th Divisions. Bursting through the Portuguese sector, the attack spread swiftly to north and south—especially to the north, where the 40th Division, feeling the thrust which pierced the Portuguese line, was forced back on its right flank to the line of the Lys, 3½ miles in its rear. The rest of the 40th, with reinforcements from the 34th Division, formed a new line between Fort Rompre and Bois Grenier, covering Erquinghem and Armentières from the south, and held it the rest of the day. Had the southern pivot also given way when the Portuguese sector was broken the consequences would have been fatal to any hope of checking the German onrush. But the 55th Division never budged after its left flank, borne back by the first assault, succeeded in forming a defensive flank between Festubert and Le Touret, and the importance of its stout defence through the battle, as Sir Douglas Haig bore witness in his dispatches, could not be over-estimated. This line was strengthened later in the day by the 21st Division, which, together with the 50th Division—both just relieved from the Somme fighting—had been hurried up as soon as the attack developed.

Next day the battle spread to the north, blazing up along the right of the British Second Army (General Plumer), the army of General Sixt von Armin attacking in another early-morning mist between Armentières and Hollebeke. The two German armies now acted in concert, and together pushed their advantage until the Lys was crossed in the south and the Messines Ridge carried in the north, with Laventie, Ploegsteert, and a dozen other historic landmarks in between. Outflanked on both sides, Armentières had perforce to be evacuated. Messines was recaptured by the South Africans, but had to be abandoned when the enemy's advance in the south pushed almost as far as Neuve Eglise. On the 11th, when the enemy continued to extend his gains with seemingly endless reinforcements, and had crossed the Lawe, a tributary of the Lys, Sir Douglas Haig issued his famous Order of the Day to his troops, which, while it reflected the gravity of the situation inspired them to fight it out:

> "Every position must be held to the last man. . . . With our backs to the wall, and believing in the justice of our cause, each one of us must fight on to the end. The safety of our homes and the freedom of mankind depend alike upon the conduct of each one of us at this critical moment."

The appeal, with its promise also of speedy reinforcements from the French army—"moving rapidly and in great force to our support"—heartened the battle-worn divisions when they sorely needed its encouragement. The pressure was still too great to prevent the Germans from taking Neuve Eglise on the 14th—after a struggle lasting two and a half days, from house to house —or Merris a day earlier, which brought them within 4 miles of Hazebrouck, where the 1st Australian Division, just detrained, kept them at bay; or Bailleul on the 15th. At midnight on the 15th the British line fell back to the defences between Meteren and Dranoutre, a move involving the simultaneous withdrawal from the Passchendaele Ridge.

These were the darkest hours of the last great battle of Ypres. There were already signs that the German advance having again failed to break a way through by sheer weight and numbers, was slowing down, and the promised

[1] Portugal was drawn into the war on the side of the Allies on 19th March, 1916, when Germany declared war on her, ostensibly because she had requisitioned German merchant ships lying in her harbours, but in reality because an invasion of Mozambique was then becoming necessary to Germany's hard-pressed troops in East Africa.

French reinforcements were close at hand. These took over the sector from Meteren to Wytschaete, where, on the 25th, before they had consolidated their positions, they were made to bear the brunt of a fresh German blow, delivered with 9 fresh divisions, from Bailleul to the Ypres-Comines Canal. The French fought desperately to save Kemmel Hill, commanding Ypres some six miles away; but in five hours the Germans had captured both the village and the crest of the hill. With the Ypres salient now dominated both from Kemmel and Messines it became necessary still further to shorten the line round Ypres. This was accordingly redrawn on the night of 26th–27th April through Pilkem, Wieltje, Zillebeke Lake, and Voormezeele.

One more effort was made by the Germans to push right through before the end of the month—on the 29th, when, in a fresh attack in force on the Franco-British front, they succeeded in reaching as far as Locre, behind Kemmel. But the French, who were in no mood to repeat their experience of Kemmel, flung the enemy back with sanguinary losses. The heaviest casualties of the Germans that day, however, were against the British 21st, 49th, and 25th Divisions, whose artillery—like the gunners of the Third Army on 28th March—had the range of them as they advanced in mass formation, and blew them to pieces. Only one of the waves of German infantry succeeded in reaching the British positions, where bomb and bayonet completed its destruction. This marked the last serious attempt on Germany's part to seize the Channel ports.

Though Ludendorff had failed to reach his objectives either on the Amiens or Flanders front he still had a sufficient superiority of force to retain the initiative. With every incentive to compel a decision before the new American army, which was now arriving at the rate of something like 150,000 a month, could enter the field in full strength, Ludendorff had either to throw up the sponge or strike again at the earliest moment in one final effort to beat the Allies to their knees. Meantime the obvious policy on the Franco-British part was to maintain an active defence until their own and American reinforcements made a counter-offensive possible. In the minor operations which marked this period of waiting, the Australians added Villers-Bretonneux to their battle honours. Villers-Bretonneux, which lies on the edge of the ridge facing Amiens—only 8 miles away—had been rushed and captured by the Germans in a surprise attack in thick fog on 23rd April. Before daybreak the next morning the Australians had surrounded the German garrison, and the end of a fierce house-to-house conflict left the place in British hands again, together with nearly 1,000 prisoners.

Third Phase of Ludendorff's Offensive. Though every day added to the danger of delay, it was not until the end of May that the German army, its plans disorganized by its unexpectedly heavy commitments in the Amiens and Flanders battles, was launched on the third and final phase of Ludendorff's great offensive with a sudden attack on the Aisne front in the direction of Paris. It was along this front that the 9th British Corps (General Sir A. Hamilton-Gordon), consisting of the 8th, 21st, 25th, and 50th Divisions, and subsequently reinforced by the 19th Division, had been sent to the French armies under General Pétain for much-needed rest after sharing to the full the honours and sacrifices of the earlier battles. By their side were crack French divisions which had also earned the rest which it was felt they could count upon along the main stretch of the Chemin-des-Dames, holding as it did some of the strongest natural defences along the whole battle front. The French had taken months in the previous year, and spent countless lives, to recapture these positions.

The very unlikelihood of choosing such a formidable sector decided Ludendorff to select it for his dramatic attack on 27th May, moving up his specially trained divisions of shock troops at the last moment—with all possible secrecy, accompanied by other surprises in the vast number of guns and aeroplanes brought into action, as well as the largest fleet of German tanks which the enemy had ever employed. Only on the very eve of the new advance did the French learn of the impending blow—too late to avert disaster. Outnumbered by 6 to 1 the Allies, British and French alike, were borne back by the onrush of picked troops as soon as the preliminary bombardment ceased. Helped as usual by a thick early-morning mist the armies of von Böhn, von Hutier, and von Below—all nominally under the German Crown Prince—had carried the whole of the Chemin-des-Dames ridge by nightfall, and were fighting on the Aisne. Within two days they were not only across the Aisne on an 18-mile front, but had swept on to the Vesle, and were even across that river west of Fismes—a depth of 12 miles from their starting-point.

Reserving his stoutest resistance for the flanks, Foch strove hard to save Soissons, but it fell again into the enemy's hands on the 29th, by which date Rheims, on the Allies' right, was

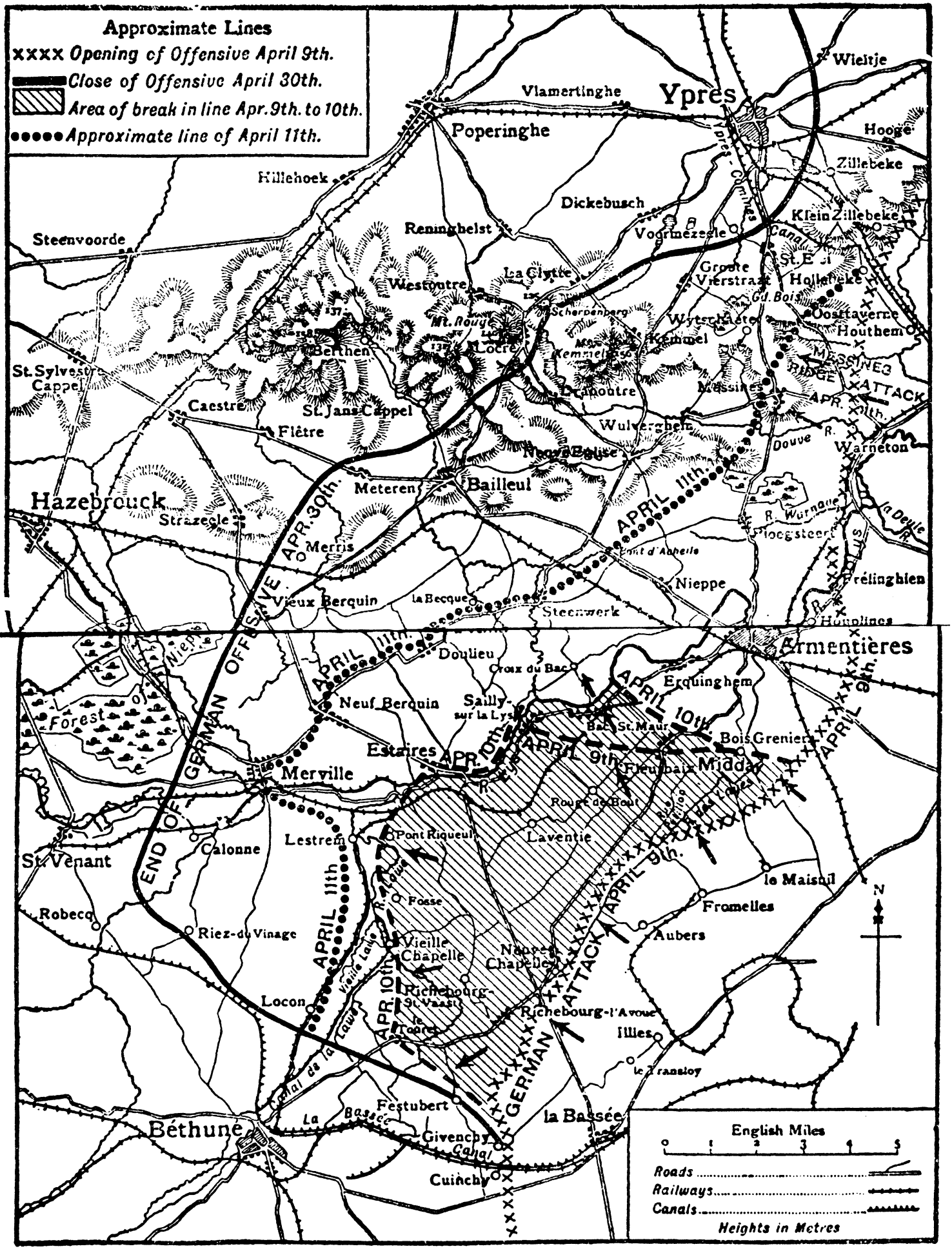
also pressed so hard that its outlying positions were carried on the 30th, and only the devoted bravery of Berthelot's Fifth Army—with Gouraud guarding the Champagne front on its right—saved the battered city. The British and French divisions which had meantime been driven back from the Chemin-des-Dames to the Aisne, and from the Aisne to the Vesle—the Allies often fighting side by side in hopeless rear-guard actions against immensely superior numbers—were now holding a line between the Vesle and the Ardre while the Germans continued to plunge deeper and deeper into the big salient which they had formed towards the Marne. The shattered divisions of the British 9th Corps now formed part of Berthelot's Fifth French Army guarding Rheims, and subsequently played a large part in repelling the enemy's attack on the north-east side of that city. In the words of General Berthelot himself: "They have enabled us to establish a barrier against which the hostile waves have beaten themselves in vain. This none of the French who witnessed it will ever forget."

By 31st May the German advance in the centre had spread as far as the Marne at Château-Thierry, extending thence along a 10-mile front to Dormans. It was at Château-Thierry on this day that the Americans began to play their part in the battle, linking up with a French colonial division on the south bank of the river and preventing the enemy from crossing. New French units were also coming into line, blocking the Germans' path south of Soissons on the road to Villers-Cotterets, as well as at Château-Thierry. Foiled in both these directions, Ludendorff turned to the Ailette front in order to get more elbow-room, and flattened out the French front between Soissons and Noyon. Again unable to make much further headway against the fierce French counter-attacks, he carried the battle still farther to his right, attacking between Noyon and Montdidier on 9th June in the hope of linking up the new Marne salient with the one already formed at Amiens, and so advancing on one immense front. The new 'drive' was again entrusted to von Hutier, whose 25 divisions, employing the same shock tactics as before, swept forward at first to a depth of some 5 miles in the centre; but, held on the wings, were fiercely counter-attacked on the 11th on their exposed right flank and robbed of most of their gains.

On the following day the German War Minister declared that "Foch's so-called Army of Reserve exists no more"; the truth being that Foch, with time and an ever-flowing stream of reinforcements on his side, was gradually becoming master of the situation, and could afford to wait until Ludendorff gave him the opportunity he wanted. Ludendorff, on the other hand, with the pick of his troops 'pocketed' in the great Marne salient, was forced to make another forward move or withdraw them. He made one more attempt on Rheims, three divisions being ordered on 18th June to take it at all costs; but the whole attack was an expensive failure. For the rest of the month, when the weather broke, and during the first half of July, Ludendorff left most of the fighting to the Allies while he prepared for one last herculean effort to burst through their line. On 28th June Foch felt his way towards his counter-stroke by a preliminary advance between Villers-Cotterets and the Aisne, when he won back over a mile of useful territory and took over 1,000 prisoners. On 4th July further minor victories were recorded along both the French and British fronts, the British success being at Hamel, where American units celebrated Independence Day by helping the Australians to recover that fiercely-contested stronghold, with 1,500 prisoners.

On 15th July Ludendorff launched his final effort on a 50-mile front on each side of Rheims. This time the Allies were warned of its direction in time. On the left, where immediate success was vital to the whole plan, the attack was flung into disorder at the very beginning by a deluge of shells from Gouraud's guns before even the German bombardment started; and when, this over, the attacking divisions of von Einem and von Mudra advanced, they found that Gouraud's army, save for volunteer garrisons in concrete forts, had returned undamaged to its main battle positions, to reach which they had to face a concentrated fire that tore their ranks to pieces. Some 50,000 German troops were admitted to have fallen that day before Gouraud's army. With the failure of the advance in Champagne the German attack on the right, where Italian as well as British and American troops were now fighting side by side with the French, was unavailing, though the line south-west of Rheims was pressed back some 3 or 4 miles, and eight divisions under von Bohn succeeded by 17th July in crossing the Marne at a number of points between Fossoy and Dormans.

Foch's Counter-stroke. They were only allowed to remain south of the Marne long enough for Foch to convert these river crossings into a death-trap. For Foch had now decided that



Germany's last bid for the Channel Ports; approximate positions of the Allies' line before and after Ludendorff's offensive in April, 1918

the moment had come when the Germans, exhausted by their advance, were least in a condition to resist a counter-stroke aimed at their flank. The flank which Foch selected for attack was that on the western side of the salient created, from its most northerly point on the Aisne near Soissons, to its southern extremity, Château-Thierry on the Marne, where the symptoms of the exhaustion of the German momentum had been furnished by the ability of American and other contingents to resist further advance. In the earlier half of July a ceaseless stream of men and guns had flowed up from the French side to take cover in the forest of Villers-Cotterets on their flank, in preparation for the blow to come; and by 18th July two French armies were assembled along



General Gouraud

the 27-mile flank, that of General Mangin aligned between the Aisne and the Ourcq, which bisected the salient, and that of General Degoutte from the Ourcq to the Marne. Mangin's army contained some of the finest French shock divisions as well as two famous British ones, the 34th and the 15th, and a number of keen American troops. Degoutte's army had the more awkward task, judged by the country over which it had to travel, but Foch's plan here, as elsewhere, was to put his best fighting material where it would pierce farthest, and hold the enemy elsewhere. By the same token the army of General Berthelot, with two other supporting British divisions, was entrusted with the task on the other side of the salient, from Rheims to Épernay, not of thrusting at the Germans but of holding them hard.

Mangin's army was ordered to strike with all its force. It was equipped with new and speedier 'whippet' tanks, and its immediate onset was masked by the accident of a July thunderstorm on the eve of the fighting. On the morning of 18th July it went forward with nothing but a barrage, but with the effect of a thunderbolt, and its average advance on that day was 5 miles, with Fontenoy and the plateau of Pernay on the Aisne firmly secured. Degoutte's army went forward for 2 miles over difficult country. A blow of immense significance had been struck along the whole length of the salient's vulnerable side.

Next day Mangin's movement continued; he tightened his hold on the Aisne and swung his right wing farther along the Ourcq so as to bring the whole line of the one good north-and-south road in the salient under the fire of his guns, and thus to hamper the German movements terribly. That alone would have forced the enemy to begin a retreat from the Marne, while it might yet be possible. Meanwhile Degoutte was advancing also, and was forcing the Germans away from the neighbourhood of Château-Thierry. The German commander, von Bohn, was not slow to recognize the implications of the situation into which Foch had forced him, and gave orders to recross the Marne. He was in time, but his retreating troops were roughly handled at the crossings, and despite all his attempts to hold up the attack on his western flank by counter-attack, the pressure of Mangin and Degoutte, added to that of de Mitry's army, which was now following him back over the Marne, became every hour more dangerous.

By 20th July not only was the Marne itself in process of being abandoned by von Bohn but Château-Thierry had fallen. Degoutte's army was 3 miles north of it. De Mitry's divisions had secured ample crossings for future movement and Berthelot's mixed forces of French, British, and Italians had begun a disconcerting attack on the eastern side of the salient. In three days the Germans lost 20,000 prisoners, and, what was more significant, 450 guns. The first *riposte* of the French Generalissimo had been delivered. It was to be followed in unending succession by others.

The German Commander-in-Chief had to gain time. It was no easy thing to withdraw his 600,000 men crowded between the Aisne and the Marne, but he was obliged to support them lest the salient should collapse too suddenly. He aimed a counter-stroke at Gouraud's army east of Rheims, but the blow spent itself in the air, and Foch replied by setting in motion the army of General Debeney, where it stood opposite to that of General von

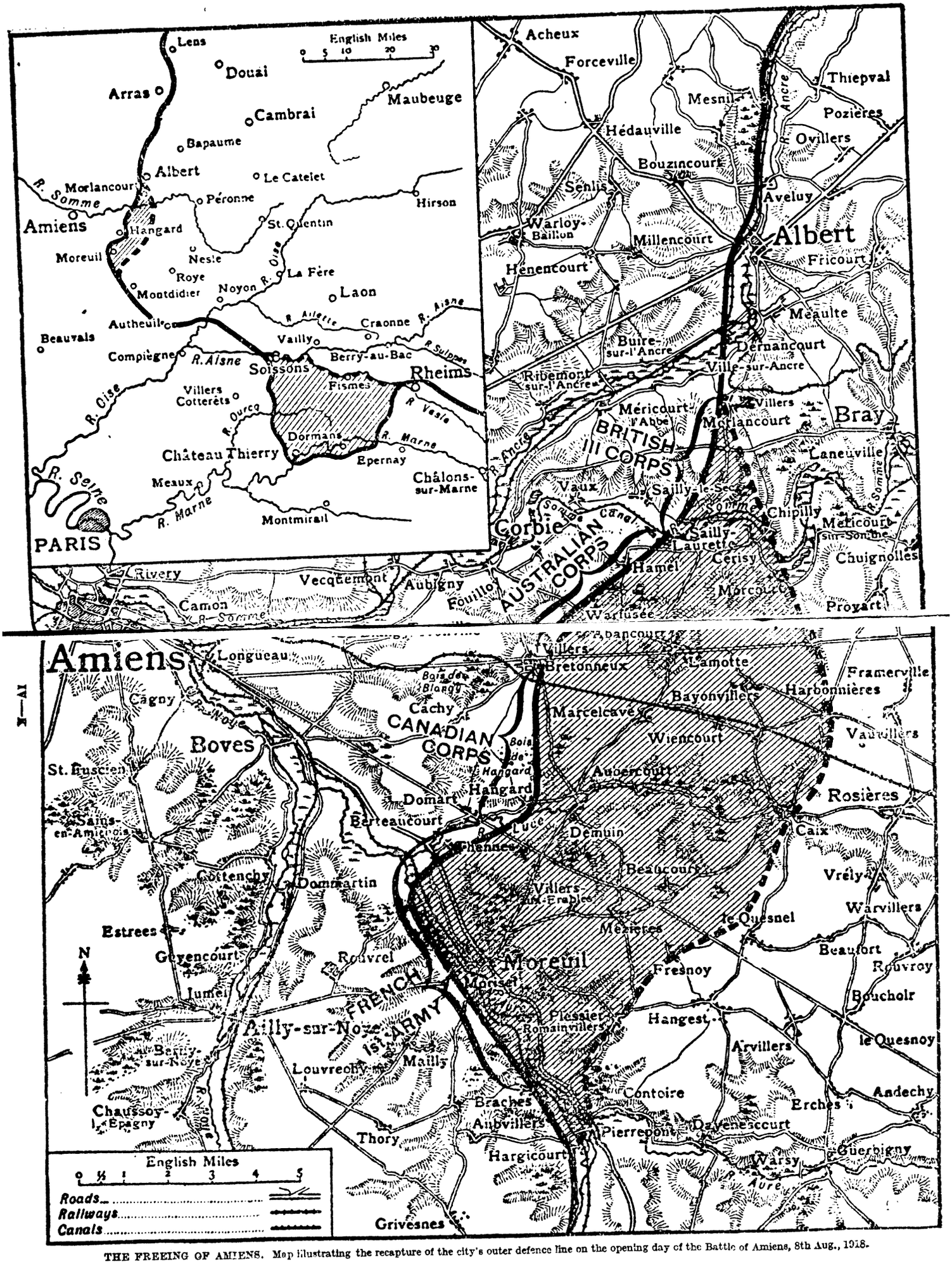
Hutier, between Montdidier and Noyon. But he had not yet gathered the full fruits of the strength of his positional assault between the Aisne and the Marne, and did not in the least allow pressure here to relax. Mangin seized Oulchy-le-Château on the Ourcq (25th July); and on 26th July Gouraud, on the other side of Rheims, recovered the ground he had ceded under the German pressure. By Sunday (28th July) the Allied attack in the Aisne-Marne salient had swept convergingly on to the line of the Ourcq, and with that achievement the most important episode in the opening of Foch's campaign was consummated. Soissons fell to Mangin on 1st and 2nd Aug., a signal that the work was done, and Foch was now free to prosecute his large plan of delivering successive blows at points where they would disperse and use up the German reinforcements most effectively.

The Allies' Victorious Offensive, 1918. Marshal Foch, after consultation with the British Commander-in-Chief, had desired the commanders of all armies, British and French, to prepare plans of action and to be ready to put them into operation at short notice. He now more particularly addressed inquiry to Sir Douglas Haig as to his willingness to undertake a continuous offensive towards the German centre. Sir Douglas Haig assented to Marshal Foch's representations as to the superior advantages to be gained from an attack there, and, while continuing a show of preparation in the Ypres area, where Ludendorff, on an estimate of the psychology of the British commander, would expect the counter-attack to come, and was already taking steps to reduce its effectiveness by masked withdrawals, transferred forces steadily to Rawlinson's Fourth Army on the Somme. This army, and the First French Army under Debeney on the right, both directed by Haig, were set in motion on 8th Aug. on a 16-mile front from Morlancourt to Morcuil. The thrust was successful beyond expectation. The British Fourth Army, on the right wing, went through the German divisions of von Marwitz (Second Army) like paper, regaining the old outer-line defences of Amiens; and Debeney's men crushing the resistance of von Hutier's Eighteenth German Army, and reaching Fresnoy and Plessier, where they linked up with General Humbert's Third French Army on the road to Roye. The captures of the day amounted to 17,000 prisoners and 500 guns, an unmistakable symptom that the German power of resistance was shaking.

On 9th Aug. Rawlinson pushed on still farther; on 10th Aug. General Humbert prolonged Debeney's still attacking line and took Montdidier, and a number of villages. These three armies continued to eat into the enemy's positions and to pin a number of German divisions down till 20th Aug., while Mangin's army at Soissons moved *en échelon* to take up contact with Humbert's right. Meanwhile Ludendorff, fully aware now that the initiative had passed out of his hands, and that the best course that lay open before him was a 'strategic retirement,' began to effect one stage of it in the Ypres and Lys district under the direction of General Sixt von Armin, whose withdrawal was followed vigilantly by the British forces; and another stage in the German salient on the Ancre, where General von Below's Seventeenth Army was stationed. Von Below withdrew on the Bapaume line from Serre, Beaumont-Hamel, and Bucquoy to the shelter of the sector of the Hindenburg line behind it (13th, 14th and 15th Aug.).

But whereas in 1917 Ludendorff had disconcerted both British and French Commanders-in-Chief by a sudden withdrawal on the Bapaume-Péronne line of the Somme, he was not now allowed to withdraw without injury. Haig's battle of Bapaume (21st Aug. and following days) was designed in two stages, the first of which brought up Byng's Third Army to a position in which it was aligned with Rawlinson's Fourth Army, and the second of which saw the Third and Fourth Army attack von Below in combination. The combined pressure of these two armies was continuously successful, though the Germans fell back stubbornly in many places. By 30th Aug. Bapaume was once again in British hands, and the line of attack was threatening the strongholds of the Hindenburg line, while its extension ran through Heudecourt and Fremicourt to Cléry. Péronne fell to the Australian Corps by a most gallant feat of arms on 1st Sept. A more strategically significant victory was gained on the same day when the capture of Bullecourt, followed by that of Riencourt and Cagnicourt, opened up the first crevice in the ramifications of the Hindenburg defences known as the Drocourt-Quéant switch line. The battle of Bapaume drove thirty-five German divisions from the old Somme battlefield, and captured 34,000 men and 27 guns.

The crevice in the Drocourt-Quéant defences was still further widened on 1st Sept., when six British divisions of Horne's First Army, including two Canadian, attacked behind tanks a 5-mile front occupied by eleven German divisions and captured Dury Ridge and Quéant, together with 16,000 men



THE FREEING OF AMIENS. Map illustrating the recapture of the city's outer defence line on the opening day of the Battle of Amiens, 8th Aug., 1918.

and 200 guns. So far, therefore, from Ludendorff's strategic retreat being conducted 'according to plan,' it cost the Germans, between 21st Aug. and 9th Sept., some 53,000 men and 470 guns; the French had been able to occupy Ham and Chauny, while the British were going forward; and General Sixt von Armin was forced cautiously to retire from the Ypres salient.

During these operations by the British armies Foch had never relaxed pressure with the three armies of Debeney, Humbert, and Mangin, while still threatening an advance beyond the Vesle in the deflating Aisne salient, west of Rheims, and preparing new blows elsewhere. At the beginning of September the position of the French armies of the centre, won by continuous fighting, was as follows: Debeney had crossed the Somme, taken Ham, and was threatening St. Quentin; Humbert was close to Tergnier and was pointing towards La Fère; Mangin was back in Coucy-le-Château and held the railway thence to Soissons; Degoutte was spreading from Soissons along the Aisne. These threats left General Ludendorff no choice but to shorten his line where he could do so with least risk. He decided on the Vesle front, where General de Mitry, with French and Americans, had been engaging his Seventh and Ninth Armies, and began to retire thence on 4th and 5th Sept. on a 19-mile front. The Americans occupied the Aisne thereupon from Condé to Viel-Arcy, and on 7th Sept. General Mangin crowned his long campaign at the Chemin-des-Dames by taking the ruined Fort de Condé. A week later Allemant and Laffaux Mill fell, and once again the French troops came in sight of Laon. Humbert and Debeney, both pushing forward, embarrassed Ludendorff in his intention of moving divisions to meet a new British movement known thereafter as the battle of Epéhy.

This battle was the preliminary movement in that great attack on the Hindenburg line which, more than any other single action, was the decisive 'blow at the heart' of the German defensive plan. The British advance, viewed as one movement, was made towards Cambrai, which was the northern bastion of the German defensive lines, as La Fère and Laon were the twin southern pillars.

On 2nd Sept. the Third Army began a local attack on a 5-mile front which captured Havrincourt and Trescault, while on the extreme right of the Fourth Army the 9th Army Corps and the Australian Corps began a movement which by 17th Sept. placed them in Maissemy, where the Fifth Army in March had been pierced. These preliminary positions having been secured, the Third and Fourth Armies set in motion their important combined attack (18th Sept.) on a 17-mile front from Gouzeaucourt, through Havrincourt to Holnon Wood, where Debeney's First Army lent assistance. The hardest fighting was at Epéhy, which gives its name to the battle, on the left centre, but by nightfall the German defences had been pierced on a 3-mile front, 12,000 prisoners had been taken, and the British forces brought within striking distance of the main Hindenburg lines.

During the weeks in September while the plans for the battle of Epéhy were ripening, Foch had struck hard at another point in the German line, which had appeared invulnerable while the Germans were strong, but was now a menace to Ludendorff's own plans for retirement because it absorbed divisions which he badly needed elsewhere, namely the long-standing salient of St. Mihiel. It was held by seven German and two Austro-Hungarian divisions in September, and Ludendorff had been withdrawing its heavy artillery; but before his plans for withdrawal could be consummated, Foch sent in General Pershing with his young American divisions, aided by two French divisions, at the salient's apex. The Americans attacked on the two faces of the salient, west and south, the strongest thrust being made by two corps of seven divisions apiece on the southern face. The attack began on 12th Sept., and in thirty hours the salient had disappeared; while in spite of the haste with which the Germans had left it—the firmest resistance was offered by the two Austro-Hungarian divisions on the western face—10,000 prisoners and 450 guns were left behind. This victory, as symptomatic as others of German disorder, freed the Verdun-Commercy railway, and completed the attenuation of Ludendorff's reserves. The 207 German divisions which Ludendorff had commanded at the period of the greatest German strength had fallen to 185, and only 21 reserve divisions remained.

The second stage of Foch's plan now had been reached. The German armies had again been brought back to the line which they had chosen in 1914, after their first rush had recoiled. It was less threatening by the loss of the St. Mihiel salient, but it had been enormously strengthened by four years of engineering. North of the defence line was the railway which, running through Brussels, Mons, Maubeuge, Mézières, Sedan, and Metz, was the chief artery of German communications, and Foch's plan was to cut this artery on either side of the great curve

which the German line made when, after coming north to south from the coast, it turned west to east at La Fere. The right half of the thrust was to be made by Gouraud's army at Rheims and the Americans on the Argonne, where they were being steadily accumulated. The more deadly attack was to be made by the First, Third, and Fourth British, and the First French Armies, which should break through Cambrai and St. Quentin towards Maubeuge.

Complementary operations were designed for the armies of Humbert and Mangin at the nose of the curve, and it was expected that, under this comprehensive pressure, Ludendorff would be compelled to withdraw divisions from the coastal sector, where an attack by the British Second Army (Plumer) and the Belgian Army might then be successful against a weakened front. A portion of Degoutte's army was sent northward in readiness for such a blow, and to the Fifth British Army (now commanded by Birdwood) was assigned a task at Lille and Lens similar to that of Humbert and Mangin at St. Gobain.

There was a pause of nearly a week, in which the Germans awaited, and the Allies prepared the new move; and then, on 27th Sept., Haig's armies struck what Foch declared to be the blow from which there was no recovery. The battle of Epéhy had given the requisite positions for the attack on that section of the Hindenburg defences which the Germans named the Siegfried line. The plan was to send forward the First (Horne) and Third (Byng) British Armies to clear the way on a line from Sauchy-Lestrée to Gouzeaucourt, seizing the crossings of the Canal du Nord, and so preparing the way for an attack by the Fourth Army. The dangerous movement was accomplished (27th Sept.): the crossings seized, the canal held, and Cambrai threatened.

On 29th Sept. the Fourth Army took up the combat, and in a tremendous action along a front of 20 miles, supported by attacks from the other British armies and the First French Army, got across the vital defences of the St. Quentin Canal in the Siegfried zone. The next day the fighting spread furiously along the front of all four armies: the breach was widened; a portion of the Scheldt Canal taken; and by 3rd Oct. the Fourth Army had pierced the Siegfried line vitally. By 9th Oct. the German defences were no longer defences, and in this decisive encounter they had lost 36,000 prisoners and 380 guns.

Elsewhere victories had been won which appear minor only by comparison. American divisions had been transferred to the left bank of the Meuse at Verdun, and, supported by French divisions, had carried Montfaucon and Varennes (10,000 prisoners); on the other side of the Argonne Gouraud was advancing, and by 1st Oct. was 9 miles from his starting-point below Moronvilliers, and had accumulated 13,000 prisoners and 300 guns.

The results of these attacks were at once apparent, as Foch had predicted, in the north. His plan of an attack by Plumer's Second British Army, and by the Belgian Army stiffened by French divisions, was as successful as he had hoped. Under the weight of the Franco-Belgian-British attack on 28th Sept. the thinly held German front melted away. By nightfall the British held all the ridge between Wytschaete and the canal north of Hollebeke; the Belgians were in Houthulst Forest. By the end of September the blood-drenched ridge of Passchendaele, and all its tragic surroundings, had passed into the Allies' hands, and the German grip on the coast had been finally unloosed. This marked the beginning of the end. Since Foch attacked between the Aisne and the Marne on 15th July the Allies had taken a quarter of a million prisoners, 3,669 guns, and 23,000 machine-guns. The rest of the campaign must either be a disaster of the first magnitude to the Germans, or, at best, a painful and ineffective retreat to the line of the Meuse.

What remained of the campaign was the work of clearing up; but this was not an easy task, because, though Ludendorff was aware that victory remained permanently with the Allies, he assured the German Government that delaying actions could be fought till the following spring. Against such an undesirable protraction of the war, Foch was preparing a final stroke in the neighbourhood of Metz with the aid of a Second American Army, which was being organized by General Pershing, who had relinquished the command of the First American Army to General Leggett. But the progress of the First American Army in the Argonne, where the fighting was conducted under circumstances of great difficulty, and where the transport was admittedly defective, was slow; and, lacking the place and the resources for another outflanking blow against the retreating Germans, the Allied armies could do no more than press their retreat.

In that retreat position after position was forced from their hands. Cambrai fell on 9th Oct.; on 15th Oct. von Einem's army was far from the coast; on 17th Oct. Ostend had fallen; Horne's First Army had taken

Douai, and Birdwood's Second Army had liberated Lille. King Albert re-entered Bruges on 25th Oct. Farther south the British Third and Fourth Armies were close to Le Cateau on 17th Oct.; and Mangin and the French had re-entered Laon—so long the German Great Head-quarters—on 13th Oct. The story of the rest of the campaign, though it involved much severe fighting in breaking the resistance of German rear-guards, is the record of the steady drive of all the British, French, and Belgian Armies which had produced the German collapse, while the right wing of Foch's greater pincers, comprising the only great new reinforcements he could bring to bear, namely, Gouraud with the Americans on the extreme right, worked its way up for a last decisive blow.

It was a slow operation; but by 4th Nov. Gouraud and Leggett had joined hands north of the Bourgogne Forest; and by 6th Nov. Gouraud entered Rethel and an American division reached Sedan. Thus, though behind schedule time, Foch's right wing approached its decisive position in the first week in November; and in the second week the left wing (British) had occupied Maubeuge. What would have been the consequence had Foch advanced his right wing farther and with effect is a matter for the military expert. That Ludendorff was in no doubt of its disastrous results to the German armies is shown by his request for an Armistice on 9th Nov.

The Balkans, 1918. Bulgaria, thoroughly war-weary, and dissatisfied with Germany's refusal to give her the whole of the Dobrudja when terms were made with Roumania, had surrendered to the Allies on 30th Sept. The last Balkan campaign had been swift and decisive. No major operations had taken place during the earlier months of 1918, but on 15th Sept. General Franchet d'Esperey, who had succeeded General Sarrail in supreme command of the Allied forces, launched an offensive which rapidly transformed the whole military situation. French and Serbian troops, on the left or Monastir front, with the eager Serbians as the spearhead of the attack, penetrated the Bulgarian positions with an impetuosity which in two days carried them 12 miles behind the enemy's lines on a 22-mile front, and drove a wedge between the First and Second Bulgarian Armies.

Meanwhile the British and Greek divisions were engaged in a far more difficult task on the Doiran front, where they suffered heavy losses in storming impregnable positions between the Dopropolje Ridge and Vetrenik, but succeeded in preventing the Bulgarians opposing them from sending reinforcements to their hard-pressed troops along the Monastir front. This 'wing of sacrifice' pinned the Second Bulgarian Army to the Doiran front until it was too late to join its retreating First Army. Realizing the plight in which it stood, it hurriedly evacuated its positions on the night of 21st Sept. and fled in confusion towards Sofia.

The pursuit of the Bulgarians was now taken up by all the Allied armies from Doiran to Monastir, the vengeful Serbians in particular harrying the retreating Second Army with a remorseless energy which drove it headlong through Northern Serbia in increasing disaster towards Belgrade, while the British and Greek forces under General Milne entered Bulgaria hard on the heels of the demoralized First Army. By 26th Sept. the Bulgarian politicians realized that the whole position was hopeless, and sent a *parlementaire* under a white flag to the Allied head-quarters. Four days later they signed an armistice at Salonika, handing over complete control of the Bulgarian railways and communications, demobilizing the Bulgarian armies, and surrendering their arms and ammunition. On 4th Oct. King Ferdinand abdicated, and his eldest son reigned in his stead as King Boris III.

Italian Campaign, 1918. In less than a month—on 3rd Nov. to be exact—Austria-Hungary, after experiences in the field similar to those which had fallen to Bulgaria's lot, surrendered to the Italians. This turn of the tide in the Italian campaign in 1918, which amply atoned for the disaster of Caporetto in the preceding year, and crowned Italian arms with triumph, followed a final attempt of the Austro-Hungarian army, now under the direction of General von Arz, to crush the Italian front in conjunction with Ludendorff's great offensive in the West. General von Arz's main attack was delivered on 15th June on a 46-mile front along the Piave, and extended across the mountain positions between the Piave and the Brenta. The two British divisions west of Asiago played a great part in hurling the enemy back in this sector, the French divisions similarly distinguishing themselves on their right.

Elsewhere some progress was made at certain points, and the Piave was crossed in two places; but by the third day it was already obvious that the attack had failed. Then the weather broke; rainstorms swept down the hills and turned the Piave, which had been low when the enemy crossed, into full flood, sweeping away a num-

ber of his bridges. Hurried efforts were made to get the marooned troops back, and though General Diaz was unable to bring up enough divisions in time to complete their discomfiture, they lost heavily enough in the retreat, their casualties before the battle died down on the other side the river amounting to some 200,000.

Biding his time for his own great counter-offensive until Foch could be assured about the situation in the West, where Italian troops distinguished themselves in the operations round Rheims, General Diaz gradually pushed the Austrians back, until by 7th July he had cleared the whole Piave delta. It was not until 24th Oct. that his final blow was delivered. Its success was immediate and overwhelming. Launched on the night of 23rd–24th Oct., the main attack consisted of an advance across the Piave with the Tenth Italian Army—placed under the command of Lord Cavan—now including three British divisions, together with the Eighth and Twelfth Italian Armies. Cavan's force formed the spear-head of the thrust, and ensured the success of the battle by seizing the Island of Grave di Papadopoli in the Piave mid-stream, held by the enemy as an advance post. This was captured in a daring surprise attack by night, without any artillery preparation, and paved the way for the passage of the troops across the swollen river. At the same time the Fourth Italian Army, with a French division, advanced across the old battle-ground of Asiago and Monte Grappa, where, however, the Austrians counter-attacked, holding up the advance until the whole front collapsed with the triumphant progress of the main attack across the Piave.

By 27th Oct. the breach had widened until it spread across the entire front of the three Italian armies, which thereupon swept the plains and mountain heights until all the enemy's positions between the Brenta and the Piave had been regained. The Austrian retreat became a rout. By the end of the month the Italians claimed 50,000 prisoners, had cut the railway between the plains and the mountains at Conegliano, and occupied Feltre. With Germany in similar plight; Turkey and Bulgaria already finished; and her own internal affairs rapidly going from bad to worse, Austria appealed to General Diaz for an armistice. When the end came on 3rd Nov. with the signing of the agreement which involved the demobilization of the Austrian army; the surrender of the Austrian fleet; the occupation by the Allies of the Trentino, the Istrian peninsula, and a portion of the Dalmatian coast and islands, the Italians had just captured both Trent and Trieste, a landing-force having arrived at Trieste for the occupation that very day. The wholesale nature of the Austro-Hungarian surrenders during the closing phase of this decisive campaign may be gauged from the fact that by 3rd Nov. they had amounted to no fewer than 300,000 prisoners and 5,000 guns.

Germany Accepts Defeat! The complete collapse of the Great War, and with it all the Pan-Germanic dreams of world-power, came with dramatic swiftness. Ludendorff resigned, and though the Kaiser had entreated Hindenburg to make one last stand on the line of the Meuse, his appeal had been in vain. Hindenburg knew the hopelessness of the position, not only of the German army but also of the German home front. Ominous disturbances were breaking out in all parts of the Fatherland, including a mutiny at Kiel. Turkey (30th Oct.) as well as Bulgaria and Austria-Hungary had surrendered, and Germany was in no position to face the Allies alone. The Armistice terms, with all their crushing humiliations, had perforce to be accepted, and were signed on 11th Nov. They included, besides evacuation of territory, the surrender of the bulk of the German navy, 5,000 additional guns, 30,000 machine-guns, 3,000 trench-mortars, and 2,000 aeroplanes. A zone of territory on the Rhine was to be occupied by the Allies, and the Treaties of Brest-Litovsk (signed by the Bolshevik Government with the Central Powers on 3rd March, 1918, in defiance of Russia's solemn engagement not to make separate peace with them) and Bucharest (forced on Rumania in March, 1917, at the close of von Mackensen's drive) were declared null and void.

Unable to face his subjects, William II abdicated on 9th, slipped across the frontier into Holland on 10th Nov., and on the 28th of that month signed the formal document of his abdication, the Crown Prince, who also sought refuge in Holland, following suit three days later. With the Kaiser fell all the rulers of the German states. On 10th Nov. the Imperial Chancellor, Prince Max of Baden, resigned in favour of Herr Friedrich Ebert, ex-shoemaker, who became 'First Imperial President of the German Republic,' with a Government formed from both wings of the Socialist party.

Last Year of Naval War. The war had been won at sea as well as on land, though the British navy had far fewer opportunities than the army of getting to grips with the enemy. The

hazards of naval warfare never ceased by day or night; and by the end of the war the range of the submarine had extended from the eastern end of the Mediterranean to the American coast. All the reckless efforts of the Germans

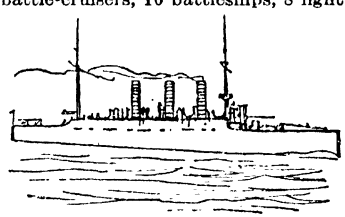


Herr Friedrich Ebert

to win the war by these means failed. With the adoption of new methods to cope with the danger—including the employment of 'Q' boats, or mystery ships—and the invaluable help of the American reinforcements, the monthly shipping losses in the closing year of the war grew progressively less, falling, indeed, from the total of 1,494,473 tons in the September quarter of 1917, to 915,513 tons in the corresponding quarter of 1918. Meantime the new tonnage under construction to make good these losses was as rapidly increasing. The U-boat war, in short, had failed; and the Germans knew it had failed.

The outstanding operation at sea in the closing year of the war was the raid on Zeebrugge and Ostend on St. George's Day under Vice-Admiral Sir Roger Keyes, the object being to block the outlet of the German submarines and destroyers from their depot at Bruges. Since all the neighbouring coast was strongly fortified, the attack was fraught with the gravest danger, and had to take the Germans as far as possible by surprise. The chief ship of the expeditionary force was the old cruiser *Vindictive* (Captain Carpenter), which, with the ferry-boats *Iris II* and *Daffodil*, were told off to act as shield to the three blocking-ships intended for Zeebrugge —*Thetis*, *Intrepid*, and *Iphigenia*. Two old submarines were also taken, charged with explosives, and ordered to ram themselves below the viaduct connecting Zeebrugge Harbour with the Mole, and then blow themselves up. One of them carried out her orders to the letter; the other's rope parted while she was being towed into position, and she was too late to help. The simultaneous attempt to land, shortly after mid-night, followed a bombardment from a squadron of monitors, and was supported by a flotilla of destroyers and a fleet of motor-boats. The *Vindictive* ran alongside the Mole within five minutes of being discovered by the German garrison, and was kept in position by the *Daffodil* and *Iris* while landing-parties jumped ashore to do what damage they could and the blocking-ships were being rammed at the entrance. This successfully accomplished—both the *Intrepid* and *Iphigenia* being blown up in the fairway—the battered *Vindictive*, taking her landing-parties aboard, backed out and returned with her supports to Dover. The first attack on Ostend, which took place the same day, was a comparative failure owing to the undetected removal of a buoy, the two blocking-ships sent for the purpose being sunk outside the harbour. Three weeks later the commander of the *Brilliant* (Commander Godsal), who was in charge of that operation, tried again, this time successfully—the old *Vindictive*, patched up as a blocking-ship, being sunk 200 yards up the channel of Ostend—but Commander Godsal was killed by a shell just after completing his task.

The German navy made one more appearance on the high seas—when, under the terms of the Armistice, 6 battle-cruisers, 10 battleships, 8 light



Vindictive

cruisers, 50 destroyers, and all her submarines were surrendered, the bulk of them to the Grand Fleet at Rosyth under Sir David Beatty on 21st Nov. On the following day the captive ships were sent to Scapa Flow, where, exactly seven months later, their German crews, while the British battle-fleet was absent on gunnery

practice, scuttled practically every vessel. A week later—on 28th June, 1919—Germany signed the Peace Treaty at Versailles, involving unconditional acceptance of all the Allies' terms.

Turkey and the War. In Aug., 1914, the German war-ships *Goeben* and *Breslau* escaped the British squadron stationed to intercept them near Messina, the escape arising partly through delay in correcting orders, and partly through the fact that the German commander had no scruple about violating neutrality in the course he sailed through the Straits of Messina. The ships reached the Dardanelles on 11th Aug., and were sold to Turkey. This was a sympton of Turkish relations with Germany rather than a determining cause of Turkey's entrance into the war as an ally of the Central Powers; but many efforts were made to change Turkey's attitude before the British, Russian, and French Ambassadors left Constantinople (1st and 2nd Nov.) and Great Britain declared war on her (5th Nov.).

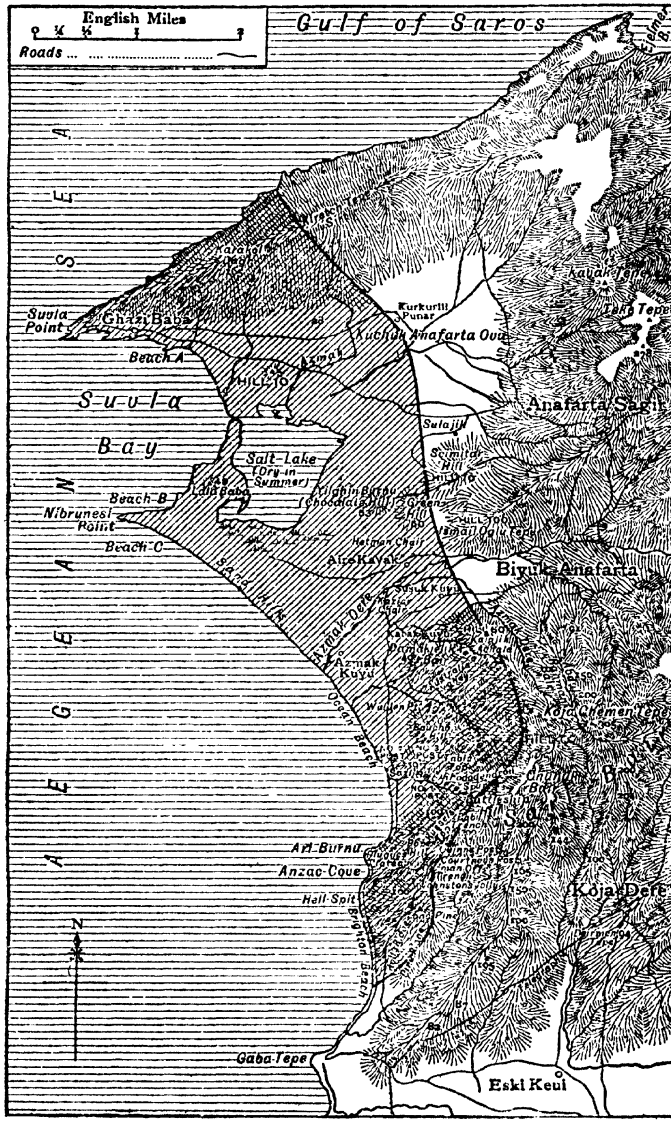
The first act of war undertaken by Turkey was the dispatch to the Caucasus front of three army corps, with a plan of campaign designed by General Liman von Sanders, and commanded by Enver Pasha. They were decisively beaten by the Russian forces at Sarikamish in December. Had the Russians possessed abundance of transport, or had the roads been less difficult, this victory might have been pressed. But Russia wanted all her resources elsewhere, and it was not till 1916, two years later, that she made any serious attempt to carry the war into Turkish territory. Then, under the direction of the Grand Duke Nicholas, and General Yudenitch, who was some years later to come into prominence as the leader of an unsuccessful attempt to reach Petrograd and overthrow the Bolsheviks (1920), a Russian expedition drove back the Turkish forces on Erzerum and captured it (16th Feb., 1915). On 16th April, after another pause to gather transport, the Russians found their way to Trebizond on the Black Sea, and during the next few months spread over the Asiatic Peninsula to Bitlis, Musk, Van, Mosul, Erzingan, and Diarbekr, fighting generally with local success, but with no concerted plan of campaign. The effort expired in the autumn, and was not revived.

Gallipoli Campaign. Before, however, the Russians undertook their own expedition, they were urgent in pressing on France and Great Britain the desirability of opening up the Dardanelles so as to bring the Allies into touch with each other through the Black Sea ports. In response to this invitation, the naval possibilities of which were insufficiently considered by the advisers of the British Admiralty, and the prospects of which had been roundly condemned by all who had previously considered the problem, Admiral Carden began a bombardment of the Dardanelles forts with old battleships, British and French, on 19th Feb., 1915. The bombardment was renewed on 25th Feb. and 6th March. Admiral Carden resigned on 16th March owing to ill-health, and was succeeded by Admiral de Robeck, who favoured the idea of breaking into the Sea of Marmora by rushing the straits. Four big ships, one the *Queen Elizabeth*, engaged the guardian forts, Chanak and Kalid Bahr, at long range (18th March); other ships closed in, and a French squadron penetrated as far as Kephez Point. But the hidden batteries, the mines, and various other devices frustrated the attempt, which was a practical failure by the afternoon. Two good ships, *Irresistible* and *Inflexible*, were put out of action, and two others, *Bouvet* and *Ocean*, sunk

After this Admiral de Robeck accepted the professional view that a fleet operation should be combined with one on land. Lord Kitchener, who had been as little disposed towards the Dardanelles adventure as Lord Fisher, reluctantly consented, and General Sir Ian Hamilton was appointed to command the British expedition, while General d'Amade was in charge of the less numerous French Colonial Corps.

Sir Ian Hamilton's force eventually comprised the 29th Division, the Australian and New Zealand (Anzac) Corps, the East Lancashire Territorial Division, and part of the Royal Naval Division. There was an unfortunate delay in getting the expedition off from its Egyptian base, and the Turks had ample time to prepare for its landing (25th April), which they did not believe to be a possible feat. The landing was effected, nevertheless, with incomparable gallantry, at five beaches on the nose of the Gallipoli Peninsula, and at Gaba Tepe (by the Anzac Corps) farther north. Some 8,000 men were got ashore in twelve hours, and an advance was made on the following day (26th April).

On 28th April the French Corps, which had made a feint attack on the other side of the Narrows, was brought across to assist in a general advance on the dominating height of Achi Baba. The resulting engagement, the battle of Krithia, revealed the fact that the Turkish field fortifications, the Turkish artillery, and the Turkish



THE SUVLA AND ANZAC LINE

Map showing approximately by the shaded portion the area occupied after the linking up of the two armies in August, 1915

numbers had all been too well organized under von Sanders to admit of being rushed. Evidence accumulated that Achi Baba, which was the key to the Dardanelles forts, could only be taken at ruinous cost by a frontal attack, though an attack in force on 6th May went nearer to success than any other, and appeared to fail only through a culminating misfortune of misdirected artillery. Fighting continued in May and June, both here and at Gaba Tepe, where General Birdwood commanded the Anzac Corps.

Engagements in which local advances were made took place on 29th May (Anzac Corps), 4th and 21st June (French Corps), 28th June (29th Division), and though the climate and the insufficient protection inflicted appalling losses on the hard-tried British and French troops, it was on the Gallipoli Peninsula that the flower of the Turkish army also was lost. Of the naval forces the *Queen Elizabeth* was summarily ordered home just before a new Turco-German submarine campaign set in; three more old battleships were torpedoed; but the English submarines retaliated by torpedoing a Turkish battleship, gunboats, and transports in the Straits.

General Gouraud relieved General d'Amade in the middle of May, but was badly wounded by a shell (30th June), and returned to France. General Sir Ian Hamilton, who had unceasingly asked for more guns and more men, received some part of the aid he asked in order to put a new plan into operation. The plan was to land a force at Sari Bair, on the neck of the Peninsula, where it could cooperate with the Anzac Corps in forcing a way to the commanding heights there, and ultimately might take the Turks in the flank. One force was to land at Anzac Cove; two other of the three new divisions sent out to Sir Ian Hamilton were to be landed 4 miles north, at Suvla Bay. The forces at Anzac were landed on 4th–6th Aug., bringing up the numbers of Sir W. Birdwood's command to 36,000. Sir F. Stopford was in command of the force to land at Suvla Bay (6th and 7th Aug.), with Generals Hammersley and Mahon as divisional generals.

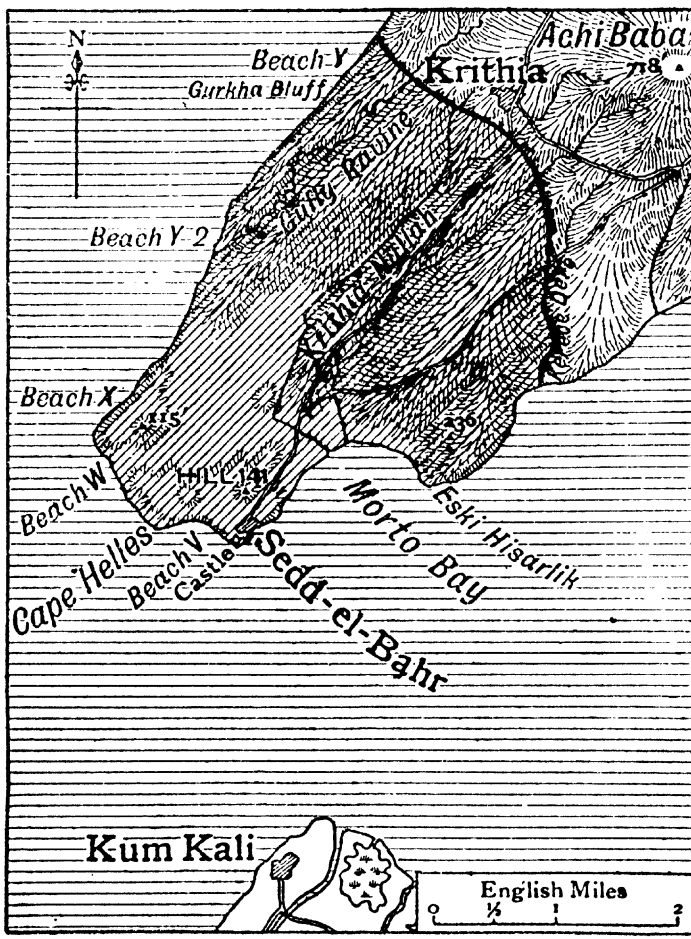
The fresh attack on the night of 6th Aug. was not completely successful, and the Anzac columns under General Godley were still short of the ridges at Koja and Chunuk on the night of 7th Aug. The Turks were then alive to the threat, and made continuous counter-attacks, so that by 10th Aug. all the efforts of the combined force of Anzacs, Gurkhas, and English regiments had failed to maintain more than a slippery hold on the ridges. The chief cause of the failure was that the contributory aid of the attack at Suvla Bay farther north had not been forthcoming, owing to various reasons. Lack of water had exhausted the unseasoned divisions landed in Suvla Bay; misunderstandings among the generals were other reasons; and when the Commander-in-Chief, on hearing of their failure, came up from Imbros, he met a situation which it was too late to redeem. General Stopford was succeeded by General de Lisle (15th Aug.). Lord Kitchener declined to send



Sir Ian Hamilton

further troops from home, and though Sir Ian Hamilton, bringing the veteran 29th Division up to Suvla, with reinforcements of yeomanry, made another attempt on 21st Aug., it was unavailing. After 24th Aug. the British campaign assumed a defensive character, and in spite of Sir Ian Hamilton's representations the War Office declined to waste further men and material on it. On 15th Oct. Sir Ian Hamilton was recalled, and Sir Charles Monro, who reported that the expedition should be abandoned, was supported by Lord Kitchener after personal inspection of the surroundings. The evacuation was carried out with remarkable success on 18th Dec. and 8th Jan. (1916). The cost of the expedition in men was 31,389 killed, 78,749 wounded, and 9,708 missing.

Mesopotamian Campaign. The Mesopotamian campaign ran contemporaneously in part with the Dardanelles operations, and in part with the campaign between Erzerum and the Caucasus in Armenia, in which Russia co-operated. A small British force, sent out to the Persian Gulf in 1914, occupied Basra (22nd Nov.) and pushed outposts forward to the junction of the Tigris and Euphrates. General Sir John Nixon took command (Jan., 1915), and in April (11th to 14th), following a Turkish attack, the British force, now a division strong, advanced to Shaiba, and on 31st May took Kurna. Amara, on the Tigris, capitulated to General Townshend (3rd June), who was empowered to push forward an advance column, while another column, under General Gorringe, beat the Turks at Nasiriyeh



Map showing approximately the area in the Southern Zone, evacuated in January, 1916

(24th July). At this time the Russians were on the headwaters of the Euphrates.

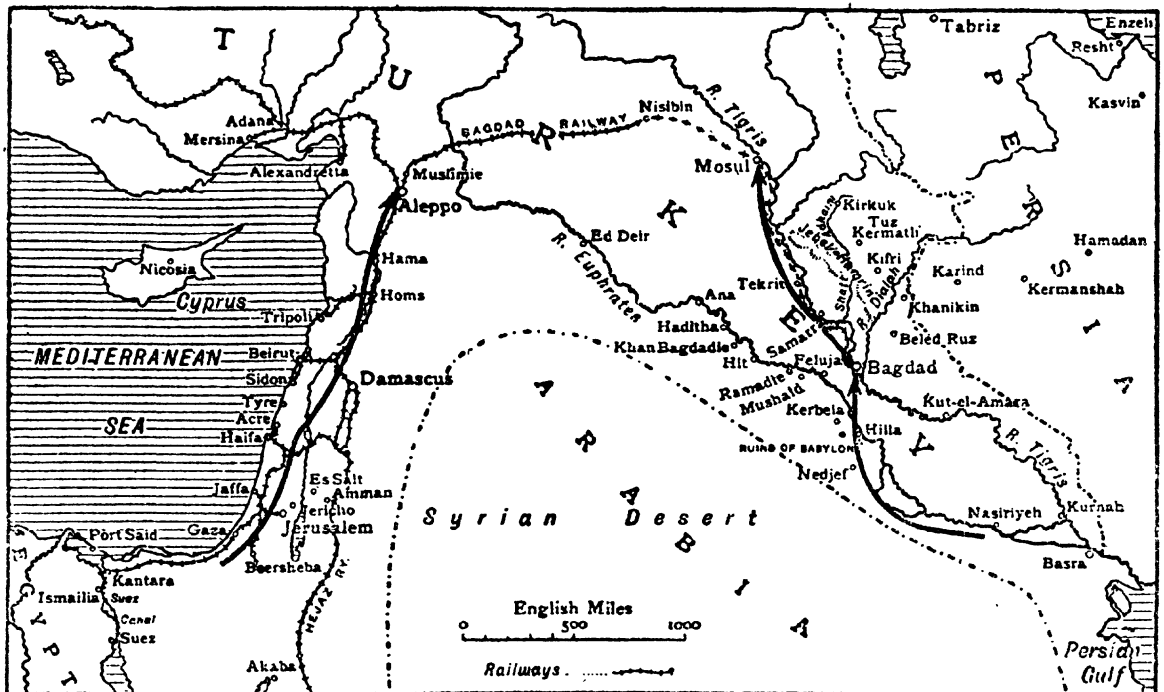
Fired by these successes, General Nixon ordered Townshend to seize Kut if possible. It was so dangerous an enterprise that probably the Turks did not believe that it would be attempted. But Townshend traversed the difficult country in six weeks, arriving within striking distance of the Turkish forces under Nur-ed-Din Bey on 15th Sept., and, in a very capably devised and executed engagement on 27th and 28th Sept., drove them before him.

Townshend, against his own better judgment, was then sent forward to attempt the impossible feat of pushing on to the Turkish base of Baghdad. He arrived in front of their advanced position, Ctesiphon, on 22nd Nov., and attacked it with his four brigades, one of which was a reinforcement, and his rather scanty cavalry and artillery. The first line of the defences was carried, but Nur-ed-Din, who had retired on his supports, counter-attacked, and in spite of Townshend's resistance compelled him to retreat (25th Nov.) by way of Azizieh, fighting heavy rear-guard actions all the way to Kut (3rd Dec.). Townshend's force suffered severely and lost part of its river transport. By 5th Dec. it was invested in Kut, and after two unsuccessful attempts to carry the town by force (8th and 23rd Dec.), the Turks sat down to starve it out. Townshend's mixed force of British and Indians, ill-fed and assailed by beri-beri and scurvy endured the siege for 145 days, till 29th April, 1916, when it surrendered to Khalil Pasha. The prisoners were at first well treated, but most of them were compelled to march through Mesopotamia, Armenia, and Anatolia to prisoners' camps, and many died from their hardships.

An attempt to relieve Kut failed. It was made by Generals Aylmer and Younghusband, whose relief expedition set out on 3rd Jan., 1916. An engagement was fought on 8th Jan., and a pitched battle at the Shatt-el-Hai on 8th March. This failed, when on the brink of success, through want of luck or enterprise at the critical moment. Several changes were made in the Mesopotamia leadership after the impossibility of relieving Kut had become apparent, and in Aug., 1916, General Stanley Maude took over the command. The attention drawn to the blunders, and the scandals of medical assistance and transport, enabled General Maude to begin his task by rectifying them, and he built light railways from Basra. He made his first move forward on 12th Dec., 1916, and the history of the Mesopotamian campaign then entered on a brighter epoch, a result due to Maude's deliberate, bold, and prudent generalship. Contact began on 5th Jan.; the right bank below Kut was cleared by 15th–16th Jan.; and by 23rd Feb. Kut itself was so far encircled that the Turks had no option but to abandon it with guns and prisoners. Maude resumed his advance on 5th March, and by 11th March had manœuvred the Turks out of Baghdad as he had forced them out of Kut. The integrity of the Mesopotamian Turkish force had been destroyed, and its portions distributed at points believed to be out of Maude's reach. One of these was at Ramadie, but a dashing night-march captured the Turkish commander and 3,400 prisoners (28th Sept., 1917). Other successes were gained at Tekrit and the Jebel Hamrin hills before Sir Stanley Maude died of cholera (18th Nov.). He was succeeded by General Marshall, who, in 1918, occupied Hit on the Euphrates, and ended the Mesopotamian campaign with a crushing victory at Mosul just before the Armistice.

Palestine Campaign. Turkey assumed the offensive against Egypt, of which the Sultans were nominally suzerains, by an attempt to force the Suez Canal in Feb., 1915. A force under Djemal Pasha made a dash across the 150 miles of the Sinai Peninsula from Palestine, and was in a position to attack Ismailia and the Bitter Lakes on 2nd Feb. The ample Imperial troops on the spot enabled General Marshall to beat off the attack with ease, but the raiders were not pursued. An attempt on a more concerted scale was made in 1916, though at this time the Turkish garrisons in the Hejaz were having difficulties with the Arabs. A base was established at El Arish, and on 3rd Aug. a well-equipped force of 18,000 advanced to attack Major-General Lawrence's outposts at Romani, in the north of the Sinai Peninsula. The attack was beaten off, and General Sir A. Murray's main body of Australians, New Zealanders, Yeomanry, Territorials, and the 52nd Division coming up, counter-attacked and drove the Turks back 18 miles, inflicting a loss of 4,000 prisoners and 4 guns. Between the 6th and 12th Aug. General Murray improved on his victory, and advanced steadily to Mazar (16th Sept.) and El Arish, evacuated by the Turks (20th Dec.). On 22nd Dec. an attack was made by one of the desert columns on Magdhaba, and the whole Turkish force of 3,000 destroyed or captured.

On 9th Jan., 1917, the columns under Generals Dobell and Chetwode



Converging lines of the main British advances in Mesopotamia and Palestine on 31st October, 1918

reached Rafa, the Mediterranean port on the southern borders of Palestine. A pipe line conveying water and a railway followed close on General Murray's advance, and by the middle of March, 1917, these had reached Rafa, enabling an advance to be begun in Palestine, with Gaza as the immediate objective. The first battle of Gaza began on 26th March. It was a failure. Chetwode's mounted forces, including the Australians, moved in a wide detour round Gaza, which was entered while Dobell's infantry attacked the main Turkish positions. But the infantry thrust was not strong enough to penetrate the opposition offered to it, and after two days' fighting the attack was called off. Water was short, and General Murray suspended further attack till 19th April, when, as frequently happened, the Turks, having been reinforced and established in good positions, fought well and beat off the assailants.

Sir A. Murray and General Dobell left the Palestine operations, and General Sir E. Allenby was sent out to organize a subsequent advance when the opportunity was propitious. He was reinforced; the communications were improved through the summer; and on 31st Oct. he surprised the Turks by making a diversion towards Beersheba while demonstrating towards Gaza. Beersheba was rushed by the Australians, and Allenby's right secured. He then sent the 52nd Division to a point between Gaza and the sea while occupying Ali Muntar, and from these two vantage points shelled the Turks out (7th Nov.).

It was the decision of the Allied War Council at Versailles in the autumn of 1917 that Allenby, strongly reinforced, should put the Turks out of the war by one decisive blow, since they were already in straits by reason of losses in their numerous campaigns, including those against the Arabs of the Hejaz, which had been organized by the Emir Feisul and Colonel T. E. Lawrence. Accordingly, the Turks were pursued through Ascalon and Ashdod to Jaffa (16th Nov.). Allenby's main columns pressed on more slowly between Beersheba and Hebron (7th Dec.), but entered Jerusalem on 9th Dec., after disposing of an ineffective Turkish stand on the day before. The operations were practically suspended after the Jordan had been crossed at the end of March, 1918, when it became necessary to recall some of the best British divisions to France to meet the last German onslaught in France and Flanders.

When this had been disposed of, Allenby, who had been supplied with Indian divisions, and who, in Sept., 1918, was much superior in forces and artillery to the Turks, resumed his attack (19th Sept.). Facing him were the Turkish Seventh and Eighth Armies in front of Shechem, and the Turkish Fourth Army east of Jordan. A heavy artillery preparation ushered in a frontal infantry attack which tore a gap in the Turkish right and right centre, and through it the cavalry swept north across the Plain of Sharon to reach and seize the passes at Megiddo. Another infantry attack pinned the Eighth Army on the Jordan. The Turks began to retreat too late, for the Imperial cavalry, pouring through the Megiddo passes, crossed the plain of Esdraelon and barred every avenue of retreat on the western side of Jordan. They only missed the capture of General Liman von Sanders at Nazareth by a few hours.

The Turkish armies were in effect destroyed, for on the eastern side of Jordan the Arab cavalry of the Emir Feisul had turned the line of retreat there, and had cut the Hejaz railway running to Damascus. In less than a week the Turkish Seventh and Eighth Armies were wiped out, and 10,000 of the Fourth Army surrendered at Rabboth Amman (29th Sept.). Haifa and Acre on the coast fell as fast as the Imperial cavalry could reach them. Damascus was entered by the Australians on 1st Oct. Beirut fell a few days later, and by the end of October General Allenby had reached Aleppo. The Turkish Cabinet immediately entered into negotiations, Enver Pasha and Talaat Pasha having been replaced. An armistice was signed on 30th Oct. at Mudros, and Turkey was out of the war. It may be added that Talaat Pasha, who was responsible for the massacres of the Armenians, was killed in Berlin by an Armenian student in 1921.

The War in Germany's Colonies. Within a few weeks of the outbreak of hostilities the war had been carried to all the scattered possessions of Germany in Africa, the Pacific, and the Far East. Among the first to fall were German Samoa (occupied by the New Zealand troops on 29th Aug.); the islands of the Bismarck Archipelago and German New Guinea (occupied by the Australians on 11th–13th Sept.); and the more northerly islands of the Pacific, surrendered at the beginning of October to a Japanese squadron. These last were at once handed over by Japan to Australia. Japan, faithful to her alliance with Great Britain, had declared war against Germany on 23rd Aug., and attacked the formidable German post of Kiao-Chau, 'the key to Northern China,' which had been seized by Germany on the flimsiest pretext in

1898. Japan invested Kiao-Chau—garrisoned by 6,000 well-armed men, with powerful defences—with a force of 23,000 troops under General Kamio, supported by a small British contingent of South Wales Borderers and Sikhs under General Barnardiston. After a six weeks' siege, and a preliminary bombardment preparatory to launching a final assault, the garrison capitulated (7th Nov.).[1]

The remainder of Germany's colonies were in Africa, where the campaigns resulting in their conquest varied from a few weeks to the whole length of the war. The shortest was in Togoland, which surrendered unconditionally to a Franco-British force under Colonel Bryant on 27th Aug., 1914, after a brisk little campaign lasting just three weeks. The Cameroons, larger than the Fatherland, took much longer to subdue, and the operations were of a more arduous nature. A false start was made from Nigeria with insufficient forces, which met with disaster towards the end of August. A more adequate expedition was then organized under General C. M. Dobell, in co-operation with French forces under General Aymerich. Duala, the capital, was occupied on 27th Sept., but it was only after desultory fighting for a year and a half that the Germans, realizing the hopelessness of further resistance, left the colony to its fate by retreating into the neighbouring Spanish territory of Rio Muni.

The campaign in German South-West Africa was held up at first by the revolt in South Africa, which had to be crushed before General Botha was free to give his undivided attention to the task which he had offered to undertake in proof of the Union's loyalty. A preliminary move had been made in September by the occupation of the coastal harbours, Luderitz Bay and Swakopmund, from which the Germans retired to concentrate in Windhoek, their capital inland. A 'regrettable incident' occurred on 26th Sept., 1914, when a British patrol was attacked at Sandfontein and a small relief force compelled to surrender. This was followed by news of the revolt of Maritz, who had been partly responsible for the reverse at Sandfontein; and the small civil war which followed in South Africa, though nipped in the bud by the sterling loyalty of most South Africans, served to postpone the conquest of German South-West Africa until the following year.

[1] Japan afterwards assisted the Allies with war supplies—particularly with heavy guns to Russia before the Bolshevik betrayal—subsequently helping to stem the tide of Bolshevism in the Far East, besides contributing with her ships to the defeat of the German submarine campaign in the Mediterranean.

When the campaign began in earnest in the spring of 1915, the whole south-eastern part of the German colony had already been cleared by Colonel van Deventer, whose desert march with three separate columns in these preliminary operations was one of the outstanding achievements of the campaign. In the great converging march which followed, led in the south by General Smuts, and in the north by General Botha, with columns consisting largely of mounted burghers from the Transvaal and Orange Free State, the Germans were outfought and outmanœuvred throughout.

The advance began on 27th April, and by 5th May Botha, building a light railway with supplies behind him, entered Karibib without opposition, and Windhoek a week later, the Germans, 5000 strong but greatly outnumbered, withdrawing the bulk of their forces to the north. Twice they proposed an armistice, offering terms, but the only terms that Botha would agree to implied unconditional surrender. Having rested and refitted his men after this trying trek across country from Swakopmund, he proceeded to enforce these terms by a series of remarkable marching feats, with his own columns in the centre and those of Brits and Myburgh to left and right respectively, starting on 18th June. In less than a week Botha's force had covered 100 miles and captured Otyiwarango; on 1st July, after a brief rest, his infantry were in touch with the enemy's main force, entrenched from Otavi to Tsumeb, with Brits and Myburgh sweeping round on either side. On 8th July all resistance collapsed with the total surrender of the Germans under Colonel Franks, the military commandant. The whole campaign in South-West Africa did not cost us more than 140 lives, and total casualties amounting to 1,200.

The conquest of German East Africa was a very different affair. It was opposed by a force which, at its maximum, could muster 25,000 well-drilled troops—2,000 of them Europeans—with 60 guns and machine-guns, and sufficient supplies of ammunition; the whole commanded by von Lettow-Vorbeck, a leader of resource and inflexible determination. When, at the outbreak of war, the British cruisers *Astræa* and *Pegasus* bombarded Dar-es-Salaam and destroyed the wireless station, the Germans retaliated by crippling the *Pegasus*, then lying at Mombasa, with their fast cruiser *Königsberg*, which had fled to East Africa after escaping the fate of the rest of von Spee's squadron off the Falkland Islands.



Map illustrating the blockade of the German East African Coast—the shaded area.—and the military operations early in 1915

They also raided the Uganda railway, occupied Taveta on the British East African border, and threatened an advance on Mombasa along the coast. This was checked by the arrival of British reinforcements, naval and military, the naval units of which forced the *Königsberg* to seek the shelter of the Rufigi River, where, as already stated, she was afterwards destroyed.

A second expeditionary force under General Aitken was brought from India in the closing months of the year, and ordered to land at the northern German port of Tanga, with the object of cutting off the enemy troops operating on the British border. The magnitude of the task had been gravely under-estimated. Landing on 4th Nov. in difficult bush country—familiar enough to the defenders, but

an impenetrable maze to the landing force—the attempt ended in disaster, costing some 800 casualties before the expedition re-embarked. Another blow was dealt by von Lettow-Vorbeck early in 1915 (19th Jan.) when he recaptured Jassin, gallantly held to the last by Indian troops under Colonel Ragbir Singh; but in the same month he lost one of his chief ports on Victoria Nyanza; in the following May other British forces captured Sphinxhaven after an action by armed steamers; and a blockade was declared of the German East African coast, where the Island of Mafia, off the mouth of the Rufigi River, was also seized. Several blockade-runners succeeded in getting through to von Lettow-Vorbeck with much-needed supplies of ammunition; and with Britain's hands full to overflowing with other campaigns, the main German forces in East Africa had perforce to be left until Botha had completed the conquest of South-West Africa, and the Union was free to lend a hand in expelling the Germans from the last and most valuable of their colonies.

When at length the new expeditionary force was nearly ready, the command was given to General Smith-Dorrien, but he was forced to relinquish it through ill-health shortly after landing in Africa. His place was filled by General Smuts, who arrived on the scene in Feb., 1916, and started his campaign in the following month by clearing the enemy from the British borderland and the Kilimanjaro district. Much valuable spade-work had been previously done in this direction by General Tighe as a preliminary to sweeping the enemy's main forces southwards, while the Belgians from the Belgian Congo cleared his north-western province of Ruanad, and British forces drove his garrisons from the shores of Victoria Nyanza.

The first stage in the new campaign was closed when Smuts established his head-quarters at Moshi, where he reorganized his force in three divisions, one (British and Indian) under Hoskins, the other two (South African) under van Deventer and Brits. Van Deventer's force had the hardest task in clearing the Germans from Kondoa Irangi on his march to the central railway, von Lettow-Vorbeck making his one great defensive stand in this direction. Van Deventer, however, was too quick for him; beat off his counter-attack after the capture of Kondoa Irangi (19th April, 1916); and struck hard when he attempted to bar the progress of Smuts's other two columns, which, after clearing the Gare and Usambara mountains in May and June, had pushed into the Nguru hills from Kangata.

By this time the Germans realized that they were outmatched both in strategy and numbers, and the bulk of them would probably have shortened the war but for von Lettow-Vorbeck, who was determined to hold out, if possible, until the fate of Germany's 'place in the sun' had been decided on the battlefields of Europe. More than once it seemed as though he could not escape the wide net which Smuts flung out to trap him, but he proved as elusive as De Wet in the South African War, usually escaping with his diminishing forces through tracks unknown to his pursuers.

All the railways and ports were lost during the remainder of 1916, Dar-es-Salaam, the capital, surrendering on 3rd Sept. Towards the end of that year the Belgians from the Congo under General Tombeur drove the enemy from Tabora, on the central railway; British troops under General Northey helped in the converging movement from Northern Rhodesia —which had been invaded by the Germans at the beginning of the war —by advancing as far as Iringa. In the extreme south some Portuguese had also joined in the movement by an advance across the Rovuma River, but were forced back by a German column, and punished by raiding parties in their own territory.

The campaign seemed practically over at the beginning of 1917, when General Smuts was summoned to Great Britain to share in an imperial conference, and General Hoskins was left to account for the remainder of the enemy, now hemmed in on nearly all sides in the south-eastern corner of the colony, with von Lettow-Vorbeck's head-quarters at Mahenge. Torrential rains came to the Germans' rescue, and little progress had been made before Hoskins, called away to another theatre of war, was succeeded by General van Deventer in May (1917).

Guerrilla warfare continued throughout the year, in which both sides suffered heavily, but it was not until 1st Dec. that van Deventer could report that the former German colony was at length clear of the enemy. Forced out of Mahenge (occupied by the Belgians on 9th Oct.), the Germans retired in two main bodies towards the Portuguese frontier, one under Tafel, which was cut off and compelled to surrender on 26th Nov., and the other under von Lettow-Vorbeck, which contrived to escape across the border and continue the war in Mozambique for nearly another year. Allied columns pursued

the remnants unceasingly, but could never get to real grips with them in the difficult bush country between the Rovuma and the Zambesi.

Towards the end of September, 1918, von Lettow-Vorbeck dashed back, recrossed the Rovuma, and coolly marched across the south-western corner of German East Africa into Northern Rhodesia, where he was being finally rounded up when news arrived of the Armistice. It was not, however, until 14th Nov. that the German leader was able to comply with the Armistice terms of unconditional surrender on his part, tendering his submission to the British magistrate of Kasama. In recognition of their "gallant and prolonged resistance," von Lettow-Vorbeck and his officers were permitted by General van Deventer to retain their swords, while the European rank and file were allowed to carry their arms as far as Dar-es-Salaam.

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EUROPIUM, rare element. Its symbol is Eu, its atomic weight 152, its atomic number 63, and it is found associated with samarium. It was discovered in 1896 by E. A. Demarçay and first isolated in 1901.

EUROTIUM. *See* PLECTASCINEÆ.

EURYDICE (ū-rid'i-sē), in Greek mythology, the wife of Orpheus (q.v.).

EUSE'BIUS, of Cæsarea, the father of ecclesiastical history, a Greek writer, born in Palestine about A.D. 265, died about 340. About 315 he was appointed Bishop of Cæsarea. When the Arian controversy broke out, Eusebius showed considerable sympathy with Arius. At the Council of Nicæa (A.D. 325), when Arian doc-



Eusebius

trines were condemned, he took a leading part. His ecclesiastical history (*Historia Ecclesiastica*) extends from the birth of Christ to 324. Amongst his other extant works is a life of Constantine the Great, which may be said to continue his ecclesiastical history to within a few years of the writer's own death.

EUSPORANGIATE FERNS, those in which the sporangium is a massive organ arising from several cells, whereas in leptosporangiate ferns it is a more delicate structure derived from a single superficial cell. The bulk of living ferns are leptosporangiate, the eusporangiate class comprising only two living families, viz. the Marattiaceæ and Ophioglossaceæ, as well as many extinct

types. The eusporangiate types include the more primitive ferns; all the other main groups of Pteridophytes, and the seed-plants are also eusporangiate.

EUSTACHIAN TUBE, in anatomy, a canal leading from the pharynx to the tympanum of the ear.

EUSTACHIO, Bartolomeo, Italian physician and anatomist, born soon after 1500, died about 1574. He devoted himself to medical science



Euterpe

and in particular to anatomy, which he much enriched by his researches. Amongst his discoveries were the *eustachian tube* and the eustachian valve of the heart.

EUSTATIUS, ST., or **ST. EUSTACHE ISLAND,** a Dutch island in the W. Indies, one of the Leeward Islands, 11 miles north-west of St. Christopher's, pyramidal in form; area, 8 sq. miles. Sugar, cotton, and maize are raised; but the principal production is tobacco. The climate is healthy, but earthquakes are frequent. Pop. 2,048.

EUSTON, name of one of the great London railway stations. It is in Euston Square, just off the Euston Road, one of London's great thoroughfares. Before 1923 it was the headquarters of the L. & N.W. Rly. It now belongs to the L.M.S. system.

EUSTON, a village in Suffolk, 3 miles from Thetford. Here is Euston Hall, a seat of the Duke of Grafton, whose eldest son is called the Earl of Euston. It is on the L.N.E. Rly. and has an interesting church.

EUTER'PE, (1) one of the Muses, considered as presiding over lyric poetry, the invention of the flute being ascribed to her. She is usually represented as a virgin crowned with flowers, having a flute in her hand. (2) In botany, a genus of palms, natives of South America, sometimes nearly 100 feet in height.

EUTHANASIA, literally, a painless or easy death, a term often used in connection with the theory or proposal that it should be lawful to administer drugs to bring about a painless death, in the case of persons suffering from painful and hopeless diseases.

EUTRO'PIUS, Flavius, a Latin historian, who flourished about A.D. 360. His abridgment of the history of Rome (*Breviarium Historiæ Romanæ*) is written in a perspicuous style, and is often read, or rather spelled out word by word, by beginners in Latin. It is of little or no authority as a history.

EUTYCHES (ū'ti-kēz), a Greek heresiarch who lived in the fifth century after Christ. He was superior of a monastery near Constantinople, and his heresy consisted in maintaining that after the incarnation there was only a divine nature in Christ under the appearance of a human body. The doctrines of Eutyches were condemned by the Council of Chalcedon in 451, and he was expelled from his monastery. He died not long afterwards. His followers were often called Monophysites (Gr. *monos*, single, *physis*, nature) as well as Eutychians.

EUXANTHINE, a substance supposed to be derived from the bile or urine of the buffalo, camel, or elephant. It comes from India under the name of purree or Indian yellow, and is used as a pigment.

EUX'INE (*Pontus Euxinus*), the ancient name for the Black Sea.

EVANGEL'ICAL, a term often used to qualify certain theological views, especially strict views on the question of the atonement, justification by faith, the inspiration and authority of the Scriptures, and allied doctrines. In England the so-called Low Church party is evangelical in its views. In a more general sense the word implies a

peculiar fervency and earnestness in insisting on such doctrines as regeneration and redemption. The 'Evangelical Church' is the official title of the Established Church of Prussia, formed in 1817 by the union of Lutherans and Calvinists.

EVANGELICAL ALLIANCE, an association of members of different sections of the Christian Church, organized in London in 1845, to lend its influence in favour of evangelical doctrines, religious union and liberty, and against superstition and unbelief. The Alliance, incorporated in 1912, has branches throughout the world, the American branch being especially strong, and has held meetings at Paris, Berlin, Amsterdam, Geneva, New York, Copenhagen, Florence, and London. A week of united prayer is held in London in the early part of January each year. The organ of the Alliance, *Evangelical Christendom*, is published in London.

EVANGELICAL ASSOCIATION, a body of American Christians, chiefly of German descent, established about the beginning of the last century. In form of government and mode of worship it generally agrees with the Methodist Episcopal Church.

EVANGELICAL UNION, the name of a religious sect, also familiarly known as the Morisonians, from the Rev. James Morison, its originator. It took rise in Scotland in 1840, and three years afterwards organized itself as a separate Christian denomination. The Morisonians maintain the universality of the atonement, combining with this the doctrine of eternal personal and unconditional election, and denying that anyone will be condemned for Adam's fall. In point of government the individual Churches are independent. The body has now only a few adherents, the majority having united in 1896 with the Congregationalists.

EVAN'GELISTS, the writers of the history or doctrines, precepts, actions, life and death of Christ; in particular, the *four evangelists*, Matthew, Mark, Luke, and John. The ancient symbols of the four evangelists are: for Matthew, *a man's face*; for Mark, *a lion*; for Luke, *an ox*; and for John, *a flying eagle*.

EVANS, Edith Mary, English actress. Born in London, she made her first appearance as "Cressida" in *Troilus and Cressida* in 1912, and later played in Vedrenne and Eadie productions and with Ellen Terry. She has played a great deal in Shakespeare and Shaw, and in revivals of Restoration comedies, at the Lyric, Hammersmith.

EVANS, Edward Radcliffe Garth Russell, English sailor and explorer. The son of a barrister and born in 1881, he was educated at the Merchant Taylors School, London, and in 1897 entered the navy. In 1902–4 he was with the *Discovery* relief expedition in the Antarctic. In 1909 he went with Scott on his expedition, and, as second in command, took charge after Scott's death. During the Great War, as commander and then captain, he served with the fleet, and in 1917, in command of the *Broke* and the *Swift*, defeated six German destroyers. He received the D.S.O. and the C.B., and many honours from learned societies, and wrote *South with Scott* and other books.

EVANS, Sir Arthur John, born in 1851, son of Sir John Evans. He was educated at Harrow, Oxford, and Gottingen, is a distinguished archæologist, as well as an investigator into the history and affairs of Eastern Europe, and in particular has made important investigations and discoveries in Crete. He has travelled in Finland, Lapland, and the Balkan countries, and has written works connected with these travels and with his archæological researches. From 1884 to 1908 he was keeper of the Ashmolean Museum, Oxford. He was knighted in 1911, and was president of the British Association 1916–7. Among his works are: *Through Bosnia*, and *Scripta Minoa*.

EVANS, Sir George de Lacy, a British general, born at Moig, in Ireland, in 1787, died 9th Jan., 1870. After some years of service in India, he joined the army of Wellington in the Peninsula in 1812, where he served with distinction. In 1814 he was sent to America, and was present at the battles of Bladensburg and New Orleans, returning to Europe in time to take part in Waterloo. In 1830 and 1831 he was elected member for Rye, and in 1833 for Westminster. In 1835 he was appointed to the command of 10,000 troops raised in Britain on behalf of the Queen of Spain. Under the training of Evans this force became an excellent army, and several times defeated the Carlists. During the Crimean War he distinguished himself as commander of the second division of the English army, and received the thanks of the House and other honours.

EVANS, Sir John, English archæologist, born in 1823, died in 1908, was an active member of a firm of paper-makers, but eventually retired from business and devoted himself chiefly to scientific pursuits, being distinguished as a geologist, numis-

matist, and antiquarian. From 1878 till 1896 he was treasurer of the Royal Society; in 1897 he was president at the Toronto meeting of the British Association. He was created a K.C.B. in 1892. His chief works are: *The Ancient Stone Implements, Weapons, and Ornaments of Great Britain and Ireland*; and *The Ancient Bronze Implements, Weapons, and Ornaments of Great Britain and Ireland.*

EV'ANSTON, a city of the United States, Illinois, 12 miles from Chicago. It is pleasantly situated on Lake Michigan. It is the seat of the North-Western University and other institutions. Pop. (1930), 63,338.

EV'ANSVILLE, a town in the United States, in Indiana, pleasantly



John Evelyn

situated on a height above the Ohio. It contains some handsome buildings, including custom-house and post office. Coal and iron abound in the vicinity, and there are numerous factories, flour-mills, and iron-foundries, and a large shipping trade. Pop. (1930), 102,249.

EVAPORATION, the process of changing a liquid into vapour, which goes on at the surface of the liquid. When evaporation takes place into a closed space above the liquid, a state is reached in which the space is saturated with vapour, and no further change is apparent. Certain conditions influence the rate at which evaporation takes place in the open, such as the extent of the exposed surface, the dryness, pressure, and temperature of the air, and the presence or absence of wind. The farmer looks for a drying wind to dry his corn-sheaves before they are carted from the field. Evaporation is always accompanied by an absorption of heat by the vapour, namely the latent heat necessary for the change of state from liquid to vapour. This heat is abstracted from the liquid, which, as a consequence, falls in temperature, and neighbouring bodies may also be cooled. A bather emerging from the water experiences this cooling as the water evaporates from his skin.

In hot countries, water is kept cool by being placed in porous earthenware jars: the evaporation which takes place at the outer surface prevents the water in the jar from becoming too warm. The continual evaporation from land and water surfaces is the cause of the presence of water in the atmosphere, whether in the form of invisible vapour or of cloud, mist, fog, rain, hail, or snow. The cooling caused by evaporation is applied in industry in the case of the ammonia compression machine, in working refrigerating plant for the preservation of food-stuffs, and in the manufacture of artificial ice. When evaporation takes place at the surface of a dry solid, the process is called sublimation, and it may be observed in the cases of iodine, camphor, and ice.

EVE, name given by Adam to his wife, because she was "the mother of all living" (*Gen.* iii, 20). Her sons were Cain, Abel and Seth. The Genesis story describes her creation from a rib taken out of Adam's flesh as a "help meet for him," and her participation in the Temptation and the Fall.

EV'ELYN, John, an English writer of the seventeenth century, born at Wotton, in Surrey, 31st Oct., 1620, died there, 27th Feb., 1706. After completing his course at Oxford, he studied law at the Middle Temple, visited various parts of the Continent, and in 1659 prepared the way for the Restoration. He published numerous works, amongst which are: *Sculptura, or the History and Art of Chalcography*; *Sylva, or a Discourse of Forest Trees*; treatises on gardening and architecture. But by far his most important work is his memoirs, comprehending a diary and correspondence, which are interesting contributions to the history of the time. Evelyn's *Diary* was first published in 1818, and an edition by Austin Dobson appeared in 1906.—Cf. H. Maynard Smith, *The Early Life of John Evelyn.*

EVENING-PRIMROSE, Œnothēra, a genus of plants, nat. ord. Onagraceæ. *Œ. biennis,* an American species common in cottage gardens

is not infrequent as an escaped plant in England.

EV'EREST, MOUNT, the highest summit of the Himálaya and the loftiest mountain in the world, 29,002 feet. It was named after Sir George Everest (1790–1886), chief of the great Indian trigonometrical Survey and Surveyor-General of India. In 1921 an expedition attempted to climb the mountain. In 1933 an aeroplane flight over Everest was a feature of the Mount Everest Expedition (*q.v.*). *See* MOUNT EVEREST EXPEDITION.

EV'ERETT, Alexander Hill, an American diplomatist, born at Boston in 1792, died at Canton in 1847. After studying at Harvard, in 1809 he accompanied John Quincy Adams to St. Petersburg (Petrograd) as Secretary of Legation. He afterwards filled successive diplomatic posts in the Netherlands, Spain, and elsewhere. He was the author, amongst other works, of *Europe, or a General Survey of the Present Situation of the Principal Powers* (1822); and a similar work on America.

EVERETT, Edward, an American statesman and author, brother of the preceding, born at Dorchester, Massachusetts, 11th April, 1794, died at Boston, 15th Jan., 1865. After travelling for some years in Germany and England, he returned to America in 1819 to occupy the chair of Greek literature at Harvard. He became editor of the *North American Review*, and entering the political world became successively member of Congress, Governor of Massachusetts, and Minister Plenipotentiary in England (1841–5). In 1845 he was appointed president of Harvard College; in 1852 Secretary of State; in 1853 a Senator. He wrote poems; a *Defence of Christianity*; and his speeches and orations have been published.

EVERGREEN, a plant that retains its verdure through all the seasons, as the fir, the holly, the laurel, the cedar, the cypress, the juniper, the holm-oak, and many others. Evergreens shed their old leaves in the spring or summer, after the new foliage has been formed, and consequently are verdant through all the winter season. They form a considerable part of the shrubs commonly cultivated in gardens, and are beautiful at all seasons of the year.

EVERLASTING-FLOWERS, a name applied to certain plants which, when dried, suffer little change in their appearance. The plants to which this name is peculiarly applied belong to the genus Helichrysum, but it is also given to members of allied genera, such as Antennaria or Gnaphalium.

EVERLASTING-PEA, a popular name for *Lathyrus latifolius*, cultivated in flower-gardens, and belonging to the same genus as the sweet-pea.

EVERSION OF THE EYELIDS (Ectropion), is a turning outward of the eyelids, and it may be congenital



Everlasting Flower
(*Helichrysum sentii*)

or acquired. The latter follows severe infection of the hair-follicles of the eyelashes.

EVESHAM (ēvz'am), a borough in England, in the county and 15½ miles S.E. of Worcester, beautifully situated on the Avon, and giving name to a parliamentary division of the county. It was the seat of a monastery as early as the eighth century. Simon de Montfort was defeated by the Royal troops at Evesham on 4th Aug., 1265. Pop. (1931), 8,799.

EVICTION, the dispossession of a person from the occupancy of lands or tenements. The term occurs most commonly in connection with proceedings by which a landlord ejects his tenant for non-payment of rent or on determination of the tenancy. The Rent Restriction Acts of 1920 to 1930, severely curtailed a land-

lord's common law rights to recover possession of certain premises at the time when but for the Act the tenancy would expire. In Ireland tenants who have been evicted for non-payment of rent are frequently re-admitted as caretakers or in some similar capacity.

EVIDENCE is that which makes evident, which enables the mind to see truth. It may be (*a*) *intuitive*, i.e. resting on the direct testimony of consciousness, of perception, or memory, or on fundamental principles of the human intellect; or it may be (*b*) *demonstrative*, i.e. in a strict sense, proofs which establish with certainty as in mathematical science certain conclusions; or it may be (*c*) *probable*, under which class are ranked *moral evidence*, *legal evidence*, and generally every kind of evidence which, though it may be sufficient to satisfy the mind, is not an absolutely certain and incontrovertible demonstration.

In jurisprudence evidence is classified into that which is *direct* and *positive* and that which is *presumptive* and *circumstantial*. The former is that which is proved by some writing containing a positive statement of the facts and binding the party whom it affects; or that which is proved by some witness, who has, and avers himself to have, positive knowledge thereof by means of his senses. Whenever the fact is not so directly and positively established, but is deduced from other facts in evidence, it is *presumptive* and *circumstantial* only. The following are the leading rules regarding evidence in a court of law:

(1) The point in issue is to be proved by the party who asserts the affirmative. But where one person charges another with a culpable omission this rule will not apply, the person who makes the charge being bound to prove it. (2) The best evidence must be given of which the nature of the thing is capable. (3) Hearsay evidence of a fact is not admissible. The principal exceptions to this rule are—death-bed declarations, evidence in questions of pedigree, public right, custom boundaries, declarations against interest, declarations which accompany the facts or are part of the *res gestæ*, &c. (4) Insane persons and idiots are incompetent to be witnesses. But persons temporarily insane are in their lucid intervals received as witnesses. Children are admissible as witnesses as soon as they have a competent share of understanding and know and feel the nature of an oath and of the obligation to speak the truth.—BIBLIOGRAPHY: Sir J. F. Stephen, *Digest of the Law of Evidence*; W. M. Best, *Law of Evidence*.

EVIDENCES OF CHRISTIANITY. These may be divided broadly into two great classes, viz. *external evidences*, or the body of historical testimonies to the Christian revelation; and *internal evidences*, or arguments drawn from the nature of Christianity itself as exhibited in its teachings and effects, in favour of its divine origin. The first Christian apologies—those of Justin Martyr, Minucius Felix, and Tertullian, written in the second century—were mainly intended as justifications of the Christian religion against the charges of atheism and immorality commonly made at that time. Of a more philosophical kind, and dealing more comprehensively with the principles of religion and belief in general, are the works of Origen, Arnobius, and Augustine in the centuries immediately succeeding. During the Middle Ages, the scientific representation of Christianity is mostly the work of the schoolmen occupied in welding Aristotelian or Platonic philosophy with the fabric of Christian dogmatics, or writing attacks on the Jewish and Mohammedan faiths.

In the sixteenth and seventeenth centuries the influences of the Renaissance and the Reformation gave rise to a spirit of inquiry and criticism which developed English deism as represented by Herbert and Hobbes in the seventeenth century, and Collins and Bolingbroke in the eighteenth. The general position of English deism was the acceptance of the belief in the existence of God, and the profession of natural religion along with opposition to the mysteries and special claims of Christianity. It was in confutation of this position that the great English works on the evidences of Christianity of Butler, Berkeley, and Cudworth were written.

In France the new spirit of inquiry was represented by Diderot, D'Holbach, and the encyclopedists in general, who assailed Christianity mainly on the ground that it was founded on imposture and superstition, and maintained by sacerdotal trickery and hypocrisy. No reply of any great value was produced in the French Church, although in the previous age Pascal in his *Pensées* had brought together some of the profoundest considerations yet offered in favour of revealed religion.

The nineteenth century has been distinguished by the strongly rationalistic spirit of its criticism. The works of such writers as Strauss, Bauer, and Feuerbach, attempting to eliminate the supernatural and the mysterious in the origin of Christianity, have been answered by the

works of Neander, Ebrard, and Ullmann on the other side.

The historical method of investigation, represented alike by the Hegelian school and the Positivists and Agnostics in philosophy, and by the Evolutionists in science, is the basis of the chief attacks of the present time against the supernatural character of Christianity. The tendency of all the critics is to hold that while Christianity is the highest and most perfect development to which the religious spirit has yet attained, it differs simply in degree of development from any other religion. Notable amongst later apologists of Christianity have been Paley (*Natural Theology*), Chalmers (*Natural Theology*), Mansel, Liddon, and others.—BIBLIOGRAPHY: J. R. Illingworth, *Reason and Revelation*; A. Garvie, *Handbook of Christian Apologetics*.

EVIL, ORIGIN OF. The difficulty of the question lies mainly in this, that the existence of evil in the world seems inconsistent with the view that it was created and is maintained by an omnipotent and beneficent creator. The various theories on the subject have all sought to elude this difficulty either by the supposition of some principle of evil equally eternal with that of good, or by regarding evil as having only a relative existence, being a kind of good in an imperfect and immature stage.

Perhaps the oldest theory upon this subject is that of Parseeism, or the religion of Zoroaster, according to which there were two original principles, one good (Ormuzd) and the other evil (Ahriman). This is the doctrine that is now very often spoken of as Manichæism, from the fact that it was adopted by Manes, who attempted to engraft it on the doctrines of Christianity.

In contradistinction to this dualistic theory with reference to the origin of evil stand the Monistic theories of Brahmanism and Platonism. According to the Brahmanic doctrine of the emanation of all things from one original being (Brahma), this original being was regarded as the soletrue existence, and the phenomenal world, with all the evils appearing in it, was held to be mere illusion. Similarly, Plato held that the good was the essence of all things, and that the evil and imperfect contained in them had no real existence. The theory enunciated by Leibnitz in his *Theodicee* resembles that of Plato. In that work he assigns to the evil existing in the world created by God, which he holds to be the best of all possible worlds, a merely relative existence. According to Plato, all that we call evil is only evil to us because we do not see it in relation to the rest of the universe, for in relation to the universe it is not evil but good, and accordingly cannot be evil in its own nature.

Another view on the subject is that which neither assigns to the evil principle (as it does to God or the good principle) an original existence, nor denies the real existence of evil, but ascribes it to the exercise of man's free-will. Besides the theoretical problem of the origin of evil, there is the practical one of the elimination of evil which forms the subject of *Ethics*.—BIBLIOGRAPHY: H. Rashdall, *The Theory of Good and Evil*; B. Bosanquet, *The Value and Destiny of the Individual*.

EVIL EYE, a power which, according to an old and widespread superstition, resides in some people of doing injury to others by a mere look, or a look accompanied by certain words or charms. This belief, common amongst the ancients, is still prevalent among the more ignorant classes in Italy, Russia, Andalusia, the Highlands of Scotland, and other places. The Finns, Lapps, and Scandinavians, the Arabs and the Turks are all firm believers in the evil eye.

EV'OLUTE. The evolute of a curve is the curve which is the envelope of all its normals or the locus of all its centres of curvature. The first curve is called the involute of the second. These names are given to the curves because the end of a stretched thread unwound from the evolute will describe the involute.

EVOLUTION, a term introduced into biological writings in the early part of the eighteenth century to denote the mode of generation of living things. At first it was used in the same sense as we now apply the word development, more especially with reference to the process whereby the germ of an animal or plant becomes transformed into the adult organism; but it is now used in biology for the process by which more complex plants or animals have been derived from a series of less specialized ancestors by transformation. In accordance with the teaching of modern biology, all living creatures are the progeny of one original group of microscopic unicellular organisms, different branches of which during many millions of years have become diversely modified in structure and function to form the vast multitudes of diverse species of plants and animals with which we are acquainted.

The idea of a transformation of one type of being into another is extremely ancient, and its origin was in all

probability genetically related to the primitive conceptions which have survived to the present day in totenism (q.v.) and such myths as the story of the were wolf. For once it was believed that a totem-animal, like a cow or a pig, could give birth to human beings, or that the Great Mother could at will assume a great variety of living forms, ranging from a mollusc or a grain of barley to a higher mammal, it was a comparatively simple step to arrange these potential 'ancestors' in a series, and provide mankind with a mythical genealogy.

It is possible that such beliefs may have suggested to the Greek philosophers, such as Aristotle, speculations as to the process by which custom and change of habit might modify the structure of animals. But it was not until the end of the seventeenth century that the trend of philosophical speculation, associated with the growing understanding of natural processes, started lines of investigation which, after many failures, eventually brought forth Charles Darwin's *Origin of Species* in 1859, and established once for all the fact that different species of animals and plants have been produced by the differentiation of the progeny of the same ultimate ancestors. The history of these events was admirably summarized by Huxley in 1878 in an article *Evolution in Biology*, republished in *Darwiniana* (1893, p. 187); in this account due credit is given to the pioneers of the eighteenth and early nineteenth centuries, such as Lamarck, and to Darwin's co-discoverer of the hypothesis of natural selection, Alfred Russel Wallace.

At the present time there is a general consensus of opinion among serious biologists, and, in fact, most educated men, as to the reality of evolution; but there is wide divergence of opinion as to the exact pedigrees of the various groups of plants and animals, and especially as to the mechanisms whereby the processes of transformation have been effected.

The evidence that establishes the proof of evolution is of manifold kinds. "The gradations of structure, from extreme simplicity to very great complexity, presented by living things, and of the relation of these graduated forms to one another. The existence of an analogy between the series of gradations presented by the species which compose any great group of animals or plants, and the species of embryonic conditions of the highest members of that group. Large groups of species of widely different habits present the same fundamental plan of structure; and parts of the same animal or plant, the functions of which are very different, likewise exhibit modifications of a common plan. Structures are found in a rudimentary or apparently useless condition in one species of a group which are fully developed and have definite functions in other species of the same group. These considerations, when studied in conjunction with the facts of the geological succession of the forms of life, of geographical distribution, and the effects of varying conditions upon living organisms, establish the truth of evolution" (Huxley).

The full meaning of these statements will be better understood if a concrete example is studied, and perhaps the case of man and his ancestry is most instructive for this purpose. The fact that man has a vertebral column, a brain and nervous system, a heart and blood-vessels, digestive and other systems of organs, built up in accordance with the arbitrary plan which is shared also by all mammals, birds, reptiles, amphibians, and fishes, proclaims that man belongs to the vertebrate group of animals, and that all such vertebrata must originally have sprung from the same common ancestors. The possession of four limbs with five fingers or toes on each, and a host of identical arrangements of bones, muscles, nerves, &c., in these limbs, reveals the fact that all the four-limbed creatures or Tetrapoda represent one group which developed from some fish-like ancestor to become an amphibian.

The discovery of fossilized remains of extinct animals reveals that the fishes are much older than the amphibians, and that a number of intermediate stages demonstrate the process of gradual transformation which converted one group of fishes into four-limbed, semi-terrestrial amphibians. Geological evidence also proves that the reptiles came definitely later than the amphibians, and that only one small group of very primitive amphibians shared in the progressive modifications of brain, limbs, and organs of circulation, &c., to become reptiles—creatures able to live wholly on the dry land, and capable of a wider range of activities than the Amphibia.

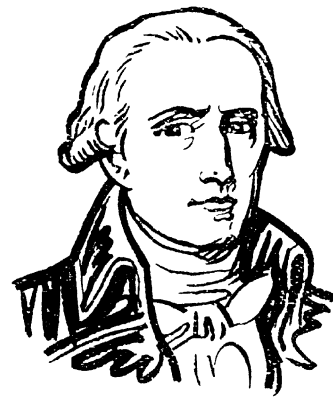
From the primitive reptiles were derived not only the highly specialized forms that have survived to the present day as lizards, tortoises, snakes, &c., creatures that differ profoundly from their earliest reptilian ancestors, but also the ancestors of birds and the ancestors of mammals. One particular group of primitive reptiles is known, from fossilized

remains found in South Africa, that reveals many of the distinctive peculiarities of mammals not shared by other reptiles; and it is now certain that these cynodonts—so called from their dog-like teeth—include the parents of the mammals. The fact that all the Mammalia are provided with glands which in the female supply milk for the nutrition of their young, that they have a hairy coat, that they have a highly developed brain more fully adapted for learning by experience than is the case in other vertebrates, that they have limbs capable of a much more varied and active range of skilled movements, and a host of identical transformations of viscera, muscles, nerves and vessels, prove the common ancestry of mammals from some very primitive cynodont reptile.

Different mammals have been specialized in structure for amazingly varied modes of life, on land, under the ground, in trees, in the air, or in rivers or the sea. Of the terrestrial animals some have been modified for fleetness, like the horse and the antelope; others for strength, like the elephant; others again, like the lion and the tiger, to prey upon their weaker relatives. At the dawn of the age of mammals one particular group was able to survive without any of the profound alterations of the structure of the limbs which such creatures as the horse and the ox, the elephant and the whale, the tiger and the bat had to adopt to avoid extinction, and retained the primitive type of limbs with their fingers and toes which became the most useful and plastic instruments for performing skilled movements and acquiring experience and knowledge as soon as the brain was sufficiently advanced in structure and capability to put these instruments to their full use.

The group of mammals which delayed the time of specialization until it was able to profit by its greater adaptability was the Prosimiæ, the ancestors of the apes and man. These small creatures for a long time lived a life of obscurity in trees without submitting to those extreme adaptations of structure which are found in most arboreal and flying mammals. But the cultivation of their powers of vision, and the acquisition of skill in the use of their primitive but plastic hands, guided by vision, eventually conferred upon some of these Prosimiæ vastly enhanced powers of skilled action and of learning by experience and of acquiring knowledge, which culminated in the attainment of the supreme power of discrimination distinctive of human intelligence.

The fact that man belongs to the same order (Primates) as the apes is proved not merely by the possession of a body which in most respects is identical in structure with such of them as the gorilla and the chimpanzee, of a similar process of development characterized by identical stages up to a certain stage, but also by the fact that the blood of man and the apes react towards one another as those of relatives, and in a way not shared by the blood-reactions of other mammals. The apes, also, are subject to certain human diseases from which other mammals are immune. Man shares with the anthropoid apes (gorillas, chimpanzees, orangs, and gibbons) so many peculiarities, which differentiate all of them from the



Lamarck

tailed monkeys that there can be no doubt that the human family was derived from a primitive anthropoid ape, possibly a species that lived in the foothills of the Himalayas in Miocene times, as is suggested by fossils recently discovered by Dr. Pilgrim, director of the Geological Survey of India.

The vestigial remains of the muscles, blood-vessels, &c., of the tail reveal the fact that man's Primate ancestry began with a tailed form. In fact, the human embryo actually possesses a tail for some weeks of its existence. If India reveals the fossilized remains of a variety of Miocene anthropoid apes closely akin to the ancestors of man, the gorilla, the chimpanzee, and the orang, the Egyptian Fayum has provided the evidence of the origin of the anthropoid apes in Oligocene times as very diminutive creatures distantly akin

to the gibbons, but bearing very obvious indications in the form of their teeth of an affinity with the Prosimian sub-order Tarsioidea, a very interesting group of Eocene Primates found in a fossilized condition in North America and France, one of the members of which has survived in the peculiar Spectral Tarsier still found living in the forests of Borneo, Java, and the Philippines. The detailed study of the structure and development of Tarsius, and comparisons with other Primates and mammals of other orders, provide the information necessary to fill in the gaps left in the geological record, and enable us to sketch out the general scheme of man's ancestry, and to appreciate the nature of the factors which determined the evolution of such an intelligent mammal as man.

Within recent years the increasing knowledge of embryology and comparative anatomy, and the recovery of fossilized remains of vast numbers of hitherto unknown animals, has established the truth of evolution and the exact line of ancestry of many animals. Professor Osborn's work on the evolution of the horse, and Dr. C. W. Andrews's revelation of the ancestry of the elephant, are striking recent illustrations of the exactness of the demonstration palæontology can give of the past history of mammals. Dr. Robert Brown and Professor D. M. S. Watson have given conclusive proofs of the origin of mammals and birds from primitive reptiles, and the latter zoologist has pushed back the ancestry of these higher vertebrates still further, and shown how the reptiles were derived from primitive Amphibia, and the changes that occurred in vertebrate anatomy when certain fishes crawled out of the water and developed into four-footed Amphibia. All of these conclusions are matters of fact and not of theory, even if we are still in the dark as to the exact mechanism whereby the variations which the forces of evolution use in effecting transformations were themselves brought about.

Within recent years there has been a revival of interest in the problem whether characters acquired by parents as the result of their individual experience can be transmitted to their offspring. For the last thirty years biologists have been influenced by the teaching of Weismann that nothing happening to the parents can affect the morphological capabilities of the germ plasm from which the next generation is derived; but recent research suggests that this negative doctrine is too rigid, and makes it probable that certain influences brought to bear upon the parents may be transmitted also to the offspring. If this is so, it opens one avenue of explanation of how structural modifications are effected and the possibility of evolution is created. But at the present moment the whole question is being investigated and discussed.

Just as every complex animal can be shown to be derived during development from a simple microscopic cell or egg, so the study of evolution reveals the fact that all animals were originally derived from microscopic unicellular animals known as protozoa, which are with difficulty distinguishable from unicellular plants, from which all the varied forms of complex vegetable life were derived. It is equally certain that these unicellular plants and animals are themselves only the specialized descendants of common ancestors—unspecialized unicellular organisms which are neither strictly vegetable nor animal. But we are quite in the dark as to the processes whereby these most primitive living organisms were evolved from inorganic matter, and how they acquired these peculiar properties of growth and differentiation and their powers of reproduction, commonly called vital, which are their distinctive characteristics. Bibliographical references to most of the matters mentioned in this article will be found in the Presidential Address to Section H of the British Association for the Advancement of Science, Dundee meeting, 1912.—Cf. *Evolution in the Light of Modern Knowledge*; *a Collective Work* (Blackie & Son).

EV'ORA, a town in Portugal, capital of the province of Alemtejo, 75 miles east of Lisbon. It is an ancient place, poorly built, and its walls, citadel, and forts are all in a state of ruin. It has a Roman aqueduct still serviceable, a Gothic cathedral, and an ecclesiastical seminary. Pop. 22,061. The district of Evora has a pop. of (1930), 180,852, and an area of 2,856 sq. miles.

EVREMOND, or **EVREMONT.** *See* ST. EVREMOND.

EVREUX (ev-*reu*), a town of N.W. France, capital of the department of Eure, in a fertile valley on the Iton. It is an ancient town with narrow streets and has many fine buildings, including an ancient Gothic cathedral. The town was frequently occupied by the English in the fifteenth century. Pop. 19,315.

EWALD (ā'vâlt), **Georg Heinrich August von,** a German Orientalist and Biblical critic, born at Göttingen 16th Nov., 1803, died there 5th May, 1875. After studying at the uni-

versity of his native town, in 1827 he became extraordinary, in 1831 ordinary professor of theology, and in 1835 professor of Oriental languages. In 1837 he lost his chair at Göttingen on account of his protest against the king's abrogation of the liberal constitution, became professor of theology at Tubingen, but in 1848 returned to his old chair at Göttingen. When Hanover was annexed by Prussia in 1866 he became a zealous defender of the rights of the ex-king. Among his chief works are the following: *Complete Course of the Hebrew Language*, *The Poetical Books of the Old Testament*, *History of the People of Israel*, *Antiquities of the People of Israel*. The *History* is considered his greatest work.

EWALD (ā'vält), **Johannes**, Danish poet, born at Copenhagen in 1743, died in 1781. After studying theology at Copenhagen University he ran away and enlisted in the Prussian service, which he soon deserted for the Austrian. On his return to Copenhagen an elegy which he wrote on the death of Frederick V of Denmark was received with general admiration, and awoke in himself the consciousness of poetic talent. His reputation rapidly increased with the publication of his tragedies, *The Death of Balder* (English translation by George Borrow), *Adam and Eve*, and *Rolf Krage*; and his odes and songs, notable amongst which are: *King Christian* and *Liden Gunver*. Ewald, who had dissipated habits, died in utter poverty. His collected works were published in 1914.

EWART, James Cossar, zoologist, was born at Penicuik, Midlothian, in 1851, studied medicine at Edinburgh University, graduated in 1874, and was soon after appointed demonstrator of anatomy in the university. From 1875 to 1878 he was Conservator of the museums of University College, London, in the latter year took his M.D. degree, and from 1878 to 1882 was professor of natural history in Aberdeen University, being then appointed to the natural history chair at Edinburgh. Since then (having been also connected with the Scottish Fishery Board for about ten years) he has devoted much attention to the question of fish-culture and preservation, and has visited North America, Denmark, and Norway for purposes of investigation. He has also carried out experiments in the hybridization of zebras and horses. His publications include: *The Locomotor System of the Echinoderms* (with G. J. Romanes, 1881); *The Natural and Artificial Fertilization of Herring Ova* (1884); *On Whitebait* (1886); *On the Preservation of Fish* (1887); *The Electric Organ of the Skate* (1888–9); *The Cranial Nerves and Lateral Sense-organs of the Elasmobranchs* (1889–91); *The Development of the Limbs of the Horse* (1894); *The Penicuik Experiments* (1899); *Guide to Zebras, Hybrids, &c.* (1900); *Multiple Origin of Horses and Ponies* (1904).

EWING, Sir James Alfred. Scottish scientist. Born in Dundee, 27th March, 1855, and educated at the University of Edinburgh, he began his lifework as assistant to Lord Kelvin. His first important post was Professor of Engineering at Tokio, 1878–83. From 1883–90 he was Professor at University College, Dundee, and from 1890 to 1903 Professor of Mechanism and Applied Mechanics at Cambridge. In 1903 he was made Director of Naval Education, and in 1916 Principal of Edinburgh University. He retired in 1929. During the Great War Ewing was a member of the explosives committee. His many honours include a knighthood (1911), an F.R.S., and the presidency of the Royal Society of Edinburgh. Ewing has done much for the improvement of electrical apparatus.

EXALBUMINOUS SEEDS, those which, when ripe, contain no endosperm, this having been entirely absorbed into itself by the developing embryo. Opposed to albuminous seeds. *See* COTYLEDONS.

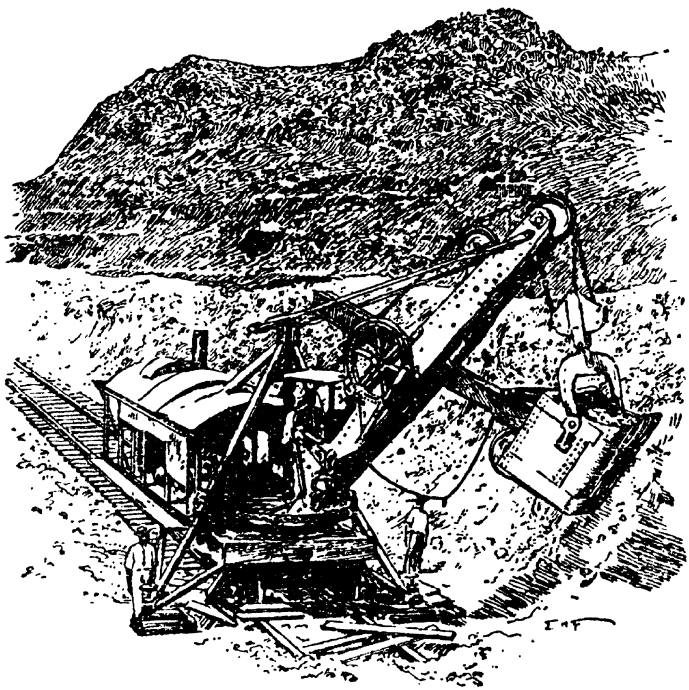
EXAMINER OF PLAYS, a British official and censor of plays, who acts for the Lord Chamberlain, under whose jurisdiction the theatres are placed. No play can be produced without the sanction of the examiner, to whom a copy of every new play intended for production must be sent seven clear days before the first performance. The examiner either grants or refuses his licence, and frequently insists upon an alteration of the text. The abolition of this censorship of plays is a subject which in recent years has given rise to much discussion in the theatre-loving world.

EXANTHE'MATA (eruption of the skin), a term applied to infectious diseases with skin eruptions, accompanied by general disturbances. The term includes scarlet fever, measles, German measles, smallpox, chickenpox, and others.

EXARCHATE (egz-ār'kāt), a name of a province or territory under an *exarch*, or viceroy. In the sixth century after Christ Justinian formed the middle part of Italy into a province of the Eastern Empire, and gave the government of it to an *exarch*. (*See* RAVENNA.) Exarch was

also the title of an ecclesiastical grade in the Greek Church, inferior to the patriarchs but superior to the metropolitans. Among the modern Greeks an *exarch* is a deputy of the patriarch, who travels about in the provinces and visits the bishops and churches.

EXCALIBUR, magic sword of King Arthur. It was given to him by the Lady of the Lake to ensure his



Excavating the Culebra Cut, Panama Canal

immunity from severe wounds and loss of blood. After his final defeat King Arthur caused Excalibur to be cast into the lake, whence a hand arose and drew it from sight.

EXCAM'BION, in Scots law, the name given to the contract by which one piece of land is exchanged for another.

EXCAVATION, the process of removing soil or rock in engineering or exploration works, such as for docks, retaining-walls, railway cuttings, canals, foundations, &c. On a small scale, or in situations unsuitable for machinery, it is performed by hand, the soil being first loosened by the pick, and then shovelled into barrows. In rocky soils, drilling and explosives may be employed. In large works power shovels or 'steam-navvies' are employed, which are essentially cranes carrying a large shovel, or a system of steel buckets of the dredger type. These carry their own means of propulsion, and run on temporary rails laid down as the work proceeds. They work against the face of the excavation, and load directly into bogies or wagons.

EXCAVATIONS. The forgotten history of the remote past has been reconstructed by those scientists who have explored the sites of ancient seats of civilization. Egyptian and Babylonio - Assyrian investigations date from the middle of the eighteenth century, but it was not until the middle of the nineteenth century, when modern scholars first penetrated

the secrets of the lost languages (*see* CUNEIFORM WRITING and HIEROGLYPHICS) that the ancient civilizations were rendered more or less articulate. As the texts were being deciphered with increasing ease and accuracy, a basis was provided for archæology, and it became possible to frame chronological systems. During the latter years of the nineteenth and the early years of the present century, excavators, philologists, and ethnologists provided a fairly continuous and detailed history of man from 3000 B.C. till classical times, thus bridging a gulf which used to be misty with doubtful legends and traditions.

Dramatic excavations were those begun by Heinrich Schliemann in 1871 at Hissarlik, the site of ancient Troy. On the hillock he dug through nine successive settlements. He afterwards excavated at Mycenæ and Tiryns in Greece and found evidence of a high pre-Hellenic culture. Following up the clues thus afforded, Sir Arthur Evans and others, excavating in Crete during the opening years of the present century, discovered abundant relics, including palaces and towns, of the earliest Ægean civilization now referred to as Minoan (*see* CRETE). Of late years Central and Western Europe have yielded evidence of the "drift" of Minoan culture to out-lying parts. Excavations in Russian Turkestan and Chinese Turkestan have revealed traces of ancient culture centres dating back beyond 2000 B.C. In Egypt one of the most amazing archæological discoveries of modern times was the excavation of Tutankhamen's tomb in 1922 by Mr. Howard Carter and Lord Carnarvon.

New discoveries are being unearthed continually in Central America. One city, known as Calakmul, was discovered in 1931. The ruins are elaborate, delicately carved, stone-built erections, almost rivalling those found in Egypt. They were built by the Mayan race, who dwelt in the American continent before the Christian era.

In Palestine also many excavations have been carried out within recent years. The discoveries made during the last few months are astounding. The lost cities of Sodom and Gomorrah have been found and made to reveal their secrets. The site of the City of David has been uncovered, and on or near the site of the House of Caiaphas, a complete series of ancient Hebrew weights and measures have been found. The site of Mamre has been uncovered, and also the library city of Kirjath-Sephar in Southern Palestine. In Mizpeh has been found a cistern believed to be the well into which Ishmael threw Gedaliah after he had slain him. In Samaria the remains of Ahab's ivory palace have been laid bare, while at Capernaum has been unearthed the remains of a church known as the church of the Multiplication of the Loaves and Fishes, the reputed scene of the miracle of the Feeding of the Five Thousand.

A very important discovery was made in 1933 by Sir Flinders Petrie, who solved a problem of history which has puzzled the world for hundreds of years. By means of excavations at Gaza he revealed the identity of the people who founded the seventh and eighth Egyptian dynasties. These people, a strong and powerful race with great skill in building, were native to the Caspian shores, and the discovery enabled the archæologist to trace Egyptian culture back to Neolithic man. *See* BABYLONIA; CRETE; EGYPT; TROY.

EX'CELLENCY, a title given to ambassadors and plenipotentiaries, governors of colonies, the President of the United States, of France, &c.

EXCESS PROFITS DUTY, devised in 1915 to meet the extraordinary expenditure occasioned by the war, is a tax upon the profits of certain trades and businesses carried on in the United Kingdom, or owned or carried on abroad by persons resident in the United Kingdom, in so far as these profits, after deduction of a specified allowance, exceed a pre-war standard. The main exceptions are agriculture, offices and employments, and professions where personal qualifications predominate and only small capital is necessary. In some cases, e.g. estate agencies, where a portion of the profits arises from professional skill, only the portion otherwise arising falls into charge.

The pre-war standard is an alternative one at the option of the taxpayer. Firstly, it may be a profits standard—the average of the profits of any two of the last three pre-war years, or if there have been only two pre-war years, then the average profits of those years, or the actual profits of the last year, or if there has been only one pre-war year, then the actual profits of that year. Where the average profits of the last three pre-war years are 25 per cent less than the average of the three years immediately preceding them, the taxpayer may take the average of any four of those six years. Secondly, it may be, and as a general rule where the business has not had one full pre-war year must be, a percentage standard, calculated at the appropriate rate on the capital in the business at the end of

the last pre-war trade year, or where there has not been one pre-war year, then on the average amount of capital employed (*a*) during the year or accounting period in question, or (*b*) in respect of periods ending after 31st Dec., 1919, during the first accounting period.

The percentage standard of sole traders, partnerships, and private companies may in respect of accounting periods ending after that date be increased by £500 per annum for each working proprietor, but not so as to exceed £750 per annum each. The general free allowance is £200, increased in 1920 to £500 for new or re-opened businesses of ex-service men. A further abatement is now granted where profits do not exceed £400, with the result that liability cannot arise unless profits exceed £832.

The rate of duty, at first 50 per cent, was raised to 60 per cent in 1916, and to 80 per cent in 1917. Reduced to 40 per cent in 1919, it was again increased to 60 per cent by the Finance Act, 1920. Farmers and professional men were exempt. It was abolished in 1921. In 1920–21 the tax produced £186,000,000. Undoubtedly it was injurious to trade and an incentive to wasteful expenditure, but an effective substitute for supplying the unparalleled financial needs of the State resulting from the war apparently could not be devised. A similar tax was introduced in the British Dominions and some foreign countries.

'Munitions Levy' applied to Government-controlled establishments for the production of munitions of war.

In the fiscal year 1919–20 the tax and levy produced £290,045,000, and in the fiscal year 1930–31 the Excess Profits Duty and the Corporation Tax produced £3,000,000.

EXCHANGE, a place in large commercial towns where merchants, agents, bankers, brokers, and others concerned in commercial affairs meet at certain times for the transaction of business. The institution of exchanges dates from the sixteenth century. They originated in the important trading cities of Italy, Germany, and the Netherlands, from which last-named country they were introduced into England. The Royal Exchange of London was established by Sir Thomas Gresham in 1556, but this is no longer used for its original purposes. In some exchanges only a special class of business is transacted. Thus there are stock exchanges, corn exchanges, coal exchanges, cotton exchanges.

EXCHANGE, in commerce, that species of transactions by which the debts of individuals residing at a distance are cancelled by order, draft, or bill of exchange, without the transmission of specie. Thus, a merchant in London who owes £100 worth of cotton goods in Glasgow gives a bill or order for that amount which can be negotiated through banking agencies or otherwise against similar debts owing by other parties in Glasgow who have payments to make in London. The creditor in Glasgow is thus paid by the debtor in Glasgow, and this contrivance obviates the expense and risk of transmitting money.

The process of liquidating obligations between different nations is carried on in the same way by an exchange of foreign bills. When all the accounts of one country correspond in value with those of another, so that there is an even balance, the exchange between the countries will be *at par*, that is, the sum for which the bill is drawn in the one country will be the exact value of it in the other. Exchange is said to be *at par* when, for instance, a bill drawn in New York for the payment of £100 sterling in London can be purchased there for £100. If it can be purchased for less, exchange is *under par* and is against London. If the purchaser is obliged to give more, exchange is *above par* and in favour of London. Although the numerous circumstances which incessantly affect the state of debt and credit prevent the ordinary course of exchange from being almost ever precisely at par, its fluctuations are confined within narrow limits, for since the Great War most countries have gradually stabilised their currencies. If direct exchange is unfavourable between two countries this can often be obviated by the interposition of bills drawn on other countries where an opposite state of matters prevails. Rate of exchange is influenced by trade balances, the volume of gold in a country, &c. *See* BILL OF EXCHANGE.—BIBLIOGRAPHY: G. J. Goschen, *Theory of Foreign Exchange*; H. Withers, *Money Changing*.

EXCHANGE, DEED OF, in English law, an original common law conveyance for the mutual transfer of real estate. It takes place between two contracting parties only, although several individuals may be included in each party; and the parties must take an equal estate, as fee-simple for fee-simple, legal estate for legal estate, copyhold for copyhold of the same manor, and the like.

EXCHEQUER (Fr. *échiquier*, chessboard), in Britain, the department which deals with the moneys received and paid on behalf of the public ser-

vices of the country. The public revenues are paid into the Bank of England (or of Ireland) to account of the Exchequer, and these receipts as well as the necessary payments for the public service are under the supervision of an important official called the Comptroller and Auditor General, the payments being granted by him on receipt of the proper orders proceeding through the Treasury. The public accounts are also audited in his department. The Chancellor of the Exchequer, who must be a member of the House of Commons, is the head of the Treasury Department. When the Prime Minister is a member of the House of Commons, he sometimes holds the office of Chancellor of the Exchequer.

EXCHEQUER, COURT OF, an ancient English court of record, established by William the Conqueror, and intended principally for the care and collection of the royal revenues. It was one of the supreme courts of common law, and is said to derive its name from the chequered cloth, resembling a chess-board, on which the sums were marked and scored with counters. The judges of this court were the chief baron and five junior or *puisné* barons. This court was abolished by the Judicature Act of 1873, and its jurisdiction transferred to the High Court of Justice. In Canada there is a Court of Exchequer for the Dominion.

EXCHEQUER AND AUDIT DEPARTMENT, a department of the English Civil Service charged with the functions of auditing the accounts of all other departments.

EXCHEQUER BILLS, bills of credit issued by authority of Parliament as a means of raising money for temporary purposes. They are of various sums—£100 or any multiple—and bear interest at a rate fixed for every half-year according to the rate ruling in the money-market at the time. These bills pass from hand to hand as money, and form part of the public unfunded debt of Great Britain. **Exchequer bonds** are similar, but they run for a definite number of years (six at most) at a fixed rate of interest.

'EXCISE', an inland duty or impost laid on commodities produced and consumed within a country, and also on licences to manufacture and deal in certain commodities. Excise duties were introduced into England by the Long Parliament in 1643, being then laid on the makers and vendors of ale, beer, cider, and perry. Being found to be a convenient and productive source of revenue, they continued to gain ground, and in 1932 yielded £68,710,020. In Britain the excise includes duties on spirits and beer, licences on dogs, guns, carriages, servants, plate, railways, game, &c. In 1917 an excise duty was laid on entertainments, matches, and table waters. Spirits and beer yielded (1932) nearly £99,000,000.

EXCI'TO-MOTOR ACTION, the action of nerves distributed to muscular organs, the stimulation of which leads to movement. Thus, irritation of a nerve supplying a muscle will lead to contraction of the muscle by excito-motor action, and irritation of certain nerves distributed to blood-vessels will lead to contraction of the vessel by acting on its muscular coat.

EXCLUSION, BILL OF, a bill introduced into the British Parliament during the reign of Charles II for the purpose of excluding the Duke of York (afterwards James II), he being a Roman Catholic, from the throne.

EXCOMMUNICATION, the exclusion of a Christian from the communion and spiritual privileges of the Church. Excommunication was a recognized penalty among the Jews (*John* ix, 22), and was practised early by the Christian Church. A distinction gradually arose between a lesser and a greater excommunication, the former being a suspension from Church privileges, the latter a formal expulsion excluding from all communion with the faithful. In the Middle Ages the Popes often excommunicated whole cities and kingdoms. In such a case all religious services ceased, and the grave inconveniences thus caused made excommunication a formidable weapon in the hands of the Pope, till with frequent abuse it lost its force. Besides excommunication an extreme degree of denunciation called *anathema*, and cutting the offender off from all the hopes and consolations of the Christian faith, is used in the Roman Catholic Church. Both Luther and Calvin were in favour of the right of excommunication by the ministers of the Church. In the Church of England both the less and the greater excommunications are recognized.—Cf. E. Taunton, *The Law of the Church.*

EXCRE'TION, in physiology, the separation and carrying off of waste matter from some organ of an animal body, a function performed by the lungs, kidneys, and the skin, besides the action of the intestinal canal.

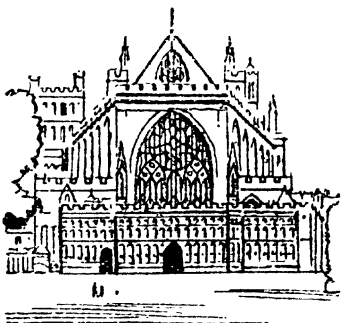
EXCUBITO'RIUM, in mediæval churches, a gallery where public watch was kept at night on the eve of some festival, and from which the great shrines could be seen.

EXE, a river of England, which rises in Exmoor, in the county of Somerset, and after a southerly course

of about 50 miles falls into the English Channel at Exmouth.

EXECUTION, in law, is a judicial writ grounded on a judgment of the court by which the writ is issued, and is granted for the purpose of carrying the judgment into effect, by having it executed. Execution is granted by a court only upon the judgments given by the same court, not upon those pronounced by another. *See* ELEGIT; FIERI FACIAS.

EXECUTIONER, the official who carries into effect a sentence of death, or inflicts capital punishment in pursuance of a legal warrant. In England the duty of executing the extreme sentence of the law devolves upon the sheriff, and in Scotland on the civic magistracy, but in practice the duty is performed by another in presence of those functionaries In the reign



Exeter Cathedral—West Front

of James I Gregory Brandon was the executioner of London, and hence the name Gregory has often been employed to designate executioners. In France the executioner is styled Monsieur de Paris.

EXEC'UTIVE, that branch of the government of a country by which the laws are carried into effect or the enforcement of them superintended. The term is used in distinction from the *legislative* and the *judicial* departments.

EXECUTOR, in law, is one appointed by a man's last will to carry its provisions into execution after the testator's death. The testator may by the English law appoint any person of sound mind and discretion, though otherwise under some legal disabilities as to contracting and transacting business in general, such as a married woman, or a minor. When, however, an infant is appointed sole executor the Judicature Act, 1925, provided that administration of the estate shall be granted by the court to the infant's guardian or some other fit person until the infant attains the age of twenty-one, when probate of the will may be granted to the infant, and until then the infant is for no purpose an executor. A trust corporation or a company, e.g. a bank, is commonly also made an executor. The duties of executors and of administrators, who are collectively called 'personal representatives,' are in general the same, the difference in the two depending mostly on the mode of appointment. The executor is nominated by the testator, the administrator by the High Court.

EX'ETER, a county of a city, river-port, and municipal borough of England, county town of Devon, on the left bank of the Exe, 10¼ miles north-west of its outlet in the English Channel. It is pleasantly situated on the summit and slopes of an acclivity rising from the river, and has handsome squares, terraces, and streets. The chief architectural feature is the cathedral (founded in 1112), a long, low building with fine west front, unique in having two towers forming its transepts, and only these two. The city has remains of the old castle and old walls, Guildhall, Albert Memorial College, training college, and St. Michael's Church. There are iron-foundries, works for agricultural implements and paper, and 'Honiton' lace is made. By a canal vessels of 300 tons can reach the city. The largest vessels remain at Exmouth.

Exeter is a place of remote antiquity, having been a British settlement long prior to the invasion of the Romans, by whom it was called *Isca Damnoniorum.* It was taken by William the Conqueror in 1068. It long returned two members to Parliament, but lost one of them in 1885. Pop. (1931), 66,039.

EXETER COLLEGE, Oxford, a college, originally called Stapledon Hall, founded in 1314 by Walter de Stapledon, Bishop of Exeter, who made a foundation for a rector and twelve fellows. In 1404 Edmund Stafford, Bishop of Exeter, added two fellowships and obtained leave to give the college its present name.

EXETER HALL, a large building on the north side of the Strand, London, opened in 1831, and capable of containing over 3,000 persons. In it the 'May Meetings' of the several religious societies were held. It was sold in 1907 by the Young Men's Christian Association to a firm of caterers, who demolished it in 1908. The Strand Palace Hotel now stands on its site,

EXETER, MARQUESS OF, English title borne by the family of Cecil.

John Holland, half-brother of Richard II, was made Duke of Exeter in 1397, but he was executed in 1400. **Thomas Beaufort** was duke from 1416 to 1425, and in 1443 **John Holland,** son of the former duke, was created duke. In a few years, however, the title was again extinct.

In 1525 **Henry Courtenay** was made Marquess of Exeter, but he lost the title when he was executed in 1538. In 1605 **Thomas Cecil,** Lord Burghley, was made Earl of Exeter, and in 1801 the 10th earl was made a marquess. The title has since been held by the Cecils. The eldest son of the marquess is called Lord Burghley and his seat is Burghley House (q.v.). **Lord Burghley** (born 1905), son of the 5th marquess, is a famous athlete, proving himself, at the Olympic Games and elsewhere, one of the greatest hurdlers of the age. In 1931 he was elected Conservative M.P. for Peterborough.

EXFOLIATION is the scaling off of dead tissues; thus there may be exfoliation of the skin, of bone, or of other parts from their living surroundings.

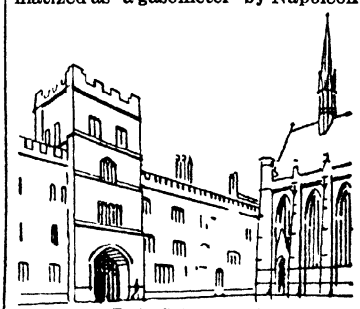
EXHIBITION, a fixed sum given for a term of years from the funds of a school, college, or university, generally upon the result of a competitive examination. An exhibition, no matter what its pecuniary value, is less of a distinction than a scholarship. At Cambridge an exhibitioner has no standing in his college different from that of the ordinary 'pensioner,' while a scholar is on the Foundation of his college.

EXHIBITIONS. The earliest recorded 'exhibition,' in the modern acceptation of the word, is that in which, for one hundred and eighty days, Ahasuerus "shewed the riches of his glorious kingdom" at Shushan (*Esther* i, 2–4). The first European exhibition was held at Venice in 1268; while the great fairs of Leipzig and Nijni-Novgorod partook of the same nature.

But the real forerunner of the modern exhibition was that held in London by the Society of Arts in 1756, when carpets, china, and similar artistic objects were displayed. This was followed in 1761 by an exhibition of agricultural machinery. In 1797 France held a display of *objets d'art* at St. Cloud; there was another two years later at the Louvre; while a third in 1802 is memorable for the first issue of an official catalogue, and for the presence of Montgolfier the aeronaut, and Jacquard the inventor of the loom that bears his name, among exhibitors.

Besides the exhibition of Irish industries, held at Dublin (1829), and the Birmingham exhibition of metal-work (1849), numerous displays were held in both Europe and America before the first International or 'Great' Exhibition of 1851. This memorable display was under the active patronage of Prince Albert, and for its accommodation the Crystal Palace was erected in Hyde Park. Its success gave the exhibition movement an impetus which produced examples at New York and Dublin (1853), both of which proved financial failures; at Munich and Melbourne (1854); Paris (1855); and at South Kensington, where was held the second International Exhibition (1862).

Five years later, after Constantinople, Oporto, and Agra had, among other places, held displays, came the great Paris Exhibition, planned on a colossal scale; though the main building in the Champ de Mars was stigmatized as 'a gasometer' by Napoleon III. Vienna had a magnificent but financially disastrous exhibition in 1873, and in 1876 Philadelphia celebrated the centenary of the Independence of the United States by a display. In 1878 Paris held another exhibition, for which the Trocadero was built. A series held at South Kensington (1871–4) had only a moderate success, but great popularity was attained by the 'Fisheries,' 'Health,' 'Inventions,' and Colonial Exhibitions held in the years 1883–6. Edinburgh was the scene of a forestry display in 1884, and at the same time New Orleans opened an exhibition which continued till the following year. The Paris Exhibition of 1889 was notable for the 'side-shows,' which included the Eiffel Tower; while the financial result of that held in 1900, which covered 550 acres of ground and admitted thirty-nine million people, was far from satisfactory. Meanwhile Chicago held in 1893 celebrated the four hundredth anniversary of Columbus's discovery of America by a huge 'World's Fair.'



Exeter College, Oxford

The present century opened inauspiciously with the assassination of President McKinley at the Pan-American Exhibition at Buffalo (1901); Glasgow had a thoroughly successful exhibition the same year; St. Louis was the scene of another in 1904; while London organized the Franco-British Exhibition in 1908. This last owed much to the late Imre Kiralfy, who had directed many previous displays, and was the designer of the 'White City' at Shepherd's Bush, where in 1914 was held the Anglo-American Exposition. The British Empire Exhibition was held at Wembley, near London, in 1924 and 1925. The Chicago World's Fair was opened in June 1933. The British Industries Fair (promoted by the Government) is held annually in London and Birmingham.

EXHUMATION, act of taking a dead body from its burial place for purposes of examining it. In Great Britain it is illegal to disturb a grave, but an exhumation can be ordered by the Home Secretary if foul play is suspected, or for any other good reason. Bodies are also exhumed sometimes in order to be buried elsewhere, but this can only be done by consent of the authorities.

EX'ILE, a punishment by which a person is compelled to leave the city, province, or the country where he has previously resided. It is a punishment for State criminals.

EXMOOR', a wild and hilly district of England, in the extreme south-west of Somersetshire, extending also into Devonshire, formerly a forest.

EX'MOUTH, a town of England, in Devonshire, 10½ miles S.S.E. of Exeter, at the mouth of the Exe. It is picturesquely situated, and is one of the best-known sea-bathing places on the Devonshire coast. The chief industries are lace-making and the fisheries. Pop. (1931), 14,584.

EXMOUTH, Edward Pellew, Viscount, a British naval officer, born at Dover in 1757, died 23rd Jan., 1833. He went to sea at the age of thirteen, served as midshipman in the *Blonde* frigate during the American War, and greatly distinguished himself at Lake Champlain. In 1782 he was made a post-captain for a brilliant action in the *Pelican*, and on the outbreak of the war in 1793 was appointed to the command of the frigate *La Nymphe*. From this time till the peace in 1802 he was employed on active service. In 1804, on the resumption of hostilities, he was sent to take the chief command on the East India station, in the *Culloden*, of seventy-four guns: and here he remained till 1809, when he had attained the rank of vice-admiral. His next appointment was the command of the fleet blockading the Scheldt. In 1814 he was made Baron Exmouth with a pension of £2,000 per annum. In 1816 he was sent with a fleet to punish the Dey of Algiers for outrages committed, and to force him to give up his Christian captives and abolish Christian slavery. Along with some Dutch war vessels he bombarded the city for eight hours, and inflicted such damage that the Dey agreed to every demand. Three thousand Christian slaves were thus restored to liberty. Lord Exmouth was made a viscount and received honours from several of the European sovereigns, and the freedom of the City of London. In 1821 he retired into private life.

EXOASCINEÆ, a family of parasitic ascomycetous Fungi, distinguished by the absence of any definite fruit-body, the asci being produced in a layer on the surface of the host. The best known are *Exoascus Pruni*, the cause of the malformed fruits called 'bladder-plums' or 'pocket-plums,' and *E. turgidus*, which produces the abnormal tufts of branches on silver birch known as 'witches' brooms.'

EXOBASIDIINEÆ, a family of parasitic basidiomycetous Fungi, resembling the Exoascineæ in most respects, but producing badicia in place of asci, a remarkable instance of parallel evolution. The commonest British species is *Exobasidium Vaccinii*, which is frequent on cowberry (*Vaccinium Vitis-Idæa*) in Scotland. *E. vexans* is the cause of a serious disease of the tea-plant called 'blister-blight,' which is very destructive to the Assam plantations.,

EX'ODUS (Gr. *exodos*, a going out), the name given in the *Septuagint* to the second book of the *Pentateuch*, because it describes the departure of the Israelites from Egypt. The contents of the book are partly historical, describing the departure of the Israelites from Egypt, and partly legislative, describing the promulgation of the Sinaitic law. One of the difficulties connected with this book is that, according to Scriptural chronology, the residence of the Israelites in Egypt was only 215 years, and it seems incredible that in this time "the threescore and ten souls" who accompanied Jacob to Egypt could have become the two and a half millions who left with Moses.

EXOGAMY (Gr. *exo*, outside, and *gamos*, marriage), a term applied to the custom of allowing marriages only between members who do not belong to the same group. The study of exog-

amy is practically a branch of ethnology. The opposite of exogamy is endogamy, or prohibition of marriage outside the tribe. Exogamy, which among other causes may be ascribed to a desire of forming useful alliances with hostile tribes, is practised among Australian aborigines, Mongols, and American Indians, and the custom is widely distributed in various forms in all stages of civilization.—BIBLIOGRAPHY: Sir J. G. Frazer, *Totemism and Exogamy*; E. A. Westermarck, *The History of Human Marriage*.

EXOGENOUS PLANTS (eks-oj'e-nus), or **EXOGENS,** old names for Dicotyledons (q.v.).

EXOGENOUS STRUCTURES, in botany, are those which arise from superficial tissues of the parent organ, as stem-branches and leaves. Opposed to endogenous structures.

EXOPHAGY, custom among certain cannibal peoples of eating only the flesh of persons outside their own social group. Some eat relatives who have died naturally, to acquire their qualities, but slay for food only persons of another kin. The custom usually characterizes those forms of man-eating instigated by revenge, *e.g.* among the Maories in ancient times.

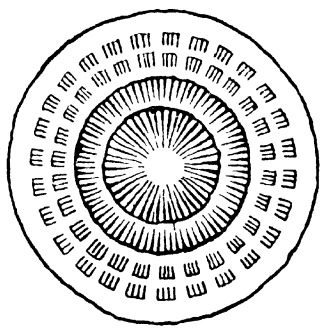
EX'ORCISM (Gr. *exorkizein*, to expel with an oath), the casting out of evil spirits by certain forms of words or ceremonies. An opinion prevailed in the ancient Church that certain persons, those particularly who were afflicted with certain diseases, especially madness and epilepsy, were possessed by evil spirits; this was called *demoniac possession*. Over such persons forms of conjuration were pronounced, and this act was called *exorcism*. There were even certain men who made this a regular profession, and were called *exorcists*. Exorcism still forms a part of the beliefs of some Churches. In the Roman Catholic Church exorcist is one of the inferior orders of the clergy.—Cf. Sir J. G. Frazer, *The Golden Bough*.

EXOSTO'SIS, in medicine, an excrescence or growth from one of the bony structures of the body. It is generally found at the end of long bones near the joints, and in connection with the skull.

EXOTHERMIC COMPOUNDS are compounds which evolve heat during their formation; these are usually stable compounds, as they must be supplied with a corresponding amount of heat for their decomposition.

EXOT'IC, belonging to foreign countries; a term used especially of plants. Exotic plants are such as belong to a soil and climate entirely different from the place where they are raised. They are nearly always greenhouse or hothouse plants.

EXPANSION, in physics, the increase of the dimensions of a body caused by a change of temperature. In general, bodies expand with rise of temperature, solids expanding least and gases most. This change in the dimensions of solids with temperature is expansion in length, area, and volume. These changes are referred to a unit called the coefficient of expansion, or expansion of unit length, area, or volume for 1° rise. For example, the coefficient of linear expansion of iron is ·000011; that is, a yard, say, of iron rod becomes longer by this fraction of a yard for each degree centi-



Section of Exogenous Plant

grade that its temperature is raised. The coefficient of volume expansion of a solid is three times its linear coefficient. Crystals have different rates of expansion along the three crystalline axes. Fused silica or quartz expands so slightly that it may be plunged when red-hot into water without being cracked. Invar, a nickel-steel alloy, which also has an extremely small coefficient of expansion, is used in making clock pendulums, which are unaffected by change of temperature. The observed expansion of liquids is affected by the expansion of the vessel containing them, and the apparent expansion of a liquid is thus always less than its real expansion. The expansion of water with rise of temperature is irregular; water contracts from 0° to 4° C., and thereafter expands at an increasing rate until the boiling-point is reached. The expansion of mercury and other liquids is employed in thermometry. Gases when kept at constant pressure expand by about $\frac{1}{273}$rd part of their volume at 0° C. for each degree rise.

EXPECTATION, in the doctrine of chances, the value of any prospect of prize or property depending upon the happening of some uncertain event. A sum of money in *expectation* upon a certain event has a determinate value before that event happens. If the chances of receiving or not receiving a hundred pounds, when an event arrives, are equal, then, before the arrival of the event the expectation is worth half the money.

Expectation of life, the number of years which a man or woman of any age may be expected to live. To calculate this with any reasonable degree of probability, it is necessary to have particulars of a large number of individuals. The earliest observations were based upon the records of the registers of certain towns. Out of a number of people alive at one date the numbers still living at the end of successive years were found, and an estimate of the probable duration of life was made. With increased facilities for collecting statistics of a larger number of lives, this estimate has since been modified. It is necessarily influenced by the progress of civilization, improved methods of sanitation, increased knowledge of the best methods of treating diseases, and other causes, but the collected statistics are now so numerous that the actuaries of life assurance offices have been able to prepare tables of mortality from which the cost of life premiums and the price of annuities are calculated.

EXPEC'TORANTS are drugs used to increase and liquefy the secretion in the lungs and air-passages. The most effective are ipecacuanha, squills, apomorphine, ammonium carbonate, and potassium iodide. Some of these are usually present in the many cough mixtures so widely used.

EXPER'IMENT, an operation designed to discover some unknown truth, principle, or effect, or to establish it when discovered. It differs from observation in the fact that the phenomena observed are, to a greater or less extent, controlled by human agency. Experiment distinguishes the modern method of investigating nature, and to it we owe the rapid made strides in chemistry and physics.

EXPERT' (Lat. *experiri*, to test), a person eminently skilled in any particular branch or profession; specifically, a scientific or professional witness who gives evidence on matters connected with his profession, as an analytical chemist or a person skilled in handwriting.

EXPLOITS, RIVER OF, a river which traverses nearly the whole of Newfoundland from S.W. to N.E., and falls into the Bay of Exploits. It is about 150 miles long, and is navigable for steamers for 12 miles.

EXPLO'SION, a sudden violent outburst accompanied by a loud noise, and giving rise to an impulsive wave which spreads outwards from the place of explosion. Generally applied to the very rapid combustion of explosive substances which, under the influence of heat or shock, are resolved with extreme rapidity into gaseous form. Substances are termed low explosives or high explosives according as they are set off by combustion or detonation.

EXPLOSIVE MECHANISM, in botany, (1) in flowers, an arrangement for the transference of pollen to an insect-visitor by a sudden movement of floral organs. (2) In fruits, an arrangement for the forcible expulsion of seeds from a fruit brought about in various ways (*see* SLING-FRUITS). The spores of Ferns, ascospores, and some conidia are also liberated explosively.

EXPLOSIVES. An explosive is a substance or mixture of substances which, by the action of a blow or of heat, can be converted very easily and suddenly into a more stable substance or substances, usually gaseous, with the simultaneous liberation of a large amount of heat. Explosives are divided into classes according to the uses to which they are put, but the line of demarcation is not always very clear. The industrial and blasting powders may be either low or high explosives. A 'low' explosive explodes by the application of heat, and burns more or less uniformly and slowly, and projects neighbouring objects to a distance. A 'high' explosive explodes under a blow, and the whole of the substance is instantly transformed, and instantly exerts its maximum pressure, creating a violent disturbance in a limited area without necessarily projecting substances to any great distance. Service explosives, for naval and military purposes, are divided into propellants and high explosives. Sporting powders are specially modified propellant powders. Examples of these classes of explosives, with notes on their composition, are given below.

Low Explosives. The best examples of the low explosive are gunpowder and similar mixtures. The constituents of the 'gunpowder' explosives are generally not explosive alone, but only when mixed. A 'gunpowder' mixture contains carbon or carbonaceous matter like wood-meal, hydrocarbons, starches, and sugars, &c., which burn owing to the presence of highly oxy-genated substances like peroxides, chlorates and perchlorates, nitrates, permanganates, chromates

and dichromates, all of which convey the necessary oxygen. In addition, there usually is present some very easily ignited substance like sulphur or sulphides, or phosphorus or phosphides, &c. As compared with other explosives, gunpowder or black-powder has certain advantages. It is cheap, easily ignited, insensitive to shock, and stable at moderately high temperature; it burns regularly, and its residue is non-corrosive. But it is weak in power, and produces much smoke. It is excellent for armour-piercing shell and for rings of time-fuses. Gunpowder made in different countries varies in composition, but for rifle, cannon, and sporting powders it usually contains 74 to 75 parts of saltpetre, 9 to 14 parts of sulphur, 12 to 16 parts of charcoal. For blasting powders less saltpetre and more charcoal is used.

Charcoal is made by the carbonization of wood. In England dogwood, alder, and willow woods are used; in Germany alder and willow are used; in France black alder and also white alder, poplar, aspen, birch, and hazel; in Switzerland hazel wood; in Spain oleander, yew, willow, hemp stems, and vine; in Italy hemp stems. The wood is generally carbonized in iron retorts. The product is allowed to cool out of contact with air, else it may inflame. Wood burnt for ordnance powders gives a yield of 20 to 30 per cent charcoal; that for small-arms gives a yield of 40 per cent. The charcoal contains from 68 to 85 per cent carbon, from 2·8 to 3·7 per cent hydrogen, from 12 to 27 per cent oxygen, and may have up to 5 per cent ash.

The saltpetre is found naturally in Chile, India, and in other countries, and is refined by crystallization from water. It is a colourless, crystalline solid. Sulphur, a pale-yellow solid, melting-point 113° C., boiling-point 444·5° C., is found in nature, and is refined to a purity of 99·5 per cent and over. It has a low ignition temperature of 261° C., and makes the powder burn more readily. Under the pressure of the press and the incorporating mill it flows and cements the minute particles of charcoal and saltpetre together. The three ingredients are ground, mixed, sieved, incorporated or mixed in drums or mills, broken down, and then pressed, corned or granulated, and glazed. Cannon powders receive an addition of graphite to reduce the rate of burning. The powder is then dried in a stove, finished in a reel to get rid of the last traces of dust, and blended. In the United States powder for blasting contains sodium nitrate instead of potassium nitrate. The powder is cheaper and stronger, but is hygroscopic. Sprengsaltpetre is largely used in Stassfurt salt-mines, where a mild explosive is required, and consists of 75 parts by weight of sodium nitrate, 10 parts by weight of sulphur, and 15 parts by weight of brown coal. It is cheap, and does not produce poisonous fumes. Bobbinite is largely used in coal-mines. It is black powder with ammonium and copper sulphates, possibly also starch and paraffin wax. When gunpowder explodes, the product consists of 43 per cent gases, 56 per cent solids, and the rest water. The composition of other industrial and blasting powders is given in the sequel.

Propellant Explosives. The chief propellants are nitrocellulose, also called nitrocotton or guncotton, and nitroglycerine.

Nitrocellulose. The chief sources of cellulose are wood and cotton. When cotton is plentiful, nitrocellulose is made as follows. Cotton-waste is hand-picked to get rid of string, wood, &c.; it is opened out by a teasing-machine, which tears off small portions at a time, and the cotton is then dried to about 0·5 per cent moisture content. The cotton is then nitrated with 'mixed acid'—a mixture of about 16 per cent nitric and 75 per cent sulphuric acid and about 8 per cent water—at 15° to 25° C. After the nitration, the acid is removed and the nitrocotton boiled up in water to stabilize it. Generally nitrocotton contains about 12 to 13 per cent. of nitrogen. Wet nitrocotton is quite safe although it can be detonated, but dry nitrocotton is very dangerous. To-day, paper is usually made from wood-pulp, and when the cotton supplies of Germany were stopped during the European War, nitrocellulose had to be made from wood-pulp via a form of paper crêpe prepared by the Germans from the pulp. For propellant purposes the nitrocotton is 'gelatinized,' either alone or mixed with nitroglycerine, and is then worked up into different forms, such as wire, rods, grains, or tape, when it becomes controllable at will, so that the firing is not dangerous.

Nitroglycerine. Mixed acid, containing 41 per cent nitric acid and 57·5 per cent sulphuric acid, is brought to 22° C. by cooling coils of brine, and pure glycerine is injected into the acid at such a rate that no glycerine accumulates unchanged, and that the temperature is kept between 15° and 22° C. When all the glycerine has been added, the liquid is allowed to stand, and the nitroglycerine rises to the surface. It is run off to the wash-house, where it is washed free from acid and settled. The process is a dangerous one, and great care must be taken at every stage of the manufacture. The floors of the plant must be free from grit

and dirt, no accumulation of liquid should be allowed anywhere, special clothing and rubber boots must be worn, no metallic implements may be used, and the plant should not be handed over for repairs except under the supervision of a responsible person. Nitroglycerine, when absorbed in a porous earth called 'Kieselguhr,' is called dynamite. Kieselguhr, or simply guhr, absorbs twice its weight of nitroglycerine; cork charcoal absorbs nine times its weight. Dynamite cartridges are generally exploded by detonators.

Preparation of Cordite; Nitrocellulose Tape (N.C.T.); Ballistite; &c. For cordite, the nitro-cotton, freed from moisture, is mixed with nitroglycerine, and the paste or the cotton itself, if N.C.T. is to be made, is incorporated into a uniform dough with ether and alcohol. Some mineral jelly is added to render the explosive more stable. The dough is pressed through different sizes of dies according to the product desired. For rifle powder fine cords are used; for artillery, thicker cords or flat ribbons of varying thicknesses are required. The cords or tapes from the dies are cut into suitable lengths, the solvents driven off, and the products blended to obtain uniform ballistic quality. For ballistite the nitrocellulose is beaten up with nitroglycerine in water. The paste is freed from water, dried, and worked into horn-like sheets by means of rollers.

High Explosives; Picric Acid. At the outbreak of the European War the chief high explosive of the Entente Powers was lyddite (in France, mélinite), also called trinitrophenol or picric acid. It is a bright-yellow solid, melting point 122° C., sparingly soluble in water, and forms easily exploded metallic salts. It is now displaced by trinitrotoluene. Picric acid is made from phenol or carbolic acid. Phenol is obtained from coal-tar, or made synthetically from benzene. The phenol is sulphonated with strong sulphuric acid, and the phenol-sulphonic acid resulting is nitrated with strong nitric acid at about 100°C. Picric acid separates, and is washed free from mineral acid and dried. It may also be made from benzene without converting it into phenol thus: The benzene is chlorinated and gives chlor-benzene. This is nitrated into dinitrochlor-benzene, and is then treated with caustic soda to give dinitrophenol. This is then further nitrated into trinitrophenol or picric acid. Picric acid has a high melting-point, it must be used pure, is dissolved by water, it attacks metals forming dangerous compounds, and requires troublesome plant for its manufacture. Hence it has been displaced by more suitable substances, notably by trinitrotoluene.

Trinitrotoluene (T.N.T.). This compound may now be made in a continuous plant. Mononitrotoluene is put in at one end of the plant and comes out as trinitrotoluene. Mixed nitric and sulphuric acid is put in at the end where the T.N.T. is obtained, and emerges, where mononitrotoluene is put in, as waste acid. T.N.T. in the past has also been made discontinuously thus: The toluene is nitrated by mixed acid into either mono- or dinitrotoluene, which is then trinitrated. The conversion into mononitrotoluene was used in the United Kingdom, France, Germany, Canada, and America; the conversion into dinitrotoluene was used in Italy. The T.N.T. emerges liquid, and is passed over a rotating drum internally cold water cooled. A knife strips the thin congealed skin of T.N.T. off. This T.N.T. is only grade 3, and for conversion into grade 1 it must be purified. Formerly this was done by means of an organic solvent, but this dangerous and expensive method has been displaced by treatment either with phenol or sodium sulphite, which gives a grade 1 product. T.N.T. is a very pale yellow solid, melting-point 80·2° C., and therefore, melted by hot water, almost insoluble in water, burns quickly in the air, is inert, and comparatively safe to handle. It has displaced picric acid owing to its superiority, physically and chemically, over that substance.

Tetryl or C.E. (Composition-Exploding). Tetryl, also called tetranitrodimethylaniline, or more correctly trinitrophenylmethylnitramine, is a powerful high explosive, and is thus obtained. One part of dimethylaniline is dissolved in 10 parts of strong sulphuric acid, and the solution allowed to flow into strong nitric acid. The temperature should be kept below 40° C., else decomposition may occur. After nitration the yellow tetryl separates out, and is filtered off and water-washed till free from acid. It is then dried in hot-air stoves. Tetryl is much more dangerous than T.N.T., and is also more poisonous to handle. No other nitro-bodies were made in England on the large scale during the European War, but on the Continent, owing to the scarcity of raw materials, dinitrobenzene, dinitrotoluene, and nitronaphthalenes, and even less important nitro-bodies, were made. Their manufacture is similar to that of those already described. Probably none of these nitro-bodies so pressed into use is as good as T.N.T.

Detonating Substances. Though modern explosives are not easily exploded by a blow, they are sensitive

to shock of given intensity, and lesser or different shocks will not suffice. The 'detonator' to produce the shock is set into the explosive. A complete shell carries two detonators. One, in the percussion cap, sets off the propellant charge which expels the projectile; the other, in the fuse in the nose of the shell, is ignited by the discharge of the gun, and detonates the high-explosive filling at a set interval after the discharge of the shell. Therefore, the shell can be exploded either in its flight when it is used as shrapnel shell, or on its arrival at its objective when it can be used for small-calibre artillery shell for field-guns, &c., or after its arrival when it is used for heavy howitzer and armour-piercing shell for destroying entrenched works, armoured forts, or ships. The manufacture of detonators is a very dangerous and delicate operation. Some substances (the copper acetylides) explode by a scratch, some (nitrogen iodide) by the touch of a feather or the tread of a fly, some explode even in solution when poured from one vessel into another (diazobenzeneperchlorates). Mercury fulminate is more often employed in the detonator, and is prepared from mercury, alcohol, and nitric acid. It is expensive, and most modern detonators consist of lead azide or salts of styphnic acid, with a layer of T.N.T. in a narrow aluminium cylinder.

The following is a list of the more important explosives, the different groups not being mutually exclusive:—

Coal-mine Explosives

American.

Aetna Coal-mine Powder A, B, C: nitroglycerine explosive.

Black Diamond: 2A, 3A, 6L.F are nitroglycerine explosives; 5, 7, 8, ammonium nitrate explosives.

Carbonite: nitroglycerine 26, barium nitrate 4, potassium nitrate 29, wood-meal or starch flour 40, calcium carbonate 0·25.

Du Pont Permissible: nitroglycerine, ammonium nitrate, common salt.

Eureka: nitroglycerine and hydrated salt.

Monobel: ammonium nitrate, nitroglycerine, wood-meal, alkali chloride.

Red H1–7: ammonium nitrate explosives.

Trogan Coal Powder: contains nitrostarch.

Austrian and Hungarian.

Chloratit: during war was used in coal-mines.

Dynammon: ammonium nitrate, potassium nitrate, red charcoal.

Paunomite: nitroglycerine, collodion cotton, ammonium nitrate, dextrin, glycerine, nitrotoluene, alkali chloride.

Titanite: Ammonium nitrate, trinitrotoluene, curcuma charcoal.

Belgian.

Alsilite: ammonium nitrate, trinitrotoluene, ferrosilicon-aluminium, salt.

Baellnite: ammonium-nitrate, trinitrotoluene.

Densite: alkaline nitrates, trinitrotoluene, dinitrotoluene, and ammonium chloride.

Favier Explosives: mixtures in varying proportions containing ammonium nitrate, nitronaphthalene, paraffin, and resin; higher nitrated naphthalenes, potassium nitrate, and tetryl may be present. Manufactured by the French Government as Explosifs N or Favier or Grisounites. Grisounites-couche for coal-mines have theoretical explosion temperatures of 1500°C. Grisounites-roche of 1900°C. Ammonite, Westfalite, Bellite, Roburite are explosives of this type; other ammonites, Belite Nos. 2 and 4, Faversham powder, and negro powder have ammonium or sodium chloride added.

British.

Ammonite: Favier type; ammonium nitrate 75, dinitronaphthalene or other nitro-body, salt 20.

Bellite: ammonium nitrate and metadinitrobenzene; salt and starch may be added.

Bobbinite: the only gunpowder explosive allowed in England, not allowed in foreign mines; alkali nitrate, carbohydrates, wax may be added. Shatters coal less than high explosives.

Cambrite: a Nobel carbonite plus 8 per cent of a cooling agent.

Denaby Powder: ammonium nitrate, alkali nitrate, T.N.T., ammonium chloride.

Dynobel: nitroglycerine 15, collodion cotton 0·5, nitrobody 3, ammonium nitrate 46, wood-meal 5·5, salt 29·5, magnesium carbonate 0·5. Limit charge, 18 to 30 ounces. Swing of ballistic pendulum, 2·35 inches.

Monarkite: ammonium and sodium nitrate, nitroglycerine, nitrocotton, starch, mineral jelly, salt.

Monobel: ammonium nitrate, nitroglycerine, wood-meal, salt, alkali chloride, magnesium carbonate; nitro-body may be present.

Negro Powder: Grisounite type; ammonium nitrate 88, T.N.T. 10, graphite 2.

Rex Powder: nitroglycerine 12, salt 20, wood-meal 8, ammonium nitrate 60. Charge 20 ounces. Swing of pendulum, 2·61 inches.

Rippite (Super): nitroglycerine, nitrocotton, potassium nitrate, borax, alkali chloride.

Roburite: ammonium nitrate 61, T.N.T. 16, salt 23.

Stomonal: nitroglycerine, ammonium nitrate, sodium nitrate, wood-meal, wheat-flour, salt, ammonium oxalate.

Thames Powder: Similar to above.

Danish.

Aerolite: ammonium nitrate 78·1 per cent, potassium nitrate 7·5 per cent, sulphur 8·75 per cent, tar 2·5 per cent, sago-meal 1·25 per cent, manganese dioxide 1·25 per cent, resin 0·6 per cent.

Poudre Blanche Cornil: ammonium nitrate, alkali nitrate, nitronaphthalene, lead chromate.

French.

Favier Explosives. *See under* BELGIAN explosives.

Grisounite. As above.

Grisoutine or Grisou Dynamite. It is a mixture of ammonium nitrate and blasting gelatine. It is the only explosive except Grisounite allowed in the more dangerous French mines.

Naphthalite (Grisou): potassium chlorate 80 per cent, aryl hydrocarbons, 12 per cent nitrocompounds not trinitro-bodies, paraffin, fatty oils, flour and other organic substances. May contain alkali chlorides and up to 4 per cent blasting gelatine.

German.

Albit (Wetter): a chlorate explosive replacing nitrates; scarce during the war.

Astralit (Wetter): ammonium nitrate explosive containing some blasting gelatine. Many varieties, which may also contain rape-oil and potato-meal. Has been used in trench howitzers.

Carbonit. Numerous compositions come under this name and are made in different countries. Consists chiefly of nitroglycerine and metallic nitrates. Arctic carbonite, a low-freezing mixture, contains 15·5 per cent nitroglycerine, 10·5 per cent nitrohydrocarbon, 42 per cent potassium nitrate, 31·7 per cent wood-meal, and 0·3 per cent calcium carbonate.

Chloratzit: potassium chloride or perchlorate, aryl nitro-bodies, resins, and carbohydrates. For coal-mines add cooling agents.

Detonit: ammonium nitrate, charcoal, meal, 4 per cent blasting gelatine, neutral salts.

Donarit: ammonium nitrate 80 per cent, trinitrotoluene 12 per cent, rye-flour 4 per cent, nitroglycerine 4 per cent. The standard in Germany for sensitiveness of ammonium nitrate explosives.

Dorfit: ammonium nitrate, trinitrotoluene, flour, salt, alkali nitrate.

Dynamit: nitroglycerine 75 per cent, Kieselguhr 25 per cent.

Gehlingerit: ammonium nitrate, trinitrotoluene, flour.

Permonit: a perchlorate explosive.

Tremonit: contains gelatinized dinitroglycerine, pea-flour, and salt.

Some Blasting Explosives

Ammonal: ammonium nitrate 80 to 90 per cent, aluminium 4 to 18 per cent, charcoal 2 to 6 per cent. The more violent mixtures contain some trinitrotoluene in addition. Has been used in grenades and by Austrians in trench-howitzer bombs. Not suitable in underground workings owing to poisonous gases evolved.

Astralit: a mixture of ammonium nitrate and blasting gelatine. May contain wood-meal, trinitrotoluene, paraffin-oil. Has been used for projectiles.

Carbodynamite: nitroglycerine absorbed in cork charcoal instead of guhr.

Gelignite: nitroglycerine 56 to 63 per cent, nitrocotton 4 per cent, wood-meal 7 per cent, potassium nitrate 27 per cent, calcium carbonate 0·2 per cent.

Oxyliquit: liquid oxygen absorbed in a porous combustible material. Used in construction of Simplon Tunnel. Very cheap; safe after misfire because oxygen evaporates off.

Perdit: German mining, demolition, and rifle grenade explosive. Ammonium nitrate 76 per cent, potassium perchlorate 6 per cent, wood-meal 2 per cent, dinitrotoluene 16 per cent.

Rendarock: a brand of American dynamite.

Sprengel Explosives: one or both of the substances to be liquid, and mixing to occur shortly before firing. Nitric acid, alkali chloride, nitrogen peroxide on nitrobenzene, nitronaphthalene, carbon bisulphide, petrol, picric acid. Panclastite, Prométhée, Rack-a-Rock, are examples of this class.

Tonite: gun-cotton and barium nitrate.

Some High Explosives

Alumtol: ammonium nitrate, trinitrotoluene, aluminium powder. Used for trench mortars, bombs, &c.

Amatol: a mixture of ammonium nitrate and trinitrotoluene, used for shell-filling. Called by Germans Füllpulver. The Germans did not develop this explosive as much as the Entente Powers, who effected great economy of trinitrotoluene.

Blastine: ammonium perchlorate, sodium nitrate, dinitrotoluene, paraffin-wax. It evolves hydrochloric acid gas.

Blasting Gelatine contains 93 per cent nitroglycerine and 7 per cent nitrocotton. It is the most powerful explosive in common use.

Crèsylite is a French explosive, and contains picric acid and nitrated cresol.

Fumyl is a smoke-producing explosive, and contains trinitrotoluene and ammonium chloride. It was used to open poison-gas shells.

Granatfülling (Shell Filling): a term used by the Germans.

Granatfülling C/84 is picric acid.

Granatfülling C/02 is trinitrotoluene.

Other substances were used by them for shell filling, such as trinitroanisole, dinitrobenzene, hexanitrodiphenylamine, and hexanitrophenylsulphide.

Lyddite: a term for picric acid, formerly used in shells.

T.N.T. is trinitrotoluene or trotyl.

Toxol is a mixture of trinitrotoluene and trinitroxylene.

Triplastite is a plastic high explosive containing 70 per cent nitrotoluenes, 8 per cent nitrocotton, 22 per cent lead nitrate. Used for shell filling.

Some Miscellaneous Explosives

Anilite: Sprengel type. French liquid explosive used in aerial bombs.

Centralite: not an explosive but a stabilizer and regulator. It is dimethyldiphenylurea.

Collodion Cotton: low nitrallon nitrocotton, soluble in a mixture of ether and alcohol. It dissolves in nitroglycerine and liquid nitrobody, preventing their exudation.

Gelatine Dynamite: a mixture of blasting gelatine with potassium nitrate and wood-meal. It may also contain calcium and magnesium carbonate and mineral jelly.

Gelignite is similar to Gelatine Dynamite, but contains less Blasting Gelatine.

Halakite: contains potassium chlorate, ammonium nitrate, trinitrotoluene or other nitro-body; may contain nitro-cotton, sodium nitrate, and wood-meal.

Pyrocollodion: highly nitrated, soluble gun-cotton. Adopted by the United States.

White Gunpowder: a mixture of potassium chlorate, potassium ferrocyanide, and sugar. Very sensitive, and only used in the laboratory.

Propellants for Shot-guns

Amberite: insoluble nitrocotton 18.6 per cent, nitrates 28 per cent, soluble nitrocotton 46 per cent, vaseline 6 per cent.

Du Pont Smokeless Powder: nitroglycerine 10 per cent, ammonium nitrate 67·5 per cent, wood-pulp 8 per cent, salt 15 per cent (for coal-mines). Soluble nitrocotton 46 per cent, metallic nitrates 2·2 per cent (for shot-guns).

E.C. Powder: insoluble nitrocotton 44 per cent to 48 per cent (Empire Powder), soluble nitrocotton 30 per cent to 34 per cent, metallic nitrates 14 per cent to 9 per cent, vaseline 6 per cent to 7 per cent, camphor 4·6 per cent.

Ideal Powder: made by Nobels.

Neonite. Similar to the above compositions, but containing 73 per cent of insoluble nitrocotton, 9 per cent soluble nitrocotton. It is also made for rifled small-arms especially for rim-fire rifles.

New Explosive Company Smokeless Powder. Similar to above.

Rifleite: insoluble nitrocotton 1·7 per cent, soluble nitrocotton 82·5 per cent, nitro-body 4·8 per cent. The nitrocellulose is made from curcuma.

Ruby Powder: a cheap non-solvent powder, 46 per cent insoluble nitrocotton, 4 per cent soluble nitrocotton.

Smokeless Diamond and Stoumarkel Smokeless are similar to above.

Propellants for Rifled Fire-arms

Amide Powder: ammonium nitrate, potassium nitrate, charcoal. Has also been used in German artillery.

Ammonpulver: ammonium nitrate and charcoal. Has been used by Austrian artillery, and lately reintroduced by the Germans.

Ballistite: equal parts of nitroglycerine and soluble nitro-cotton with some mineral jelly.

Cordite: the principal smokeless powder of the British Empire.

Indurite: gun-cotton and nitrobenzene. Abandoned by U.S. navy.

Neonite: a gelatinized powder. Contains nitrocellulose insoluble and soluble, metallic nitrates, and vaseline.

Noddite: a strip sporting-rifle powder containing nitro-glycerine, nitrocellulose, mineral jelly.

Rottweil Smokeless Powder: a gelatined powder containing camphor and diphenylamine.

See also GRENADE; SHELL; TORPEDO; FIREWORKS; ROCKETS.

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EXPO'NENT. In algebra a^3 denotes three a's multiplied together; a^n means that n of the letter a are to be multiplied. These numbers or letters placed immediately above and to the right of another number or letter are called exponents, and indicate the power to which the number or letter is raised. Exponents can be fractional or negative, in which case new interpretations can be found. On the assumption that $a^m \times a^n = a^{n+n}$ for all values of m and n, $a^{\frac{1}{n}}$ is interpreted as the nth root of a, a^{-n} as the reciprocal of a^n.

EXPONENTIAL THEOREM. If $a^x = N$, x is said to be the logarithm of N to the base a. There are two bases of logarithms in common use, the base 10 and the Napierian base e. The exponential theorem states that the value of e^x is given by the infinite series $1 + x + \frac{x^2}{1.2} + \frac{x^3}{1.2.3} + \ldots + \frac{x^n}{1.2.3 \ldots n} +$, &c. Putting x equal to 1, $e = 1 + 1 + \frac{1}{1.2} + \frac{1}{1.2.3} + \frac{1}{1.2.3.4} +$, &c. e can be expressed to any number of decimal places by working out the value of the terms on the right-hand side. It is an incommensurable number which to five decimal places is equal to 2·71828. *See* LOGARITHM.

EXPORTS. *See* FOREIGN TRADE.

EX POST FACTO, in law, a term designating something as done after and bearing upon something previously done; thus a law is said to be *ex post facto*, or retrospective, when it is enacted to punish an offence committed before the passing of the law.

EXPOSURE, the situation of a building, &c., with respect to sun and wind; 'aspect' with regard to the quarter of the heavens. A house facing south-west or south-east will be found much healthier than one facing due north; and as it is also warmer, less fuel will be required for heating purposes.

EXPRESSED OILS, in chemistry, are those which are obtainable from bodies only by pressing, to distinguish them from mineral and essential oils, which last are, for the most part, obtained by distillation.

EXTENSION, (1) in physics and metaphysics, that property of a body in virtue of which it occupies a portion of space. (2) In logic, *extension* is the extent of the application of a general term, that is, the objects collectively which are included under it; thus, the word figure is more extensive than triangle, circle, or parallelogram; European more extensive than French, Frenchman, German, &c. Matter and mind are the most extensive terms of which any definite conception can be formed. Extension is contrasted with *comprehension* or *intension*.—Cf. Titchner, *Text-Book of Psychology*.

EXTINCTEUR (eks-tan-teur), an apparatus for the extinction of fire, consisting of a metallic case containing water and materials for generating carbonic acid. When required, the materials are brought into contact by pushing a rod which breaks a bottle containing acid, the gas mixes with the water, and the pressure generated is sufficient to project the water charged with the gas to a distance of 40 or 50 feet.

EX'TRACT, a term to denote all that can be dissolved out of a substance by a specified menstruum, such as water, alcohol, ether, &c. In modern pharmacy the term is applied to two kinds of preparation from vegetables. One is got by digesting the plant in water or other solvent, and evaporating or distilling away the excess of solvent until the extracted matter is sufficiently inspissated. The other is got by bruising the plant in a mortar, separating the juice, warming it until the green colouring-matter separates, and filtering it off. The juice is next heated until the albumen coagulates, and again filtered. The juice is now evaporated to a syrup, the green colouring-matter added and well mixed, and the evaporation is thereafter continued until the required concentration is attained. Extracts must be capable of being redissolved, so as to form a solution like that from which they were derived. Extracts are used in cookery, medicine, and the manufacture of perfumery.—

Extract of Meat (*extractum carnis*) is a soft, yellowish-brown solid, or very thick syrup, which is employed as a portable soup. It is now manufactured on the large scale by processes proposed by Liebig.

EXTRADI'TION (Lat. *ex*, out, and *tradere*, to hand over), the act by which a person accused of a crime is given up by the Government in whose territories he has taken refuge to the Government of which he is a subject. Conventions have been entered into by Britain with almost all civilized countries for the apprehension and extradition of persons charged with particular offences, especially those of the most heinous stamp, such as murder, robbery, embezzlement, arson, rape, and piracy. The Extradition Act of 1870 makes special provision that no criminal shall be surrendered for a political offence, and that the criminal shall not be tried for any but the crime for which he was demanded. Other British Extradition Acts are

those of 1873, 1895, and 1906. *See* INTERNATIONAL LAW.—Cf. Sir E. Clarke, *The Law of Extradition*.

EXTRAVAGAN'ZA, in music or the drama, a species of composition designed to produce effect by its wild irregularity and incoherence; differing from a burlesque in being an original composition and not a mere travesty.

EXTRAVASA'TION (Lat. *extra*, beyond, and *vas*, vessel), an escape of some fluid, as blood or urine, from the vessel containing it. *Blood extravasation*, in contusions and other accidents, is when blood-vessels are ruptured by the injury, and the blood finds its way into the neighbouring tissues. In some accidents to the urethra and bladder extravasation of urine is a very serious occurrence.

EXTREME UNCTION has been, since an early period, one of the seven sacraments of the Roman Catholic Church. It is performed in cases of mortal disease by anointing in the form of a cross, the eyes, ears, nose, mouth, hands, feet, and reins (in the case of males). It is administered after confession and the eucharist, and is believed to remove the last stains of sin. It can only be administered by a bishop or priest, and is not applied in the case of young children or excommunicated persons.

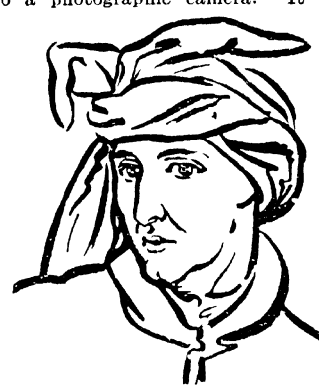
EXU'MA, GREAT and **LITTLE,** two of the Bahama Islands. The former is 30 miles long and 3 miles wide, and has a good harbour. Pop. 3730.

EYALET (I'a-let), a former administrative division of the Turkish Empire, subdivided into sanjaks or provinces, and kazas or districts. It was ruled by a pasha, and gave place to the vilayet on the reorganization of the empire in 1871.

EYCK (Ik), **Hubert** and **Jan van,** brothers, famous painters of the old Flemish school, born at Maaseyck, Hubert in 1366, Jan probably about 1385. They lived first at Bruges, whence the younger brother is called John of Bruges, and afterwards at Ghent, to which they removed about 1420. Here they executed the celebrated *Adoration of the Lamb* for the Cathedral of Ghent; a painting which, in its different parts, contains above three hundred figures, and is a masterpiece. It was in two horizontal divisions, comprising ten panels, of which only the two central ones remain at Ghent, the others being at Berlin. Hubert did not live to see it completed. He died at Ghent (1426), as did also his sister Margaret, who was likewise a painter (1431).

Jan finished the work in 1432, and returned to Bruges, where he remained till his death, which took place in 1441, and executed several excellent pieces. His reputation became very great even during his lifetime, by his share in the introduction of oil-painting; the original invention of which has been incorrectly ascribed to him by many. Jan van Eyck also introduced improvements in linear and aerial perspective, and in painting upon glass. Three portraits by Jan van Eyck, *The Scholar*, *The Man with a Turban*, and *Giovanni Arnolfini and his Wife*, are in the National Gallery, London; the *Madonna of the Chancellor Rollin* is in the Louvre.—Cf. W. H. J. Weale, *John and Hubert van Eyck*.

EYE, the organ of vision, is an instrument presenting some analogy to a photographic camera. It is



Van Eyck

provided with a lens for focussing images upon a sensitive membrane called the *retina*. The walls of the globe of the eye are formed principally of two fibrous membranes: one white and opaque—the *sclerotic* (Gr. *skleros*, hard)—which envelops two-thirds of the globe posteriorly; and the other transparent, and resembling a horny plate, whence its name, *cornea* (Lat. *corneus*, horny). The sclerotic is a tough fibrous coat, and is the part to which the phrase 'white of the eye' is applied. In the front of the globe the sclerotic is abruptly transformed into the transparent portion (the cornea), which is circular, and which forms a window through which one can see into the interior. A membrane, the *conjunctiva*, so named because it unites the eye to the lid, spreads over the anterior portion of the globe, and then folds back on itself and lines the internal surface of the eyelids. On the internal surface of the sclerotic is

a vascular membrane called the *choroid*. This is essentially the blood-vessel coat of the eyeball. About the place where the sclerotic passes into the cornea the choroid becomes continuous with the *iris*, a round curtain, the structure seen through the cornea, differently coloured in different individuals. In its centre is a round hole the *pupil*, which appears as if it were a black spot.

The *iris* forms a diaphragm suspended in the space behind the cornea which is filled with clear fluid, the *aqueous humour*. The *iris* consists of a framework of connective tissue, and its posterior surface is lined by cells containing pigment which gives the colour to the eye. In its substance are bundles of involuntary muscular fibres, arranged in a ring round the margin of the pupil. In a bright light the circular fibres contract and the pupil is made smaller; but in the dark these fibres relax and allow the pupil to dilate more or less widely, thus allowing more luminous rays to enter the eye. Just behind the pupil is the *crystalline lens*, resembling a small, very strongly magnifying glass, convex on each side, though more so behind. Minute bands of muscle in the choroid can alter the convexity of the lens, and thus adapt its focus to the position of objects at different distances. The large space in the globe of the eye that intervenes between the retina lining its inner surface and the lens in front is occupied by a transparent jelly-like mass called the *vitreous body*. The internal surface of the choroid, or rather the pigmentary layer which covers it, is lined by the retina or nervous tunic upon which the images of the objects that we see are focussed.

The retina is a very complex mechanism consisting of certain elements which are stimulated by light, and others that transmit the effects of such stimulation as a nervous current to the optic nerve which carries it to the brain. It is composed of cones and cylinders or *rods*, joined together like the stakes of a palisade, perpendicular to the plane of the membrane, and forming by their free extremities a mosaic, each microscopic division of which is about 0·0008 of a line in diameter according to Helmholtz, and represents a section of a rod. These rods and cones are believed to be the agents by whose aid the waves of light become transformed into the stimulus of a sensation. The ocular globe is put in motion in the orbit by six muscles, grouped two by two, which raise or lower the eye, turn it inward or outward, or on its antero-posterior axis. In these movements the centre of the globe is immovable, and the eye moves round its transverse and vertical diameters. These three orders of movements are independent of each other, and may be made singly or in combination, in such a manner as to direct the pupil towards all points of the circumference of the orbit.

Each eye is furnished with two eyelids, moved by muscles, which shield it from too much light and keep it from being injured. They are fringed with short, fine hairs called eyelashes; and along the edge of the lids is a row of glands similar to the sebaceous glands of the skin.

The eyebrows, ridges of thickened integument and muscle, situated on the upper circumference of the orbit and covered with short hairs, also regulate to some extent the admission of light by muscular contraction. In reptiles, some fishes (sharks, &c.), in birds, and in some mammals a third eyelid or nictitating membrane is present, and can be drawn over the surface of the eye so as to clear it of foreign matters, and also to modify the light.

The lachrymal apparatus is composed of, firstly, the *lachrymal gland*, which lies in a depression of the orbital arch; secondly, the *lachrymal canals*, by which the tears are poured out upon the conjunctiva a little above the border of the upper lid; thirdly, the *lachrymal ducts*, which are destined to receive the tears after they have bathed the eye, and of which the orifices or *lachrymal points* are seen near the internal ends of the lids; fourthly, the *lachrymal sac*, in which the lachrymal ducts terminate, that empties the tears into the *nasal canal*. The tears, by running over the surface of the conjunctiva, render it supple and facilitate the movements of the globe and eyelids by lessening the friction. The influence of moral or physical causes increases their secretion, and when the lachrymal ducts do not suffice to carry them off they run over the lids.

Vision. The retina renders the eye sensible of light, and we may therefore consider it as the essential organ of vision. The function of the other portions is to focus the luminous rays on the surface of the retina, a condition necessary for distinct vision and the clear perception of objects. The visual impressions are transmitted from the retina to the brain by means of the optic nerve. The two optic nerves converge from the eyes toward the centre of the base of the brain, where there is a partial interlacement of their fibres in such a manner that a portion of the right nerve goes to the left side of the brain, and a part of the left nerve to the right side; this

is called the *chiasma* or *commissure* of the optic nerves. The principal advantage of having two eyes is in the estimation of distance and the perception of relief. In order to see a point as single by two eyes we must make its two images fall on corresponding points of the retinas; and this implies a greater or less convergence of the optic axes according as the object is nearer or more remote. To accommodate the eye to different distances the lens is capable of altering itself with great precision and rapidity. When we look at a near object, the anterior surface of the lens bulges forward, becoming more convex the nearer the object; the more distant the object the more the lens is flattened.

When the transparency of the cornea, the crystalline lens, or any of the contents of the globe of the eye is destroyed, either partially or entirely, then will partial or total blindness follow, since no image can be formed upon the retina; but although all the media and the cornea be perfectly transparent, and retain their proper forms, which likewise is necessary to distinct vision, yet injury or inactivity of the optic nerve, or injury of the parts of the brain with which it is connected, may produce disturbance of vision or total blindness.

Defective vision may also arise from the crystalline lens being so convex as to form an image before the rays reach the retina (a defect known as short sight or myopia), in which case distinct vision will be procured by interposing a concave lens between the eye and the object of such a curvature as shall cause the rays that pass through the crystalline lens to meet on the retina; or the lens may be too flat, a defect which is corrected by convex lenses. In old age, and in fact in most people after about forty-five years of age, the elasticity of the lens becomes reduced, and convex lenses become necessary to make it possible to focus near objects. This condition is known as *presbyopia*.

In the lower organisms the organs of sight appear as mere pigment spots. In higher forms, simple lenses or refracting bodies occur. Insects, crustaceans, &c., have large masses of simple eyes or ocelli aggregated together to form compound eyes—the separate facets or lenses being optically distinct, and sometimes numbering many thousands. In the cephalopods well-developed eyes presenting a distant analogy in structure to those of the highest animals are found; and in all vertebrate animals the organ of vision corresponds generally to what has been described, though they vary much in structure and adaptation to the surroundings of the animal.—Cf. J. Herbert Parsons, *Diseases of the Eye*.

EYE (ā), a municipal borough, England, county Suffolk, 20½ miles north of Ipswich. Up till 1885 it sent a member to Parliament, and it still gives its name to a parliamentary division of East Suffolk. Pop. 1733.

EYEBRIGHT (*Euphrasia officinālis*), a small plant belonging to the nat. ord. Scrophulariaceæ, which is common in Britain and most parts of Europe, in North Asia, &c. It is an annual, half-parasitic on grass-roots, from 3 to 8 inches high, often much branched. The whole plant has a bitter taste. Under the name of *euphrasy* it formerly enjoyed a great reputation in diseases of the eyes.

EYEMOUTH, a fishing-town of Berwickshire, Scotland, at the mouth of the Eye, an important place in the thirteenth century. Pop. (1931), 2,231.

EYE-PIECE, in a telescope, microscope, or other optical instrument, the lens, or combination of lenses to which the eye is applied. As the use of a single lens limits the field of view, eye-pieces are generally formed from two lenses or lens systems, called the eye-lens and the field-lens, placed at a distance apart. The Ramsden or positive eye-piece consists of two lenses of equal focal length placed at a distance apart equal to two-thirds of the focal length of either lens. The object looked at requires to be a short distance in front of the field-lens. In the Huyghens or negative eye-piece the focal lengths of the field- and eye-lenses are in the ratio 3 to 1, and the distance between the lenses is twice the focal length of the eye-lens. As a result the image formed by, say, the objective of a telescope is in focus when between the two lenses.

EYLAU (I'lou), a small town, about 23 miles distant from Königsberg, in E. Prussia, Germany, famous for a bloody battle fought between Napoleon and the allied Russians and Prussians, on the 7th and 8th of Feb., 1807. Both sides claimed the victory. The loss of the Allies was about 20,000 men, while that of the French must have been considerably greater.

EYRA, wild cat of S. America (*Felis eyra*). It inhabits the region between S. Brazil and N. Mexico. It is about the size of a small domestic cat, and is reddish yellow in colour, with an elongated, weasel-like body, short legs, and a long tail. It is fierce in its habits and preys on poultry.

EYRE (ār), **Edward John**, Australian explorer and colonial governor, born in Yorkshire 1815, died in 1901. He went to Australia in 1833, in 1839 discovered Lake Torrens, and in 1840

explored its eastern shores and the adjacent Flinders Range. He then commenced his perilous journey along the shores of the Great Australian Bight, and reached King George's Sound, in Western Australia, a distance of 1200 miles, with a single native boy, having left Adelaide more than a year before. In 1845 he published *Discoveries in Central Australia*. After filling several governorships, he was appointed Governor of Jamaica in 1862. In 1865 he was confronted with a negro rebellion, which he crushed with some severity, and was recalled. On his return to England John Stuart Mill and other so-called humanitarians took measures to try him for murder, but failed. Tennyson and Carlyle were among his most strenuous defenders.

EYRE, LAKE, a large salt-water lake of South Australia. Area 3700 sq. miles, but it is subject to great fluctuations in size.

EYRES-MONSELL, Sir Bolton Meredith, English politician. Born in 1880, a son of Lieut-Colonel Bolton Monsell, he entered the navy in 1894. In 1904 he married and took the additional name of Eyres. He left the navy in 1906 and in 1910 was elected M.P. for S. Worcestershire, now Evesham division, which he still represents. In 1914 he returned to the navy, and was mentioned in despatches. In the Coalition of 1919–22 he held a household appointment, and was Civil Lord and then Financial Secretary to the Amiralty. In 1923–24 and 1924–29 he was Parliamentary Secretary to the Treasury. Since 1923 he has been chief whip of the Conservative Party. He was made a privy councillor in 1923 and awarded the G.B.E. in 1929. In 1931 he became First Lord of the Admiralty in the National Government.

EZE'KIEL (Heb. yehezqēl, 'God shall strengthen'), the third of the great prophets, a priest, and the son of Buzi. He was carried away when young (about 599 B.C.) into the Babylonian captivity. His prophetic career extended over a period of twenty-two years, from the fifth to the twenty-seventh year of the captivity. The *Book of Ezekiel* contains predictions made before the fall of Jerusalem, 586 B.C. (chaps. i–xxiv); prophecies against some of the neighbouring tribes (chaps. xxv–xxxii); prophecies concerning the future of Israel (xxxiii–xxxix); and a series of visions relating to the circumstances of the people after the restoration.

EZRA, a celebrated Jewish scribe and priest. Under his guidance the second expedition of the Jews set out from Babylon to Palestine in the reign of Artaxerxes I, about 458 B.C. The important services rendered by Ezra to his countrymen on that occasion, and also in arranging, and in some measure, it is believed, settling the canon of Scripture, are specially acknowledged by the Jews, and he has even been regarded as the second founder of the nation. Josephus states that he died in Jerusalem; others assert that he returned to Babylon, and died there at the age of 120 years. *The Book of Ezra* contains an account of the favours bestowed upon the Jews by the Persian monarchs, the rebuilding of the temple, Ezra's mission to Jerusalem, and the various regulations and forms introduced by him. It is written partly in Hebrew and partly in Chaldee; this has led some to conclude that it is the work of different hands.

F

F, the sixth letter of the English alphabet, is a labio-dental articulation, formed by the passage of breath between the lower lip and the upper front teeth. It is classed as a surd spirant, its corresponding sonant spirant being *v*, which is distinguished from *f* by being pronounced with voice instead of breath, as may be perceived by pronouncing *ef, ev*. The figure of the letter F is the same as that of the ancient Greek digamma, which it also closely resembles in power. As a mediæval Roman numeral F stands for 40, and with a bar above it, it is 40,000. F, in music, is the fourth note of the diatonic scale.

FAAM-TEA, or **FAHAM-TEA,** a name given to the dried leaves of the *Angræcum fragrans*, an orchid growing in the Mauritius and in India, and much prized for the fragrance of its leaves, an infusion of which is used as a stomachic and as an expectorant in pulmonary complaints.

FABER, Frederick William, D.D., a theologian and hymn-writer, the nephew of George Stanley Faber, born at Durham in 1814, died 26th Sept., 1863. In 1845 he became a convert to Roman Catholicism, and founded the oratory of St. Philip Neri, afterwards transferred to Brompton.

FABIAN SOCIETY, a Socialist organization, founded in 1888, whose object, as defined by the basis which members are required to sign, is the nationalization of all land and industrial capital for the benefit of the whole community; this result to be attained, not by any violent upheaval, but by educating the minds of the masses and gradually extending the control of the State over the factors of production. Its policy, as expounded in *Fabian Essays* (1889) by a number of its early members, is frankly opportunist, and contemplates the use of existing political machinery and the acceptance of any measure of reform which will further the ultimate aims of the society.

The name is derived from that of the Roman general, Quintus Fabius Maximus, known as Cunctator from the cautious tactics by which he ultimately defeated Hannibal.

Prominent members of the society at different times have been Bernard Shaw, Sidney Webb, H. G. Wells, and J. A. Hobson. The society has branches in Great Britain, the Colonies, and America, and has issued a number of publications, notably *Fabian Tracts*. A research department recently established has done useful work. The growth of the labour movement has rather diminished the importance of the society, and has led to some secessions from its ranks. Its headquarters are at 11 Dartmouth St., Westminster, London, S.W. 1.

FABII (fā'bi-ī), an ancient and renowned family of Rome, who, having undertaken the duty of defending Roman territory against the incursions of the Veientines, established themselves at a post on the River Cremera. Being drawn into an ambush, they were killed to a man (477 B.C.). A boy who happened to be left in Rome became the second founder of the family. Among its celebrated members in after times was Fabius Maximus, whose policy of defensive warfare was so successful against Hannibal in the second Punic War (218–201 B.C.); and Quintus Fabius Pictor, who lived about the same time and wrote a history of Rome in Greek, thus being the earliest Roman historian.

FABLE (Lat. *fabula*, narrative), in literature, a term applied originally to every imaginative tale, but confined in modern use to short stories, either in prose or verse, in which animals and sometimes inanimate things are feigned to act and speak with human interests and passions for the purpose of inculcating a moral lesson in a pleasant and pointed manner. The fable consists properly of two parts—the symbolical representation and the application, or the instruction intended to be deduced from it, which latter is called the *moral* of the tale, and must be apparent in the fable itself.

The oldest fables are supposed to be the Oriental; among these the Indian fables of Pilpay or Bidpai, and the fables of the Arabian Lokman, are celebrated. Amongst the Greeks, Æsop is the master of a simple but very effective style of fable. The fables of Phædrus are a second-rate Latin version of those of Æsop. In modern times Gellert and Lessing among the Germans, Gay among the English, the Spanish Yriarte, the Italian Pignotti, and the Russian Ivan Krylov, are celebrated. The first

place, however, amongst modern fabulists belongs to the French writer La Fontaine. R. L. Stevenson wrote a collection of fables.—Cf. Walter Jerrold, *The Big Book of Fables.*

FABLIAUX (fab'li-ō; O.F. *fabliaus*, Lat. *fabella*, dim. of *fabula*, story), in French literature, the short metrical tales of the Trouvères, or early poets of the Langue d'Oil, composed for the most part in the twelfth and thirteenth centuries. These productions were intended merely for recitation, not for singing, and had as their principal subjects the current gossip and news of the day, which were treated in a witty and sarcastic way. The fabliaux lashed not only the clergy and nobility in their degeneracy, but even mocked the religious chivalrous spirit, and the religious and knightly doctrines and ceremonies.

FABRE, Jean Henri, French entomologist, born at Sainte-Leone, Aveyron, in 1823, died 11th Oct., 1915. The son of very poor parents, he received a free education at Rodez, and then went to the normal school at Vaucluse, and at the age of eighteen he began his career as teacher. He was in charge of a primary school, and in his spare time studied mathematics and physics. He subsequently became professor of physics at the College of Ajaccio, and his interest in insects having in the meantime been aroused, he turned his entire attention to entomological pursuits. His reputation as a naturalist increased, and his work was praised by Darwin. He was particularly noted for the remarkable patience with which he investigated the life-history of insects, and for his minute and painstaking observations. His works first appeared in the *Annales des sciences naturelles* from 1855–8, and were afterwards amplified in his *Souvenirs Entomologiques* in 10 volumes, published between 1878 and 1907. He was made a chevalier of the Legion of Honour, and in 1912 the French Government granted him a pension. His works were translated into English by A. Texeira de Mattos.

FABRIA'NO, an episcopal city of Italy, province of Ancona. Pop. 23,750.

FABRICIUS, Gaius (with the cognomen Luscinus), an ancient Roman, celebrated on account of his fearlessness, integrity, moderation, and contempt of riches. After having conquered the Samnites and Lucanians, and enriched his country with the spoils, of which he alone took nothing, he was sent on an embassy to Pyrrhus, King of Epirus, who tried in vain to corrupt him by large presents. When consul in 279 B.C., Fabricius delivered up to Pyrrhus his treacherous physician, who had offered to poison his royal master for a sum of money. In gratitude for the service the king released the Roman prisoners without ransom. In 275 B.C. Fabricius was chosen censor. He died about 250 B.C.

FABRICIUS, Johann Albrecht, a German scholar, born at Leipzig in 1668, died in 1736. He became professor of rhetoric and moral philosophy at Hamburg, and published many learned works, amongst which are his *Bibliotheca Latina*, *Bibliotheca Ecclesiastica*, and *Bibliotheca Antiquaria.*

FABRICIUS, Johann Christian, German entomologist, born 1743, died 3rd March, 1808. After studying at Copenhagen, Leyden, Edinburgh, and under Linnæus at Upsala, he obtained the post of professor of natural history in the University of Kiel. In 1755 appeared his *Systema Entomologiæ*, which gave to this science an entirely new form. In 1778 he published his *Philosophia Entomologica*, written upon the plan of the well-known *Philosophia Botanica* of Linnæus.

FACCIOLATI (fät-cho-lä'tē) Jacopo, Italian classical scholar, born 1682, died 1769; professor in the University of Padua. The most important work with which he was connected was the *Totius Latinitātis Lexicon*, compiled by Forcellini under his direction and with his co-operation.

FACE, the front part of the head, the seat of most of the sense-organs. The bony basis of the face, exclusive of the thirty-two teeth (these not being in the strict sense bones), is composed of fourteen bones, called, in anatomy, the *bones of the face.* The anterior part of the brain-case (frontal bone) also forms an important feature of the face. Of all these bones the lower jaw only is movable, being articulated with the base of the skull. The other bones are firmly joined together and incapable of motion. In most mammals the jaws project much more than in men, and form the prominent feature of the face, while the forehead recedes. *See* FACIAL ANGLE.

FACE'TIÆ, humorous sayings, witticisms, jests. There have been many collections of such. Amongst the most notable are the *Asteia* (Jests) of Hierocles, an old Greek collection, the *Liber Facetiarum* of Poggio Bracciolini, and Joe Miller's *Jest-Book.*

FACIAL ANGLE, an angle of importance in the method of skull measurement introduced by Camper, the Dutch anatomist, who sought to establish a connection between the

magnitude of this angle and the intelligence of different animals and men, maintaining that it is always greater as the intellectual powers are greater. Suppose a straight line drawn at the base of the skull, posteriorly across the external orifice of the ear to the bottom of the nose, and another straight line from the bottom of the nose, or from the roots of the upper incisors, to the most prominent part of the forehead, then both lines will form an angle which will be more or less acute. In apes this angle is only from 45° to 60°; in the skull of a negro, about 70°; in a European, from 75° to 85°. In another mode of drawing the lines the angle included between them varies in man from 90° to 120°, and is more capable of comparison among vertebrate animals than the angle of Camper. Though of some importance in the comparison of races, this angle is fallacious as a test of individual capacity.

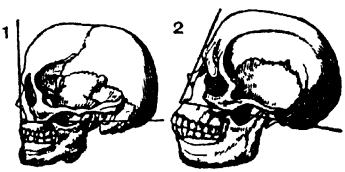
FACIAL NERVE, a motor nerve which supplies the muscles of expression on either side of the face. Injury to this nerve produces *facial paralysis*, the result of which is that the affected side is smooth, unwrinkled, and motionless, the eyelids are wide open and cannot be closed, and the muscles of the sound side having it all their own way drag the mouth to that side.

FACTOR, in arithmetic, is any number which divides a given number without a remainder, thus 3, 5, 7 are all factors of 105. In algebra, any expressions multiplied together to form a product are said to be factors of the product; for example, $x + 1$, $x + 2$, $x + 3$ are factors of $x^3 + 6x^2 + 11x + 6$.

FACTOR, in commerce, an agent employed to do business for another in buying or selling, or in the charge of property. A factor differs from a broker in holding a wider and more discretionary commission from his employer, in being able to buy and sell in his own name, and in having a lien on goods for his outlay. The difference, however, depends so much upon the usage of the particular trade, or upon the special instructions constituting the agency, that no exact line of demarcation can really be drawn between them. The term factor has in common usage generally given place to the terms agent and broker, the former applied in the more general, the latter in the more restricted sense. It is still retained in some special cases, as in that of house-factors and factors on landed property in Scotland, who have charge of the letting and general management of house property, farms, &c.; called in England estate agents.

FAC'TORY (from *factor*), a name which appears originally to have been given to establishments of merchants and factors resident in foreign countries; it now more commonly signifies a place in which the various processes of a particular manufacture are carried on simultaneously. The rapid growth of factories in this sense is a comparatively recent development of industry, resulting from the free use of machinery and the consequent subdivision of labour.

Amongst the advantages of the factory system are generally counted: first, increased productiveness arising from the minute division of labour; second, the mechanical accuracy and the cheapness of the product turned out by machinery; third, the facilities for union and co-operation for common improvement afforded by bringing large masses of workmen together. But this last consideration is probably more than counter-balanced by the



Facial Angle
1, European. 2, Negro

smaller amount of independent intelligence called forth in the individual worker, through the monotony of the minutely subdivided operations.

Decided disadvantages of the factory system are the unhealthiness of the crowded rooms, where the air is full of deleterious elements; and the increasing demand on the labour of women and children, interfering as it does with the economy of domestic life.—BIBLIOGRAPHY: R. W. Cooke-Taylor, *Factory System and Factory Acts*; B. L. Hutchins, *A History of Factory Legislation*.

FACTORY ACTS, Acts passed for the regulation of factories and similar establishments. Considering that women and children were not qualified fully to protect themselves against the strain of competition, the British legislature has passed a series of Acts to regulate the conditions of their employment in factories. The immediate occasion of the first Act passed to regulate factory employment in England was the outbreak of an epidemic disease which committed great havoc among the younger persons employed in factories in the district round Manchester at the beginning of the nineteenth century.

An Act was passed (1802) in which provision was made for the regular cleansing and ventilation of mills and factories, and also for limiting the hours of labour to twelve daily. A number of others were passed in the 19th and 20th centuries. Under these laws all factories are subject to strict inspection by Home Office officials.

In 1819 an Act followed which prescribed an hour and a half for meals in the course of a working day, and prohibited children under nine years of age being employed in factory work at all. Various Acts were passed up to 1878, when a general Factory and Workshop Act was passed, consolidating the previous series of statutes. Its scope was extended by a further series of enactments, until in the year 1901 the last general Act was passed, which consolidates and amends all previous legislation. The Act contains general provisions regarding drainage, sanitary conveniences, overcrowding, ventilation, fencing of dangerous machinery, &c. Factories are distinguished from workshops as making use of steam or other mechanical power.

In textile factories the hours of labour for women and young persons (the latter between 14 and 18 years of age) are restricted to 10, but only 6½ on Saturday and 56 in the week. In non-textile factories and workshops the hours may be 10½ per day and 60 per week at most. Children (of 12 to 14 years) were not allowed to be employed more than 6½ hours on any one day. (The Education Acts now prohibit almost entirely the employment of 'school children' in factories and workshops.) Provision is made for a certain number of annual holidays. Special provisions for particular kinds of factories are made, and under these the employment of females and young persons is regulated in bleaching- and dyeing-works, lace-factories, manufactories of earthenware, lucifer matches, percussion caps, cartridges, blast-furnaces, copper-mills, forges, foundries, manufactories of machinery, metal, india-rubber, gutta-percha, paper, glass, tobacco, letterpress printing, bookbinding, &c. The Act of 1901 included laundries carried on by way of trade or for the purposes of gain. An Act of 1907 extended the Act of 1901 to laundries carried on as ancillary to another business or incidentally to the purposes of any public institution. Acts passed in 1911 and 1929 gave power to make regulations applicable to cotton-cloth factories. Certain exceptions in regard to working overtime are provided for; thus women may sometimes work 14 hours a day. So far there has been no direct interference in any of the Factory Acts with the labour of adult male persons; but it is obvious that indirectly the position of the male labourer also is affected by legislation of this sort. All factories are subject to strict inspection by Home Office officials.

FAC'ULÆ (Lat. *facula*, a torch), bright markings on the sun's disc, i.e. portions more brilliant than the general surface. They are supposed to be parts of the luminous surface, or photosphere, which are elevated to a greater height, and therefore suffer less absorption of their light in its passage through the overlying gases and vapours. Like the spots, they are in a state of constant change, and exhibit a similar periodicity in numbers and extent.

FACULTIES, COURT OF, in English law, a jurisdiction or tribunal belonging to the archbishop. It does not hold pleas in any suits, but has power to grant licences or dispensations, such as, to marry without banns, or to remove bodies previously buried.

FACULTY, the members, taken collectively, of the medical or legal professions; thus we speak of the medical faculty, and (in Scotland) of the faculty of advocates. The term is also used for the professors and teachers collectively of the several departments in a university; as, the faculty of arts, of theology, of medicine, of science, of music, or of law.

FACULTY, in law, is a power to do something, the right to do which the law admits, or a special privilege granted by law to do something which would otherwise be forbidden.

FÆCES, the excrementitious part evacuated by animals. It varies, of course, with different species of animals, according to their diet. The main constituents are unassimilable parts of the food, on which the digestive process has no effect, and other portions, quite nutritious, but which have escaped digestion, also certain waste matters, &c. In disease the composition varies extremely.

FAED (fād), **John,** R.S.A., artist, born in Kirkcudbrightshire in 1820, died in 1902. He showed artistic talent at an early age, and in 1841 went to Edinburgh to study. Some years later he acquired a considerable reputation, and was elected to the Royal Scottish Academy in 1851. Among his principal works are: *Shakespeare and his Contemporaries*; *An Incident of Scottish Justice*; *The Morning after Flodden*; *A Wappenshaw*; two series of drawings illustrating *The Cotter's Saturday Night* and *The Soldier's Return*; *John Ander-*

son, My Jo; *Auld Mare Maggie*; *The Gamekeeper's Daughter*; *The Hiring Fair.*

FAED, Thomas, R.A., younger brother of the preceding, born at the same place in 1826, died in 1900. He studied in Edinburgh, where at an early age he became known as a clever painter of rustic subjects. In 1852 he settled in London, where he won a high reputation. The subjects he painted are for the most part domestic or pathetic, and in these he invented and told his own story, and that with a success that emulates Wilkie. Among his principal works are: *Sir Walter Scott and his Friends* (1849), *The Mitherless Bairn* (1855), *The First Break in the Family* (1857), *Sunday in the Backwoods* (1859), *His Only Pair* (1860), *From Dawn to Sunset* (1861), *The Last o' the Clan* (1865). A number of Faed's works have been engraved in large size, and have been very popular.

FAENZA (fä-en'za), a town and episcopal see of N. Italy, in the province of and 19 miles south-west of Ravenna. It is supposed to have been the first Italian city in which the earthenware called *faience* (q.v.) was introduced. The manufacture still flourishes here, and there is also a considerable trade. Pop. (town) 22,400, (commune) 40,164.

FAEROE. Correct spelling of Faroe (q.v.).

FAGACEÆ, a nat. ord. of apetalous Dicotyledons, all trees and shrubs, mostly natives of temperate regions. It includes the beeches and oaks, and the sweet chestnut (Castanea).

FAGAN, James Bernard, Irish dramatist and producer. Born 10th May, 1873, a son of Sir John Fagan, the surgeon, he was educated at Clongowes and then at Trinity College, Oxford. He became an actor, but made his reputation in 1899 by his play, *The Rebels*. Other successes include *The Prayer of the Sword*, *Under Which King, Hawthorne*, *And So to Bed* and *The Greater Love*. He died on 17th February, 1933.

FAGGING, a custom which formerly prevailed generally at most of the English schools, and is still practised at Eton, Winchester, Harrow, Rugby, and one or two other places. It consists in making the junior boys act as servants or 'fags' in the performance of multifarious menial offices for elder boys, such as carrying messages or preparing breakfast for their master, in return for which the elder boy accepts a certain responsibility for keeping order, and becomes the recognized adviser and protector of his 'fags.'

FAGGOT-VOTE, a term formerly applied in Britain to a vote procured by the purchase of property so as to constitute a nominal qualification without a substantial basis. Faggot-votes were chiefly used in county elections for members of Parliament. The way in which they were usually manufactured was by the purchase of a property which was divided into as many lots as would constitute separate votes, and given to different persons, who need not be resident members of the constituency. The practice disappeared after the Reform Act of 1884.

FAGUET, Émile, French literary historian, critic, and journalist, born at La Roche-sur-Yon in 1847, died in 1916. He became professor of poetry at the Sorbonne in 1897. Endowed with a keen power of analysis and a wealth of original ideas, he was one of the most brilliant French critics of the nineteenth century. Whilst praising the literature of the seventeenth century, Faguet somewhat depreciated the writers of the eighteenth century. Among his numerous works are: *Le théâtre contemporain* (1880–91), *Dix-huitième siècle* (1890), *Seizième siècle* (1893), *Drame ancien et drame moderne* (1898), *Histoire de la litérature francaise* (1900), *Propos litéraires* (1902), *Initiation into Literature*, and *Initiation into Philosophy.*

FAGUS. *See* BEECH.

FAHLERZ (fäl'erts), or grey copper ore, is of a steel-grey or iron-black colour. It occurs crystallized in the form of the tetrahedron, also massive and disseminated. Its fracture is uneven or imperfectly conchoidal. Specific gravity, 4·5–5·1. *Tetrahedrite*, the typical species, is composed of copper, sulphur, and antimony. Part of the copper is often replaced by iron, zinc, silver, or mercury, and part of the antimony by arsenic.

FAHLUNITE, a mineral of a greenish colour occurring in six-sided prisms. It is a pseudomorph after iolite, and consists mainly of hydrous aluminium silicate. It takes its name from Fahlun in Sweden.

FAHRENHEIT (fä'rĕn-hīt), **Gabriel Daniel,** German physicist, known for his arrangement of the thermometer, was born at Danzig in 1686, died in 1736. Abandoning the commercial profession for which he had been designed, he settled in Holland to study natural philosophy. In 1720 he effected a great improvement by the use of quicksilver instead of spirits of wine in thermometers. He invented the Fahrenheit scale (*see* THERMOMETER), and made several valuable discoveries in physics. He

was elected a fellow of the Royal Society of London in 1724.

FAIDHERBE (fā-derb), **Louis Leon Cesar, a** French general, born in 1818, died in 1889. He entered the army in 1840, served in Africa and the West Indies, was appointed Governor of Senegal in 1854, and afterwards of a district in Algiers from 1867 to 1870. After the fall of Napoleon III, he was summoned by the Government of the National Defence to France and appointed commander of the army of the north. He fought some bloody but indecisive battles with the Germans under Manteuffel and Goeben. After the war he was elected to the Assembly by Lille, his native place, but on the triumph of Thiers retired from politics to private life. He wrote *Epigraphie Phénicienne*, and valuable monographs on Senegal, the Sudan, and other parts of Africa.

FAIENCE (fa-yens'), imitation porcelain, a kind of fine pottery, superior to the common pottery in its glazing, beauty of form, and richness of painting. Several kinds of faience are distinguished by critics. It derived its name from the town of Faenza, in Italy, where a fine sort of pottery called *majolica* was manufactured as early as the fourteenth century. The majolica reached its greatest perfection between 1530 and 1560. In the Louvre , the Musée de Cluny, the British and Victoria and Albert Museums, at Berlin, and at Dresden are rich collections of it. The modern faience appears to have been invented about the middle of the sixteenth century, at Faenza, as an imitation of majolica, and obtained its name in France, where a man from Faenza, having discovered a similar sort of clay at Nevers, had introduced the manufacture of it. True faience is made of a yellowish or ruddy earth, covered with an enamel which is usually white, but may be coloured. This enamel is a glass rendered opaque by oxide of tin or other suitable material, and is intended not only to glaze the body, but to conceal it entirely. *See* POTTERY.—Cf. M. L. Solon, *The Old French Faience.*

FAILLY (fā-yē), **Pierre Louis Charles Achille de,** French general, born in 1810, died in 1892. He distinguished himself in the Crimean War, and commanded a division against the Austrians in 1859. He was the means of introducing the Chassepôt rifle into the French army, and commanded the troops which dispersed Garibaldi's irregulars at Mentana. At the outbreak of the Franco-German War Failly received the command of the 5th Corps, but was very unfortunate or unskilful in his organization of operations. His masterly inactivity in the early weeks of the war caused great popular indignation in France. Sedan ended his career as a soldier.

FAILSWORTH, a town of England, in Lancashire, 4 miles north-east of Manchester, with cotton-mills. Silk-weaving and hat-making are also carried on. Pop. (1931), 15,724.

FAINÉANTS (fā-nā-ân; Fr., 'do-nothings'), a sarcastic epithet applied to the later Merovingian kings of France, who were puppets in the hands of the mayors of the palace. Louis V, the last of the Carlovingian dynasty, received the same designation.

FAINTING, or **SYNCOPE,** a sudden suspension of the heart's action, of sensation, and the power of motion. It may be produced by loss of blood, pain, emotional disturbance, or organic or other diseases of the heart. It is to be treated by placing the patient on his back in a recumbent position or even with head slightly depressed, sprinkling cold water on his face, applying stimulant scents to the nostrils, or anything which tends to bring back the blood to the brain. The admission of fresh cool air and the loosening of any tight articles of dress are important.

FAIRBAIRN, Patrick, Scottish theologian, born 1805, died 1874. He became a minister of the Established Church, but joined the Free Church at the disruption in 1843. In 1853 he was appointed professor divinity in the Free Church College, Aberdeen, and in 1856 principal of the Free Church College, Glasgow. Among his works are: *Typology of Scripture*; *Jonah: his Life, Character, and Mission*; *Ezekiel*; *Prophecy*; *Hermeneutical Manual*; *Pastoral Epistles of St. Paul.* He edited and wrote extensively for the *Imperial Bible Dictionary.*

FAIRBAIRN, Sir William, British civil engineer, born at Kelso, Roxburghshire, in 1789, died 18th Aug., 1874. He was apprenticed as an engine-wright at a colliery in North Shields, and commenced business on his own account in Manchester with James Lillie in 1817, where he made many improvements in machinery, such as the use of iron instead of wood in the shafting of cotton-mills. About 1831, his attention having been attracted to the use of iron as a material for shipbuilding, he built the first iron ship. His firm became extensively employed in iron shipbuilding at Manchester and at Millwall, London, and had a great share in the development of the trade. He shares with Stephenson the merit of

constructing the great tubular bridge across the Menai Strait. Fairbairn was one of the earliest members of the British Association for the Advancement of Science, of which he was president in 1861 and 1862. He was created a baronet in 1869. Sir William wrote many valuable professional books and papers, amongst which are: *On Canal Steam Navigation* (1831); *Iron: Its History, Properties, and Manufacture* (1841); *Application of Iron to Building Purposes* (1854); *Iron Ship-building* (1865). His brother Sir Peter, born 1799, died 1861, had also great mechanical ability, and founded large machine-works at Leeds.

FAIRBANKS, Douglas, American motion picture actor and producer. He was born in Denver, Colorado, 23rd May, 1883, and educated at the Colorado School of Mines and Harvard. He acquired stage experience in Shakespearean drama and other plays and once played a small part in London. His first screen appearance was with D. W. Griffith in *The Lamb* and he became so popular that later he had his own producing company. His speciality is athleticism and his most famous pictures are *The Mark of Zorro*, *Robin Hood* and *The Thief of Bagdad*. He now owns his own producing company, and is interested in The United Artists Corps in America and the Allied Artists Ltd. in England and the continent. In 1920 he married Mary Pickford.

FAIRFAX, Edward, the translator into English verse of Tasso's *Jerusalem Delivered*, was the natural son of Sir Thomas Fairfax of Denton, and born in the last quarter of the sixteenth century. He settled at Newhall, in the parish of Fewston, Yorkshire, to a life of studious leisure. The first edition of his translation bears the date of 1600. One or two eclogues by him also remain. He died in 1635.

FAIRFAX, Thomas, Lord, parliamentary general during the English Civil War, born in 1611 at Denton, in Yorkshire, died at Nun Appleton, Yorkshire, 12th Nov., 1671. He was the son and heir of Ferdinando, Lord Fairfax, to whose title and estates he succeeded in 1648. After serving in the Netherlands with some reputation, he returned to England, and on the rupture between Charles I and the Parliament joined the forces of the latter. In 1642 he was appointed General of the Horse, and two years later held a chief command in the army sent to co-operate with the Scots. In 1645, on the resignation of the Earl of Essex, Fairfax became general-in-chief of the Parliamentary army. After the victory at Naseby he marched into the western counties, quelling all opposition, put down the insurgents in Kent and Essex in 1647, and captured Colchester. In April, 1649, he was occupied along with Cromwell in suppressing revolt in the army; but positively declined to march against the Scottish Presbyterians. He was a member of Cromwell's first Parliament. He co-operated in the restoration of Charles II, being one of the committee charged to secure his return.

FAIRFIELD, Municipality of New South Wales. It is 14 miles west of Sydney, of which it is practically a suburb, and with which it is connected by railway. Pop. 7,400.

FAIRFORD, a town in Gloucestershire, England, 8¼ miles east by south of Cirencester, with a church the twenty-eight windows of which are filled with beautiful stained glass, formerly ascribed to Albert Dürer, but now known to have been designed and executed in England. Fairford was the birth-place of John Keble. Pop. 1,500.

FAIR HEAD, a basaltic promontory on the north coast of Ireland, County Antrim, rising to the height of 636 feet

FAIRIES AND ELVES. The fairies of folk-belief must be distinguished from the fairies of imaginative literature Shakespeare, for instance, drew upon the fairy-lore of living tradition to create a new fairy mythology (as in *A Midsummer Night's Dream*) which became a literary convention. In the fairy stories of Hans Andersen the folk-material was similarly used in a free and individual manner. A distinction must likewise be drawn between the Celtic fairies and the Teutonic elves. The former are mainly females, like the nymphs of Homer, ruled over by a fairy queen, while the latter are mainly males, ruled over by an elf-king. Mab, the fairy queen, had no consort in British fairy literature until Oberon, King of the Fairies, was imported from mediæval romance. His name 'Auberon,' anciently 'Alberon,' is identical with that of the German elfin king 'Alberich.' Indeed, the very names 'fairy' and 'fay' were introduced into these islands from abroad.

More than one class of supernatural beings referred to in Gaelic as the *side* (Irish) or *sith* (Scottish), and pronounced *shee*, are now called 'fairies.' These include the Danann deities of Irish mythology and 'the mothers' (Y Mamau) of Welsh folk-lore. The word *side* or *sith* has the secondary meaning of 'peace,' and refers to the

silence of death and the silence of fairy movements. It may also be translated as 'supernatural,' 'Otherworld,' or 'unearthly.' Mysterious diseases that come in epidemics and afterwards disappear are referred to as diseases of the *side* or *sith*. Cat demons are *cait shith*, the cuckoo is *eun sith*, the mythical 'water horse' is *each sith*, a monstrous dog that passes over land and sea by night is *cu sith*, while the 'will-o'-the-wisp' is *tcine sith* ('super-natural fire'). In Iceland *side* refers to the dwellings (earth mounds, &c.) of the Dananns, &c., as well as to the supernatural inhabitants.

The fairies of folk-belief always come from the west on eddies of wind, and cannot be seen except by those who have 'second sight,' or those whose eyes have been anointed with a green balsam possessed by fairies. Sometimes the fairies render themselves visible to all, but one who grasps the garment of a fairy finds his hand closing on nothing. The usual height of fairies is about 3 feet, but they have power to shrink and pass through a crack in a door. They may also assume great stature. The Danann *side* of Ireland are of human or above human height. In Scotland 'green ladies' are of ordinary human size. The chief fairy colours are blue (the eyes), golden (the hair), and green, red, and grey (for clothing). Occasionally fairy beings are white and black. A black fairy with a red spot above the heart is referred to in Scottish stories, but is rare. He can be slain by piercing the red spot. The *side* or *sith* may be attired entirely in green with red caps, or have red cloaks and green skirts. A beautiful fairy queen may suddenly transform herself into an ugly old hag with black and white face and garments, as did the fairy who carried off Thomas the Rhymer to the Underworld.

The dead were supposed to go to Fairyland, the Pagan Paradise. Those who died before their time were doomed to visit their former haunts as 'green ladies,' i.e. green ghosts, until their measure of life was completed. Stories that tell of visions of the dead in the Underworld refer to them feasting and dancing, or reaping corn and plucking fruit in well-watered valleys. The resemblance of the Celtic Agricultural Paradise to the Otherworld of the Egyptian Osiris, which was originally situated under the ground, is of special interest. Both in the Underworld Paradise and on the 'Isles of the Blest' (the Celtic *Avalon* or 'apple land' and 'Land of the Ever-Young') is a tree of life, which may be an apple tree, a hazel tree, or a rowan tree. The apples, nuts, or berries confer longevity on the gods and the souls of human beings that partake of them. On those human beings who have won their favour, the fairies bestow weapons, implements, musical instruments, songs, tunes, and medicines, and the power to work charms and foretell future events.

In the Underworld, fairies engage in metal working and other industries. Sometimes they visit houses, and spin and weave with supernatural skill and speed in a single night big bales of clothing material, or make beautiful garments. Fairies possess gems, gold, silver, and copper in their underground dwellings. Cornish miners hear them working in their mines. The 'banshee' (Ir. *ben-side*) is a Fate who is seen washing the blood-stained clothing, or the 'death clothes,' of those who are doomed to die a sudden death. She either howls, or sings a weird song, or can be heard 'knocking' as she strikes the clothing with a beetle during the washing, when a tragedy is at hand. Fairy women of great beauty have human lovers, but vanish for ever after a few meetings, with the result that their lovers become demented. Fairy men (*fer-side*) likewise upset the minds of girls. The fairies abduct human children, leaving 'changelings' in cradles, or carry off wives to act as 'wet nurses' or midwives. Men who die suddenly are supposed to be transported to Fairyland. King Arthur, the Rev. Mr. Kirk of Aberfoyle, Thomas the Rhymer, and others were removed to the Fairy Paradise.

Among the Celtic *side* are *pixies*, *geniti-glinni* (valley genii), *Bocanachs* (male goblins), *Banánachs* (female goblins), *Demna aeir* (spirits of the air), &c. Fairies may appear in animal forms, chiefly as beautiful birds. Elves are workers in metals, like Wayland Smith, and guardians of treasure who assume the forms of fish, otters, serpents, &c. Black elves dwell under the ground, and white elves haunt the air and the sea. Sea-elves are 'nikkers.' The Greek 'Fates,' like the Celtic fairies, spin, weave, and embroider wedding and other garments in a single night for those they favour, and sometimes appear in groups of three, as old hags, to foretell tragic events or work spells. Celtic 'women of the *side*' sometimes appear in groups of three.

The nereids are, like the fairy ladies, beautiful and capricious, and are likewise invariably blue eyed and golden haired. 'Nereid born' refers to the changeling idea. Nereids travel on whirlwinds, and, like the Celtic fairies, cause spinning spirals of dust on highways. They accept offerings of

food. Lacon, the shepherd in Theocritus (Idyll V), sings, "I will set a great bowl of white milk for the nymphs," In the Scottish Highlands the milk offering was poured on the ground for those 'under the earth,' or into a hollowed stone (*clach-nagruagaich*).

The Indian 'nagas' have power to change from serpent to human form, or to appear as half-human, half-reptile beings. Like the Celtic fairies, they have been referred to by some writers as aborigines who hid from invaders in earth-houses, in forests, and among the hills. In this connection P. C. Roy, the translator of the *Mahábhárata*, writes: "Nagas are semi-divine and can move through air and water and ascend to high heaven itself when they like, and have their home at Patala (the Underworld). To take them for some non-Aryan race, as has become the fashion with some . . . is the very height of absurdity . . . None of these writers, however, is acquainted with Sanskrit, and that is their best excuse."

The fairies and elves of China and Japan resemble those of Europe. In Polynesia there are fairy-like beings. They are called *Patupaiarehe*, and dwell in lonely places, appearing only at night. Human beings receive gifts from them, or knowledge of how to make nets, weapons, &c. The changeling idea is as prevalent as in Europe. It is of special interest to find that the Polynesian fairies have, like the Celtic, fair hair and white skins. Other peoples believe in the existence of fairy-like beings. *See* FOLKLORE. — BIBLIOGRAPHY: T. Keightley, *Fairy Mythology*; E. S. Hartland, *Science of Fairy Tales*; Delattre, *English Fairy Poetry from the Origins to the Seventeenth Century*; H. A. Giles, *China and the Chinese*; J. G. Lawson, *Modern Greek Folklore and Ancient Greek Religion*; Sir George Grey, *Polynesian Mythology*; P. W. Joyce, *Social History of Ancient Ireland*.

FAIR ISLE, an island lying nearly midway between the Orkney and Shetland Islands, 3 miles long by 2 broad. It is inaccessible except at one point, and rises to the height of 711 feet. Some grain is grown, but the surface is mostly in pasture. The men engage in fishing; the women knit a well-known variety of hosiery, introduced, it is said, by Spaniards who escaped from the wreck of one of the vessels belonging to the Spanish Armada. There are two lighthouses. Pop. 250.

FAIR OAKS, BATTLE OF, fought at Fair Oaks, in Virginia, 7 miles east of Richmond, between the Confederates under General Johnston and the Union troops under General M'Clellan, 31st May, 1862. The loss on each side was nearly 6,000 men; the result was indecisive.

FAIRS (Lat. feria, holiday, connected with *festus*, feast), periodical meetings of persons having goods or wares for sale in an open market held at a particular place, and generally for the transaction of a particular class of business. The origin of fairs is obviously to be traced to the convenience of bringing together at stated times the buyers and sellers of the stock-produce of a district. In Europe the numerous festivals of the Church afforded the most favourable opportunity for the establishment of these markets. This association is indicated in the German name of a fair, which is identical with that used for the ceremony of the mass.

In the Middle Ages fairs were of great importance, and were specially privileged and chartered by princes and magistrates, public proclamation being made of their commencement and duration. But modern facilities of communication have much diminished the necessity for periodical markets, and it is now chiefly amongst agriculturists that they are of much importance, large agricultural meetings being held in various districts for the sale of cattle and horses, and for the exhibition of agricultural implements. There are also, especially in Scotland, a considerable number of hiring fairs for farm servants.

In the less developed commerce of the East, however, they still retain much of their ancient importance and magnitude. In Europe the most important fairs of the present day are those at Leipzig and Frankfort-on-the-Main in Germany, at Lyons in France, and Nijni-Novgorod in Russia. The last is, indeed, the largest fair in the world. The fairs of Great Britain now mostly consist of the weekly market-days of country towns and the agricultural meetings already mentioned. In many places the old fair-days are still kept, but are now merely an assemblage of penny-theatres, peep-shows, and such amusements.

Amongst the fairs which were once celebrated saturnalia, or rather bacchanalia, may be mentioned Donnybrook Fair in the county of Dublin; Bartholomew and Greenwich Fairs, London; and Glasgow Fair. The first three are now extinct. Fairs in the sense of markets are unknown in the United States, but the term is usually given to ladies' fancy bazaars, collections of fine art or the higher industries for public exhibition.—Cf. C. Walford, *Fairs, Past and Present*.

FAIR TRADE, an economical policy

advocated by many in Britain, which, while not opposed to free trade in principle, would meet the prohibitory tariffs that foreign countries may put on British goods by placing equally heavy duties on goods sent from these countries to Britain. *See* FREE TRADE.

FAIRWEATHER, MOUNT, on the west coast of North America, in Alaska territory. It rises to the height of 14,900 feet, and is covered with perpetual snow.

FAIRY RING, a circle, or part of a circle of grass, of a darker colour and more luxuriant growth than the surrounding herbage, superstitiously associated with fairy revels. Actually it is due to the growth of a subterranean fungus-mycelium, which gradually spreads outwards from a central



Castle at Falaise

point of origin, the older parts dying and serving as manure for the grass, which appears even more vigorous than it really is by contrast with that on the outermost edge of the ring, where the living mycelium has a bad effect upon the grass-roots. The commonest fairy-ring fungus is *Marasmius oreades*, the fairy-ring champignon.

FAITH, the assent of the mind to the truth of what is declared by another, resting on his authority and veracity, either without other evidence or on probable evidence of any kind. In a special sense the term faith is used for the assent of the mind to what is given forth as a revelation of man's relation to God and the infinite, i.e. a religious faith. In Christian theology we have: first, *historical* or *speculative faith*, or belief in the historic truthfulness of the Scripture narrative and the claims of Scripture to an inspired and supernatural origin; second, *evangelical* or *saving faith*, that emotion of the mind (as Dwight defines it) which is called trust, or confidence exercised towards the moral character of God, and particularly of the Saviour.—Cf. W. R Inge, *Faith and its Psychology*.

FAITH-HEALING. The tenets of the Peculiar People and of other believers in healing by faith differ from the views of Christian Scientists in this respect: that, while the latter hold pain and disease to be illusions of the imagination, the faith-healer admits their existence, but affirms the possibility of their removal by non-scientific means. Some make use of anointing with oil, while others hold prayer and the laying-on of hands to be the only requisites. Faith-healing traces its source to the raising of the apparently dead, the curing of the sick, the restoration of sight to the blind, and other recorded miracles of Christ; thence through the miracles of the disciples and their successors, down to the performances of Dorothy Trudel in Switzerland, and the displays of Dowie in London (1904). Faith-healers flourish extensively in Sweden and America, while even in England 'Bethshans' (houses of cure) have been established.

Faith, or some may say credulity, attributes the alleged cures to supernatural agency; science sees in them the action of 'suggestion,' with an exalted and emotional state of mind in the patient, more especially when surrounded and encouraged by a crowd of expectant and credulous lookers-on. Excessive reliance on his or her own powers has not seldom brought faith-healer within the menace of law, owing to neglect to employ a qualified medical man, and the consequent death of the sufferer. In a broad sense of the term the belief in healing by faith has been at the root of 'touching' for the King's Evil, a practice followed by several English and French sovereigns (*see Macbeth* iv, 3, 141); of the value placed on relics; of alleged cures effected at such 'holy places' as St. Winifred's Well in Wales, and at Lourdes; and of the firm belief, not yet entirely extinct, in many rustic remedies, such as the removal of children's ailments by immuring a live shrew in a cleft ash tree.—BIBLIOGRAPHY: F. Podmore, *Mesmerism and Christian Science*; G. B. Cutten, *Three Thousand Years of Mental Healing*.

FAIYUM. *See* FAYOUM.

FAKENHAM, market town of Norfolk. It stands on the Wensum, 21½ miles from King's Lynn, on the L.N.E. and L.M.S. Rlys. Pop. 2,966.

FAKIRS (fá-kērz'; literally 'poor men'), a kind of fanatic met with chiefly in India and the neighbouring countries, who retire from the world and give themselves up to contem-

plation. They are properly of the Mohammedan religion, but the term is often used for a mendicant of any faith. They are found both living in communities and solitary. The wandering fakirs gain the veneration of the lower classes by absurd penances and self-mutilations.

FALABA, town of Sierra Leone, W. Africa. It is 170 miles from Freetown and is a trading centre. Pop. 6,000.

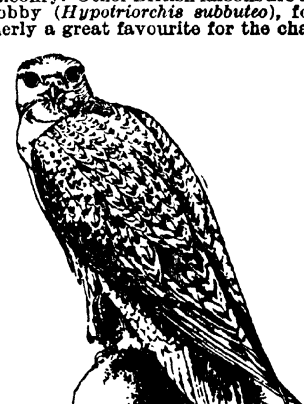
FALAISE (fȧ-lāz), a town, France, department of Calvados, picturesquely situated on a rocky precipice (Fr. *falaise*) 19 miles S.S.E. of Caen. It contains several objects of interest, among others the ruined castle of the Dukes of Normandy, where William the Conqueror was born. Pop. 6,850.

FALASHAS, inhabitants of Amhara, in Abyssinia, who claim descent from Jewish emigrants during the reign of Jereboam. *See* ABYSSINIA.

FALCKENSTEIN, Edward Vogel von, a Prussian general, born in 1797, died in 1885. In 1813 he entered the Prussian army, distinguishing himself at the battles of Katzbach and Montmirail. In 1848 he served in the Holstein campaign, and he acted as colonel and chief of staff in the war with Denmark in 1864. In the war of 1866 he commanded the Seventh Army Corps. On the outbreak of the Franco-German War in 1870 he was appointed military governor of the maritime provinces.

FALCON (fȧ'kn), a name of various birds of prey, members of the family Falconidæ. The falcons proper (genus Falco), for strength, symmetry, and powers of flight are the most perfectly developed of the feathered race. They are distinguished by having the beak curved from the base, hooked at the point, the upper mandible with a notch or tooth on its cutting edge on either side, wings long and powerful, the second feather rather the longest, legs short and strong. The largest European falcons are the jerfalcon or gyrfalcon proper (*Falco gyrfalco*), a native of the Scandinavian Peninsula, and the Iceland falcon (*F. islandus*); to which may be also added the Greenland falcon (*F. candicans*). Between these three species much confusion at one time prevailed, but they are now distinctly defined and described. These three Arctic falcons are often referred to the special genus Hierofalco. In the Greenland falcon the prevailing colour at all ages is white, in the Iceland falcon dark. The latter more nearly resembles the true gyrfalcon of Norway, which, however, is generally darker, rather smaller, but with a longer tail.

The average length of any of these falcons is about 2 feet. The Greenland species used to be the most highly prized by falconers. Its food consists chiefly of ptarmigans, hares, and waterfowl. It is found over a wide range of northern territory. The peregrine falcon (*F. peregrinus*) is not so large as the jerfalcon, but more graceful in shape. It chiefly inhabits wild districts, and nestles among rocks. It preys on grouse, partridges, ptarmigans, pigeons, rabbits, &c. Its flight is exceedingly swift, said to be as much as 150 miles an hour. The peregrine falcon was one of those most frequently used in falconry. Other British falcons are the hobby (*Hypotriorchis subbuteo*), formerly a great favourite for the chase



Greenland Falcon

of small game when falconry was in fashion; the merlin or stone-falcon (*Æsalon regulus*), small but swift and spirited; the kestrel or wind-hover (*Tinnunculus alaudarius*), one of the most common British falcons. The term falcon is by sportsmen restricted to the female, the male, which is smaller and less courageous, being called *tiercel, tersel, tercelet,* or *falconet.* *See* FALCONRY.

FALCO'NE, Aniello, Italian painter, born in 1600, studied along with Salvator Rosa under Spagnoletto. His paintings, consisting chiefly of battle-pieces, are masterpieces, but very rare. He died in 1665.

FALCONER (fȧk'nér), **Hugh,** Scottish naturalist, born in 1808, died, 1865. After having graduated in arts at Aberdeen and medicine at Edinburgh, he went to India as a surgeon

in 1830. Here he made valuable geological researches, and turned his attention to the introduction of tea cultivation. In 1837 he accompanied Barnes's second mission to Cabul. He visited England in 1843 and published an illustrated descriptive work entitled *Fauna Antiqua Sivalensis* (Ancient Fauna of the Sivâlik Hills). He returned to India in 1848, where he had been appointed superintendent of the botanic gardens at Calcutta. In 1855 he returned to England, where he died.

FALCONER, William, poet and writer on naval affairs, born at Edinburgh in 1732. He went to sea in the merchant service, was wrecked, and wrote a poem (*The Shipwreck*) descriptive of the incidents, published in 1762.



Falcon with Hood

He then entered the navy, and was rated as midshipman on board the *Royal George*. In 1769 he published a *Universal Marine Dictionary*. The same year he sailed for Bengal as purser of the *Aurora* frigate, which is believed to have foundered at sea.

FALCON'IDÆ, a family of diurnal birds of prey, in which the destructive powers are most perfectly developed. The family includes the different species of eagles as well as the hawks and falcons properly so called, and comprises the sub-families Gypaëtinæ (lammergeiers), Polyborinæ (carrion hawks), Accipitrinæ (hawks and harriers), Aquilinæ (eagles), Buteoninæ (kites and buzzards), and Falconinæ (falcons).

FALCONRY (fą'kn-ri), also called *hawking*, the pursuit of game by means of trained hawks or falcons. Falconry is a sport of great antiquity in Asia, having been followed in China as early as 2000 B.C. In Europe it was, during the Middle Ages, the favourite amusement of princes and nobles, and, as ladies could take part in it, became very general. Charlemagne passed laws in regard to falconry, while in Germany Henry the Fowler and the Emperor Frederick the Second were greatly addicted to it, and the latter wrote a work on the subject. In France it reached its greatest popularity under Francis I, whose grand falconer controlled an establishment of fifteen nobles and fifty falconers, at an annual cost of about 40,000 livres. In Britain the sport was practised before the Norman Conquest, but became still more popular after it, and till about 1650 enjoyed the prominence now held by fox-hunting. One of the most interesting of English works on the subject is that which forms the first part of the *Boke of St. Albans*, first printed in 1481. George Turberville's *Booke of Faulconrie or Hawking*) 1575) and Simon Latham's *The Falcon's Lure and Cure* (1633), may also be mentioned.

Through the invention of fire-arms gradually superseded this amusement, it is not yet entirely extinct. The Duke of St. Albans is still hereditary grand falconer, and presents the king with a *cast* (or pair) of falcons on the day of his coronation. In Persia and other Eastern countries hawking is still in favour. The game hunted includes hares and rabbits, and, in the East, gazelles; with herons, wild geese, and many smaller birds.

The training of a hawk is a work requiring great patience and skill, the natural wildness and intractable nature of the birds being very difficult to overcome. When a hawk suffers itself to be hooded and unhooded, quietly, and will come to the trainer's hand to receive food, its education is considered far advanced, and the work, of accustoming it to the *lure* may be proceeded with. The *lure* may be a piece of leather or wood, covered with the wings and feathers of a bird, and with a cord attached. The falcon is fed from it, and is recalled from flight by the falconer swinging the lure round his head with a peculiar cry. When the bird has been taught to obey the lure, it is next practised in the art of seizing its game, being initiated with prey fastened to a peg, and flown later at free game. When fully trained and being used for sport, the falcon is kept hooded until actually required to fly. Among the many technical terms connected with falconry may be mentioned that of *mew* (= moult), from which is derived the familiar name of *mews*, originally places where hawks were kept while moulting. — BIBLIOGRAPHY: J. E.

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FALD'STOOL (O.H.Ger. *falden*, to fold, and *stol*, chair), a folding stool provided with a cushion for a person to kneel on during the performance of certain acts of devotion, especially a kind of stool placed at the south side of the altar, on which the Kings of England kneel at their coronation. The term is also given to a small desk at which the litany is enjoined to be sung or said.

FALER'NIAN WINE an ancient wine of great repute amongst the Romans It was made from the grapes grown on Mount Falernus in Campania. It was strong and generous, probably much resembling modern sherry.

FALIE'RO, Marino, Doge of Venice, born in 1274, commanded the troops of the republic at the siege of Zara in Dalmatia, where he gained a brilliant victory over the King of Hungary. He succeeded Andrea Dandolo, 11th Oct., 1354, was accused of the design of overthrowing the republic and making himself sovereign of the state, and beheaded 17th April, 1355. The last scenes of his life are depicted in Byron's tragedy of *Marino Faliero*.

FALKENHAYN, Erich von. German soldier. Born 11th Nov., 1861, he entered the army in 1880 and ten years later joined the general staff. In 1900 he saw service in China and rose to be chief of the staff of the 4th army. In 1913 he was appointed Minister of War and when the World War began he held that position. In Dec., 1914, he succeeded Moltke as chief of the general staff and directed operations until he was superseded in Aug. 1916. He then took command of the army that invaded Rumania and was afterwards in charge of the Turkish Armies. He died 8th April, 1922.

FAL'KIRK, a parliamentary burgh of Scotland, in Stirlingshire, 24¾ miles west by north of Edinburgh. The older portion of it is old-fashioned and irregularly built. There are several modern suburbs. In the town or its vicinity are the Carron Ironworks, the Falkirk Foundry, and others works, collieries, chemical-works, and distilleries. Falkirk is connected with the port of Grangemouth by a railway 3 miles long. The Trysts of Falkirk, held on Stenhousemuir, 3 miles to the N.N.W., are the largest cattle-fairs in Scotland. Falkirk is an old town, with many historical associations. In the neighbourhood was fought the battle of Falkirk in 1298 between Sir William Wallace and Edward I, the Scots, who were much inferior in numbers, being defeated. About 1 mile south-west from the town the Highlanders under Prince Charles defeated the Royal forces under General Hawley, 17th Jan., 1746. **Stirling and Falkirk Burghs** return one member to the House of Commons. Pop. of Falkirk (1931), 36,565.

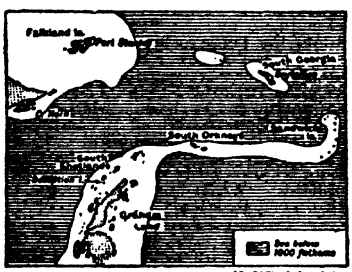
FALKLAND (fak'land). **Lucius Cary,** Viscount, an English man of letters, born about 1610. His father being then Lord-Deputy of Ireland, he was educated at Trinity College, Dublin. After passing a short time abroad, he devoted himself to a life of retirement and literary studies, chiefly residing at his seat at Burford, near Oxford, which he made a kind of academy for the learned men of the neighbouring universities. In 1639 he joined the expedition against Scotland; and in 1640, his peerage being Scottish, he was chosen member of the House of Commons for Newport, in the Isle of Wight. In the first instance he warmly supported the Parliament, but doubts of the ultimate objects of the parliamentary leaders caused him to modify his attitude; and in 1642 he accepted from Charles I the office of Secretary of State. When hostilities began, he embraced decidedly the cause of the king, though he desired peace rather than victory. He was slain at the battle of Newbury, 20th Sept., 1643. He left behind him a work entitled *A Discourse on the Infallibility of the Church of Rome*, several pamphlets and published speeches, and a few poems, but nothing that explains the universal praises bestowed on him by contemporaries.

FALKLAND (fak'land), an ancient royal burgh of Scotland, county of Fife, 25 miles north of Edinburgh. It was once the residence of the Scottish kings, and possesses remains of an ancient palace and some curious old houses. There was formerly a castle here, in which David, eldest son of Robert III, was starved to death by order of his uncle the Duke of Albany, but no trace of it now remains. Falkland Palace was garrisoned by Rob Roy in 1715. Pop. (1931), 791.

FALKLAND ISLANDS, an island group belonging to Great Britain, in the South Atlantic Ocean, about 300 miles east of the Straits of Magellan. They consist of two larger islands, East Falkland and West Falkland, containing respectively about 2,580 and 2,038 sq. miles, with a great number of smaller ones surrounding them; total area, 4,618 sq. miles. They are hilly and boggy, entirely destitute of trees, but covered with a variety of

grasses very nutritive for the sheep and cattle the rearing of which is the principal industry. Fish and sea-fowl abound. Wool, frozen meat, hides, and tallow are the chief exports; value in some years £609,000. The climate is equable and very healthy.

History. The Falkland Islands were discovered by Davis on the 14th Aug., 1592. In 1710 a French vessel from St. Malo touched at them, and named them Îles Malouines. Settlements were afterwards formed on them by the French, Spaniards, and British alternately, but the British have ultimately retained possession of them. They now form a Crown colony which has a Governor and other officers appointed by the Government. Port Stanley, in East Falkland, is a thriving settlement, and has now a wireless station. During the European War



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Falkland Islands and Dependencies
The various groups of islands lie on a submarine ridge stretching in a curve from Graham Land to Cape Horn

the Germans suffered a naval defeat off the Falkland Islands in Dec., 1914. Pop. of the group (1931), 2,392.

FAL'LACY (Lat. *fallax*, apt to mislead), in logic, is when an argument is used as decisive of a particular issue, which in reality it does not decide. Properly a fallacy is a fault in the form of reasoning (*see* LOGIC), but the term is applied also to faults in the substance of the argument such as the *petitio principii*, or proving one proposition by assuming another which is identical with it; *ignoratio elenchi*, or mistaking the point at issue; *post hoc ergo propter hoc*, or arguing as if sequence were the same thing as cause and effect.

FALLIÈRES, Clément Armand, eighth President of the French Republic, born at Mézin, department of Lot-et-Garonne. The son of peasants, he studied law, was mayor of Nérac for some years, and in 1876 was elected to the Chamber of Deputies. Under-Secretary of State in the Ministry of the Interior in 1880, he became Minister of the Interior in 1882, Minister of Public Instruction from 1883 to 1885, and subsequently Minister of Justice and Public Instruction. He entered the Senate in 1890. In 1899 he became President of the Senate, and on 16th Jan., 1906, was elected President of the Republic. During his tenure of office Fallières displayed decided democratic principles and a tendency towards the Left. It was due to his initiative that a Ministry of Labour was formed in 1909. His term of office ended in Jan., 1913. Fallières was one of France's most democratic Presidents. He died 22nd June, 1931.

FALL OF BODIES. All bodies on the earth, by virtue of the attraction of gravitation, tend to the centre of the earth. A ball held in the hand presses downward; if dropped, it descends vertically; if placed on an inclined plane, it rolls down, in doing which it presses the plane with a part of its weight. In the air bodies fall with unequal velocities, a piece of paper, for instance, more slowly than a ball of lead; and it was formerly thought that the velocity of the fall of bodies was in proportion to their weight.

This error was attacked by Galileo, who, experimenting with balls of different substances which he dropped from the tower of Pisa, was led to the conclusion that the resistance of the air acting on different extents of surface was the cause of the unequal velocities, and that in a vacuum all bodies would fall with the same velocity.

The truth of this last proposition was first demonstrated by Newton in his celebrated 'guinea-and-feather' experiment, where a guinea and feather are shown to fall side by side in the vacuum of the air-pump. This experiment proves that the force of gravitation in bodies is proportional to their inertia, that is, to their mass. The laws of falling bodies, that is of bodies falling freely in a straight line and through a distance short in comparison with that of the earth's centre are the following:

1. When a body falls from rest it acquires velocity at the rate of about 32·2 feet per second every second. This number, which represents the acceleration due to the force of gravity, varies slightly with the locality, increasing from the equator to the poles, and diminishing as we recede from the surface of the earth (*see* GRAVITY). At the end of five seconds, therefore, the body would be found to be moving at the rate of $5 \times 32{\cdot}2$, that is, 161 feet per second.

2. The space fallen through in the first second is half of 32·2, that is, 16·1 feet; and the space fallen through in

any given time is found by multiplying the square of the number of seconds by 16·1. Thus in three seconds a body falls 9 × 16·1 feet, or 144·9 feet.

3. The square of the velocity acquired by falling through any number of feet is found by multiplying twice that number by 32·2. Thus if a body falls 9 feet, the square of the velocity acquired is 2 × 32 × 9, or 576 if we take 32 instead of 32·2; and taking the square root of 576, we find that a velocity of 24 feet is acquired in a fall of 9 feet.

4. When a body is projected vertically upward with a given velocity, it continues to rise during a number of seconds found by dividing the number that expresses the velocity of projection by 32·2; and it rises to a height found by dividing the square of that number by 2 × 32·2, or 64·4. For a machine used in verifying the laws of falling bodies, *see* ATTWOOD.

FALL OF MAN, a commonly received doctrine of Christianity, founded upon the historical narrative contained in the third chapter of the book of *Genesis*, together with the allusions to the same matter in other parts of Scripture. Adam, having eaten of the forbidden fruit, is said to have fallen; and the relation of mankind in general to this fall is stated by St. Paul in the words: "By one man's disobedience many were made sinners" (*Rom.* v. 19). Thus, in the fall of Adam, all men are held to have fallen and to have contracted 'original sin,' alienating them from God and rendering them morally inadequate. The doctrine of the fall does not stand alone in Scripture. It is argued by some interpreters that in the original sentence pronounced on the transgressors there is contained the promise of a redemption, and that the whole scope of Scripture is directed to the development of this promise, and of the divine scheme of providence associated with it.

FALLOPIAN TUBES, in anatomy, are two ducts each of which opens by one extremity into the womb, at either angle of the fundus, and terminates at the other end in an open trumpet-shaped mouth, which receives the ovum as it escapes from the ovary and transmits it to the womb. They are named after Fallopius or Fallopio, an Italian anatomist of the sixteenth century, who first recognized their functions.

FALLOW DEER, a European and Western Asiatic deer, the *Cervus dama*. It is smaller than the stag, of a brownish-bay colour, whitish beneath on the insides of the limbs, and beneath the tail. The horns, which are peculiar to the male, are very different from those of the stag; they are not properly branched, but are broader towards the upper part, and divided into processes down the outside. A simple snag rises from the base of each, and a similar one at some distance from the first. It was introduced at an early period into Britain, possibly by the Romans, and is kept in many English parks.

FALLOW LAND, ground that has been left uncultivated for a time, in order that it may recover itself from an exhausted state. Strictly speaking, fallow ground is left altogether without crops; but in agricultural usage strict fallow is not always adopted, and the term fallow is applied to various modes of treatment, of which at least three distinct varieties are recognized: *bare fallow*, *bastard fallow*, and *green-crop fallow*. Bare fallow is that in which the land remains completely bare for a whole year; in bastard fallow it is ploughed up and worked after the removal of a spring or summer crop, preparatory to the sowing of a root or forage crop, to occupy the ground during autumn or winter; in green-crop fallow the land is sown with a root-crop, such as turnips or potatoes, placed in rows far enough apart to admit of the intermediate spaces being stirred, pulverized, and cleaned, during its growth, by horse or hand implements.

FALL RIVER, a city and port, Bristol County, Massachusetts, United States, on an arm of Narraganset Bay, on Taunton River, 50 miles S.S.W. of Boston. It is at the head of deep-water navigation, and the terminus of a line of steamers from New York. It contains several handsome streets, and has extensive cotton, woollen, and calico-printing factories, as well as ironworks. Pop. (1930), 115,274.

FALMOUTH, a seaport and municipal borough of England, in Cornwall, 269¼ miles W.S.W. of London. There is a good harbour there, with a fine roadstead affording excellent refuge for shipping. Falmouth was at one time an important packet station, but is now chiefly a port of call, its principal trade being in supplies and stores for shipping. Falmouth and Penryn together give name to a parliamentary division of the county, returning one member to Parliament. Pop. (1931), 13,492.

FALSE ACACIA, tree of the leguminous order *Robinia pseudacacia*, also called bastard acacia or locust tree. It is a native of North America and attains a height sometimes of 60 or 80 feet. It is widely cultivated in Britain and Europe, its long sprays of fragrant white or rose-purple flowers closely resembling those

of the yellow laburnum. It is usually called acacia erroneously, as the true acacia is a mimosa.

FALSE IMPRISONMENT, the unlawful imprisonment or detention of any person. Every confinement of the person is imprisonment, whether in a common prison or a private house, or even by forcibly detaining one in the streets or highways. The law punishes false imprisonment as a crime, besides giving reparation to the party injured, through an action of trespass.

FALSE PERSONIFICATION (English law). All forms of false personation, for the purpose of obtaining the property of others, are made penal by express statute. To personate the owner of any share, stock, or annuity, &c., is felony, and renders the offender liable to penal servitude for life, or to a modified term of penal servitude or imprisonment. The false personation of voters at an election is a misdemeanour punishable with imprisonment and hard labour, for a term not exceeding two years.

FALSE PRETENCES, phrase used in English law. It is an offence to obtain or attempt to obtain, goods or property on false pretences, which is "a false representation by words, writing or conduct of an existing fact." To convict a person of this offence, it must be shown that he acted with intent to defraud and that he knows that the statement he made was false.

FALSET'TO (It.) applies, in singing, to the notes above the natural compass of the voice. It is also called the *head* or *throat* voice, in contradistinction to the *chest* voice, which is the natural one. The falsetto voice is produced by tightening the ligaments of the glottis.

FALSE WEIGHTS AND MEASURES. The using of false weights and measures is an offence at law punishable by fine. By various British statutes standards are provided for weights and for measures of capacity or dimension, and all contracts of sale, &c., are referred to such standards unless there is a special agreement to the contrary. *See* WEIGHTS AND MEASURES.

FAL'STER, an island belonging to Denmark, situated at the entrance of the Baltic, east of Laaland, from which it is separated only by a narrow strait; flat, well watered, and wooded; productive in grain, pulse, potatoes, and, above all, fruit; area, 183 sq. miles. The principal town is Nykjöbing. Pop. 37,460.

FALUN, or **FAHLUN** (fä'lun), a town of Sweden, on Lake Runn, 130 miles north-west of Stockholm. It has an excellent mining school, museums, and mineralogical collections. Within the town boundary is the famous Falun copper-mine, formerly the richest in Sweden, and worked for 500 years. Pop. 13,370.

FAMA CLAMO'SA ('as clamant report'), in the ecclesiastical law of Scotland, is a public report imputing immoral conduct to a clergyman, licentiate, or office-bearer of the Church. When the fama has become so notorious that it cannot be overlooked, the presbytery, after due inquiry, and if no particular party comes forward to institute a process, usually appear as accusers themselves.

FAMAGUS'TA, or **FAMAGOSTA,** a seaport on the east coast of Cyprus. It is of remote antiquity, was an important place during the Middle Ages under the Lusignan kings of Cyprus and the Venetians, but, after being captured by the Turks in 1571, it declined. It has improved under the British, and has got a new harbour. Pop. 6980.

FAMATI'NA, a district and mountain range in the Argentine Republic, province of La Rioja, rich in copper; highest summit, the Nevada de Famatina, 19,758 feet high.

FAMILIAR SPIRITS, demons or evil spirits supposed to be continually within call and at the service of their masters, sometimes under an assumed shape, sometimes attached to a magical ring, or the like, sometimes compelled by magic skill, and sometimes doing voluntary service. We find traces of this belief in all ages and countries, under various forms.

FAMILY, unit of society consisting of father, mother and their offspring. It is used also for a larger unit, brothers, sisters, and their offspring, and we speak of the royal family and the Cavendish family meaning a group of relatives.

Many scholars have inquired into the early history of the family and although they disagree on many points they agree that it goes back to the beginnings of human society. It evolved from a society in which unions were promiscuous and paternal parentage uncertain, and became one of the bases on which our modern civilization is built.

The family was mainly patriarchal and under the rule of the father, and in many countries it included his children by various wives and concubines. In some societies it was matriarchal, the mother being the recognized head, but this state of affairs has long passed away, except perhaps among one or two primitive peoples. In the western world, protected by the

power of the Christian Church, it took the form which it now retains.

Family is used by zoologists and botanists for a group of organisms that in certain vital principles resemble each other. A family in this sense consists of several genera.

Family is also used for a group of languages, e.g. the Aryan or Indo-European family.

Family, in zoological classification, a group of species more comprehensive than a genus and less so than an order, a family usually containing a number of genera, while an order contains so many families. Family names usually terminate in -Idæ (after Latin patronymics, such as Æacidæ, sons or descendants of Æacus). In botany it is sometimes used as a synonym of natural order.

FAMILY COMPACT, the name given to an alliance organized by the Duc de Choiseul, first minister of Louis XV, between the various members of the Bourbon family, then sovereigns of France, Spain, the Two Sicilies, Parma, and Piacenza, mutually to guarantee each other's possessions. It was signed 15th Aug., 1761, and entailed on Spain a war with England.

FAMILY ENDOWMENT, the steady fall in the birth-rate has given prominence to the principle of regulating salaries and wages to some extent by the number of a man's family. For long payments for children have been made to ministers in the Wesleyan Methodist church and the scheme has been introduced into one or two educational establishments. In New South Wales there is a state scheme of this kind. Employers pay a tax on the amount paid by them in wages, and this goes in allowances to those workers who have dependent children. This family endowment principle was introduced in 1927. There is in London a society for introducing something of the kind into Great Britain.

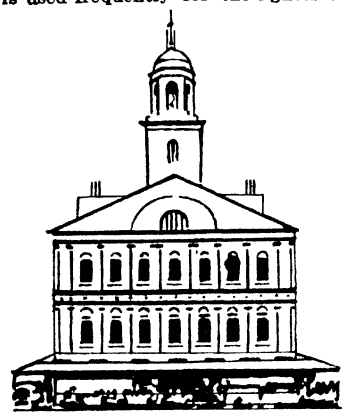
FAMINE, an extreme scarcity of food affecting considerable numbers of people at the same time. Its causes are either natural, such as crop failures due to disease or to excessive or deficient rainfall, the effect of these being aggravated when the crop concerned is one on which the population mainly depends; or political and economic, such as war, or defects in the organization of production and distribution. In the Early and Middle Ages famines were frequent; but the rapidity of modern communication and transport made famines rare in Europe, until the conditions caused by the Great War produced great scarcity in Central Europe. In Ireland the years 1811, 1816, 1822, 1831, 1846 were marked by failure of the potato crop, and in the last-mentioned year the dearth was so great that £10,000,000 were voted by Parliament for relief of the sufferers. India has been the seat of many great famines, which recur at more or less regular intervals; but of late the British officials have been successful in organizing preventive and relief measures, such as improvement in railways and irrigation, the multiplication of industries, and the institution of a famine insurance grant. Amongst the more recent famines are that in North-West India (1837–8), in which above 800,000 perished; that in Bengal and Orissa (1865–6), when about a million perished; that in Bombay, Madras, Mysore (1877); that of 1896-7; and that of 1900 in Bombay, Punjab, &c., perhaps the most serious on record, when the Government spent £10,000,000 in relief. In China a great famine took place in 1877-8 in which over 9 millions are said to have perished; another took place in 1888–9, owing to the overflow of the Yellow River.

FAN, the name of various instruments for exciting a current of air by the agitation of a broad surface. (1) An instrument made of wood or ivory, feathers, thin skin, paper, variously constructed and mounted, and used by ladies to agitate the air and cool the face. As an article of luxury the fan was well known to the Greeks and Romans. Fans are said to have been introduced into England from Italy in the reign of Henry VIII, and Queen Elizabeth was very fond of them. There is a collection of fans at the Victoria and Albert Museum, London. (2) Any contrivance of vanes or flat discs revolving by the aid of machinery, as for winnowing grain, for cooling fluids, urging combustion, or assisting ventilation, is also so called.

FANAR'IOTS, or PHANARIOTS, the inhabitants of the Greek quarter, or Phanar in Istanbul, particularly the noble Greek families resident there since the times of the Byzantine emperors. The dragoman or interpreter of the Porte and other high officials used to be taken from their number. They have now mostly lost their influence at Istanbul, and have in many cases transferred themselves to Athens.

FANAT'ICISM, a term applied more particularly to the extravagance manifested in religious matters by those who allow themselves to be hurried away by their fancy and feelings, to the adoption not only of wild enthusiastic views, but also of inordinate and not infrequently persecuting measures. By an extension of the term it is also sometimes applied to other forms of extravagance.

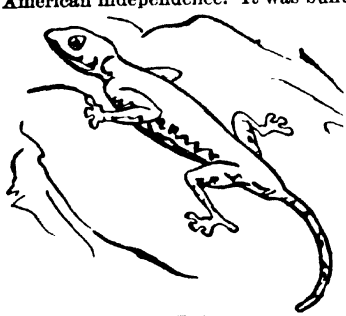
FANCY, a term approaching imagination in meaning. In its general acceptation it refers both to the forms of the imagination and to the mental faculty which produces them; but it is used frequently for the lighter or



Faneuil Hall, Boston

more fantastic forms of the imagination, and for the active play of that faculty which produces them. *See* IMAGINATION.

FANEUIL HALL (fan'ū-il), a public building in Boston, famous as the place where stirring speeches were made at the outbreak of the war for American independence. It was built



Fan-Foot

between 1740 and 1742 by a Huguenot merchant named Peter Faneuil.

FANFARE (Sp. *fanfárria*, brag), a short, lively, loud, and warlike piece of music, composed for trumpets and kettle-drums. Also small, lively pieces performed on hunting-horns, in the chase.

FAN-FOOT, a name given to a North African lizard of the genus Ptyodactylus (*P. lobatus*), one of the geckoes, much dreaded in Egypt for its supposed venomous properties.

FANG, term applied to the poison teeth of certain snakes, particularly the viper and rattlesnake. The poison fangs are usually larger than the ordinary teeth and are grooved or traversed by a duct from the poison gland. When a snake strikes its prey, the venom is pressed out of the gland into the duct by muscular contraction and thence conducted into the wound made by the fang.

FANNICH, district and loch of Scotland. The district is in the County of Ross and Cromarty and consists of a group of mountains and a deer



Fan-tail Pigeon

forest. Near these is Loch Fannich, a lake about 6¼ miles long. A short stream, called Fannich Water, carries off its waters.

FANNING ISLAND, a coral island in the centre of Polynesia, lat. 3° 51′ N., long. 159° 22′ W. Since 1888 it belongs to Britain, is a landing-place of the Canada-Australia cable, and the stretch from this to Vancouver, 3,458 miles, is the longest in the world. The island was discovered by Edmund Fanning in 1798. Area, 15 sq. miles; pop. about 200. It forms one of a small group sometimes called Fanning Islands.

FANO, a seaport of Italy, on the Adriatic, province of Pesaro e Urbino, 29 miles north-west of Ancona. It is a handsome town and has a triumphal arch erected to Augustus, and other antiquities. Pop. 11,689.

FAN-PALM, a name sometimes given to the talipot palm or *Corypha*

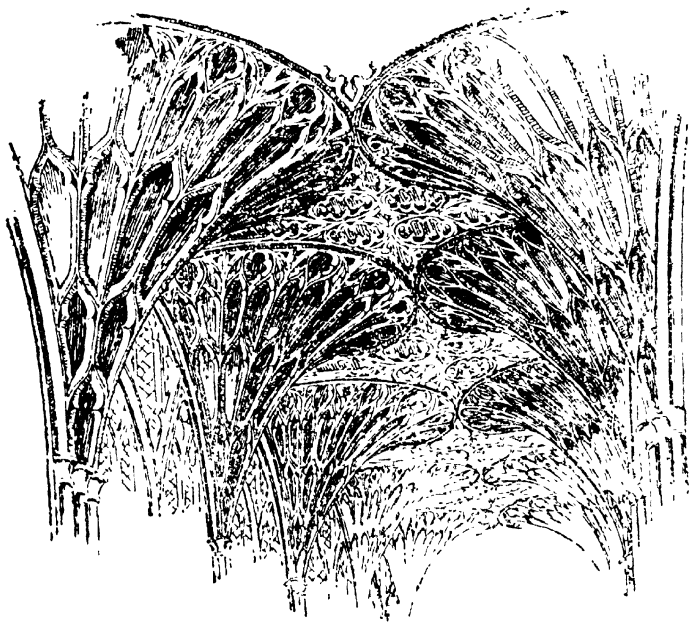
umbraculifera, a native of Ceylon and Malabar. *See* TALIPOT PALM.

FANS, an African race of people inhabiting the region of the west coast about the Gaboon River and the Ogoway. They are an energetic race, skilled in various arts, and are rapidly increasing in numbers (about 300,000). They are cannibals, but contact with Europeans is leading them to give up the practice.

FANSHAWE, Sir Richard, an English diplomatist, poet, and translator, born in 1608, died at Madrid in 1666. He studied at Cambridge, was secretary of the English Embassy at Madrid, and took the Royal side on the outbreak of the Civil War in 1641. He was made a baronet in 1650, was take prisoner at Worcester, but permitted to go at large on bail. After the Restoration he was employed on several diplomatic missions, and in 1664, as Ambassador at Madrid, negotiated a peace between England, Spain and Portugal. His poetical abilities were above mediocrity, as is evinced by his translations of the *Lusiads* of Camoens, the *Pastor Fido* of Guarini, the *Odes* of Horace, and the fourth book of the *Æneid*.

FAN-TAIL, a variety of the domestic pigeon, so called from the fan-like shape of their tails. Also a name applied to certain birds (species of Rhipidura) of the fly-catcher family, native to India, Australia, and New Zealand.

FANTASIA, musical composition free from formal restrictions and often descriptive. Originally a fantasia was a composition for instruments vari-



Fan-tracery Vaulting, Gloucester Cathedral

ously combined, but without voices. As composed by Byrd and his contemporaries the fantasia was the immediate precursor of the sonata. Bach, Mozart and Beethoven carried on the tradition.

FANTEES, a people of West Africa inhabiting the coast district of the Gold Coast Colony, between the Ashantis and the sea. They were at one time the most numerous and powerful people situated immediately on the Gold Coast seaboard; but their power was almost entirely broken after 1811 by repeated invasions of the Ashantis, and they have since

lived under British protection. The soil is fertile, producing fruits, maize, and palm-wine.

FAN-TRACERY, in architecture, elaborate geometrical carved work, which spreads over the surface of a vaulting, rising from a corbel and diverging like the folds of a fan. Fan-tracery vaulting is much used in the Perpendicular style, in which the vault is covered by ribs and veins of tracery, of which all the principal lines diverge from a point, as in Henry VII's chapel, Westminster Abbey.

FAO, village of Iraq. It stands on the Shatt-el-Arab, about 3 miles from the Persian Gulf. It was seized by the



Michael Faraday

British in Nov., 1914, and, when fortified, was used as a base for the operations in Mesopotamia.

FARAD, the practical unit of capacity for electricity, in the electromagnetic system of units. The capacity of a conductor or condenser whose potential is raised by one volt when given a charge of one coulomb. This unit is too large for most purposes, and capacities are usually expressed in microfarads (q.v.).

FAR'ADAY, Michael, one of the greatest of English chemists and physicists, was born in humble circumstances at Newington Butts, near London, 22nd Sept, 1791, died 25th Aug., 1867. Early in life he was apprenticed to a bookbinder in London, but occupied himself in his leisure hours with electrical and other scientific experiments. Having been taken by a friend to Sir Humphry Davy's lectures, he attended the course, and became so interested that he decided to abandon his trade.

With this end he sent his notes of the lectures to Sir Humphry Davy, who was so struck with the great ability they showed that he appointed him his assistant at the Royal Institution. In 1829 he became lecturer at the Royal Military Academy at Woolwich, and in 1833 he was appointed to the newly established chair of chemistry at the Royal Institution. It was while in this office that he made most of his great electrical discoveries. His communications to the *Philosophical Transactions* were published separately in three volumes (1839, 1844, 1855). In 1832 he received the honorary degree of D.C.L. from Oxford, and was made an honorary member of the Academy at Berlin. In 1835 he received a pension of £300 a year from Lord Melbourne.

Faraday's researches in electrolysis laid the foundations of electrochemistry, and were followed by many important discoveries in electrodynamics (including the laws which are the basis of modern electrical power), and in various departments of pure and applied chemistry, particularly in the liquefaction of gases, the manufacture of glass, the metallic alloys and the vaporization of mercury.

As an experimentalist Faraday was considered the very first of his time. As a popular lecturer he was equally distinguished, and used to draw crowds to the Friday evening lecture at the Royal Institution. Amongst his published works we may mention the following: *Researches in Electricity* (1831–55), *Lectures on Non-metallic Elements* (1853), *Lectures on the Forces of Matter* (1860), *Lectures on the Chemical History of a Candle* (1861).—BIBLIOGRAPHY: J. Tyndall, *Faraday as a Discoverer*; S. P. Thompson, *Michael Faraday: his Life and Work.*

FARADIZATION, or **FARADISM,** the medical application of the induced currents which Faraday discovered in 1831.

FARALLO'NES, a group of small islands in the Pacific, about 30 miles from the entrance to the Bay of San Francisco.

FARAN'DOLA, an exciting dance popular amongst the peasants of the south of France and the neighbouring part of Italy. The men and women, placed alternately and facing different ways, form a long line winding out and in with a waving motion.

FARCE, a subdivision of comedy, characterized chiefly by exaggeration and lack of rational character draw-

ing. Farce stands in the same relationship to comedy as melodrama does to tragedy. Many farces commence with an impossible postulate, such as *The Comedy of Errors*, Jonson's *Silent Woman* is one of the best English farces. Gilbert's *Engaged* and *Foggerty's Fairy* are notable modern examples.

FARCY, a disease to which horses are liable, intimately connected with glanders, the two diseases generally running into each other. It is supposed to be a disease of the absorbents of the skin, and its first indication is generally the appearance of little tumours called farcy buds on the face, neck, or inside of the thigh. By an order in Council animals affected with farcy must be destroyed.

FARDEL-BOUND, a term applied to cattle and sheep affected with a disease caused by the retention of food in the maniplies or third stomach, between the numerous plaits of which it is firmly impacted. Over-ripe clover, vetches, or rye-grass are liable to produce the disease.

FAREHAM, a town of England, in Hampshire, at the north-west extremity of Portsmouth harbour, giving name to a parliamentary division of the county. It has building-yards, potteries, and brickworks, and a considerable trade. Pop. (1931), 11,575.

FAREL, Guillaume, one of the earliest and most active of the Swiss reformers, was born in 1489 in Dauphiny, died in 1565. At an early period he was led by his intercourse with the Waldenses to adopt similar views. After preaching in various parts of Switzerland, he came to Geneva, where he was so successful at the religious conferences of 1534 and 1535 that the Council formally embraced the Reformation. He was instrumental, also, in persuading Calvin to take up his residence in Geneva. An attempt on the part of the two reformers to enforce too severe ecclesiastical discipline was the cause of their having to leave the city in 1538. Farel took up his residence at Neufchâtel, where he died.

FAREWELL, cape of Greenland, the country's most southerly point. Situated on an island, it is perilous to sailors on account of currents and drift-ice.

FARGO, a town of N. Dakota, United States, on the Red River of the North and the N. Pacific Railroad. Pop. 28,619.

FARIA Y SOUSA, Manuel de, Portuguese historian and poet, born 1590, of an ancient and illustrious family, died about 1649. Among his writings are: *Discursos Morales y Politicos, Epitome de las Historias Portuguesas; Comentarios sobre la Lusiada;* and a collection of poems.

FARIBAULT, a town of Minnesota, United States, 52 miles south of St. Paul's by rail. Here are the State asylum for the deaf, dumb, and blind, and an episcopal divinity college. Pop. 12,767.

FARIDPUR (*fa*-rēd-pūr'), a district of India, in Eastern Bengal; area, 2,300 sq. miles; pop. 2,121,000. Chief town, Faridpur, on the Marā Padmā. Pop. 14,500.

FARINA, a term given to a soft, tasteless, and commonly white powder, obtained by trituration of the seeds of cereal and leguminous plants, and of some roots, as the potato. It consists of gluten, starch, and mucilage.

FARINELLI, Carlo. an Italian singer, born at Naples in 1705, died in 1782. His true name was Carlo Broschi, and to develop his vocal powers he was made a eunuch. He sang in Vienna, Paris, and London with the greatest success. On visiting Spain, where he intended only a brief sojourn, he found King Philip V plunged in a profound melancholy. He succeeded in rousing him from it by the powers of his voice, and became his prime favourite and political adviser. But the penalty of his advancement was that for ten years he had to sing every night to his royal master the same six airs. On his return to Italy, in 1762, he found himself almost forgotten, but continued to exercise a splendid hospitality in his country house, near Bologna.

FARINGDON, market town of Berkshire, sometimes called Great Faringdon. It is 18 miles from Oxford, on the Great Western Rly. Faringdon is an agricultural and hunting centre. Pop. 2,758.

The title of Baron Faringdon has been held since 1916 by the family of Henderson. Alexander Henderson, the 1st baron, was born in London, 28th Sept., 1850, and became a stockbroker. For a time he was chairman of the G.C. Rly. From 1898-1906, and again 1913-16, he was a Unionist M.P. In 1902 he was made a baronet and in 1916 a baron. His seat is Buscot Park, near Faringdon.

FARINI, Luigi Carlo, an Italian statesman and author, born in 1812, died 1st Aug., 1866. He studied medicine at Bologna, and practised as a physician. He became known as a nationalist and patriot in the political movements of 1841, had to leave the country for a time, but returned and was made a member of the Reform Ministry at Rome during the disturbances of 1848. Disapproving equally the views of the old Conservative and

the extreme Republican party, he went to Piedmont, where he was elected a Deputy, and fought with great energy both in pamphlets and in Parliament on behalf of Cavour and the Piedmontese Constitutionalists. After the peace of Villafranca, he was chosen dictator of the duchies of Parma and Modena, and was mainly instrumental in inducing them to unite with the Piedmontese monarchy. His *History of the Papal States from* 1814 *to* 1850 is well known. In 1862 he became President of the Ministry, but lost his reason in 1863.

FARMERS-GENERAL (Fr. *Fermiers généraux*), private contractors, to whom under the old French monarchy was let out the collection of various branches of the revenue, poll-tax, duties on salt and tobacco, and customs. These contractors made enormous profits on the farming of the public revenues. A revenue collected in this way not only imposed a much heavier burden on the people, but the merciless rigour of irresponsible and uncontrolled exactors subjected them to hardships and indignities to which they could not submit without degradation. In 1790 the system was suppressed by the Constituent Assembly, and many of the farmers-general were sent to the guillotine by the Revolutionary Tribunal.

FARNE, or FERNE, ISLANDS, a group of seventeen islets, England, separated from Northumberland by a channel about 1¼ miles wide. They have been the scene of some disastrous shipwrecks. (*See* DARLING, GRACE.) The islands were acquired by the National Trust in 1924, and have become a bird sanctuary. There are two lighthouses. Pop. 15.

FARNESE (fär-nā'ze), an illustrious family of Italy, whose descent may be traced from about the middle of the thirteenth century, and which gave to the Church and the Republic of Florence many eminent names, amongst which the following may be mentioned: Pietro Farnese died 1363), a general of the Florentines in the war against Pisa; Alessandro, who became Pope as Paul III (1534–49), and whose gifts to his natural son Pier Luigi of the duchies of Parma and Piacenza laid the foundation of the wealth and greatness of the family; Ottavio (1520–85), son and successor of Pier Luigi, spent a long and peaceful reign in promoting the happiness of his subjects. Alessandro (1546–92), elder son of Ottavio, became famous as a most successful general of the Spaniards in the wars with the Netherlands and France. Ranuzio (1569–1622), son of Ottavio, was a gloomy and suspicious tyrant. The line became extinct with Antonio in 1731.

The name of the Farnese is associated with several famous buildings and works of art. The *Farnese Palace*, at Rome, was built for Pope Paul III, while he was cardinal, by Sangallo and Michel Angelo. It now belongs to France, and is occupied by the French Embassy. Its sculpture gallery was formerly very celebrated, but the best pieces have been removed to Naples, including the following: the *Farnese Bull*, a celebrated ancient sculpture representing the punishment of Dirce, discovered in 1546 in the Baths of Caracalla at Rome; *Farnese Hercules*, a celebrated ancient statue of Hercules by Glycon, found in the Baths of Caracalla in 1540; *Farnese Flora*, a colossal statue of great merit, found in the Baths of Caracalla; *Farnese Cup*, an antique onyx cup, highly ornamented with figures in relief.

FARNHAM, a town of England, county of Surrey, 3½ miles S.W. of Aldershot; a well-built place. North of the town is Farnham Castle, the residence of the Bishops of Winchester. The staple trade is in hops. Farnham was the home of Swift's 'Stella' (Hester Johnson). Pop. (1931), 18,294.

FARNOL, John Jeffery, English author. He was born 10th Feb., 1878, and educated privately. In 1902 he went to America, where he contributed stories to magazines and for two years painted scenery for the Astor Theatre in New York. His first novel, *Lady Caprice*, published in America, appeared afterwards in England as *The Chronicles of the Imp*. Returning to England in 1910, the publication of *The Broad Highway* made him immediately popular with the readers of romantic adventure. This was followed by others, notably, *The Amateur Gentleman*, *The Honourable Mr. Tawnish*, which was dramatized, *Beltane the Smith*, *Black Bartlemy's Treasure*, *Martin Conisby's Vengeance*, *Peregrine's Progress*, *Sir John Dering*, *Another Day*, *Over the Hills* and *The Jade of Destiny*. He also published a volume, *War Impressions*, in 1918.

FARNWORTH, a manufacturing and mining town of Lancashire, England, 2½ miles from Bolton. Pop. (urban district, 1931), 28,711.

FARO, a seaport of Portugal, province of Algarve, 62 miles S.E. of Cape St. Vincent. It is surrounded by Moorish walls, and has a convenient harbour. Its trade is considerable. Pop. 12,925.

FARO, a promontory forming the north-east point of Sicily at the entrance to the Strait of Messina. The point is strongly fortified, and on it there is a lighthouse over 200 years old.



FARNESE

A, Farnese Hercules at Naples
B, Farnese Bull at Naples
C, Alexandra Farnese
D, Farnese Palace in Rome

FAROE ISLANDS (fā'rō; Dan. *Färöer*, 'Sheep Islands'), a group of islands in the North Atlantic, lying between Iceland and Shetland. They belong to Denmark, and are twenty-one in number, of which seventeen are inhabited. The islands generally present steep and lofty precipices to the sea. Barley is the only cereal that comes to maturity; turnips and potatoes thrive well. There is no wood, but plenty of excellent turf, and also coal. The inhabitants are chiefly engaged in fishing and the rearing of sheep. Thorshavn, in Strömö, the largest island, is the seat of government. Pop. 24,200.

FARQUHAR (fär'kär), **George**, Irish playwright, was born in Londonderry in 1677, and died in 1707. He was for a short time at Trinity College, Dublin, but was, according to one account, sent down for making a profane though clever joke on the miracle of walking on the sea. He became an actor, but left the stage after inadvertently injuring a fellow-actor, owing to his forgetting to substitute a stage-sword for the genuine article. He produced his first comedy, *Love and a Bottle*, in 1698. It is a lively and amusing comedy, and was well received. *The Constant Couple* (1699) was also successful, as was its sequel *Sir Harry Wildair*. His other best-known plays are *The Recruiting Officer* (1706), and his masterpiece *The Beaux' Stratagem* (1707), written when he knew that death was fast approaching him. Farquhar was in dire poverty most of his life; he had a commission in the army for a while, but gave it up owing to some false hopes of promotion held out by the Duke of Ormond. He increased his embarrassments by marrying in 1703 a penniless woman who had fallen in love with his appearance, and pretended to be an heiress. Although he lived and died in great distress, his gaiety never flagged; and *The Beaux' Stratagem* is one of the most mirthful comedies of the time.

Farquhar was a great playwright, and not much of a literary man. His comedies are all good acting comedies. He had been an actor himself, and so was much more closely in touch with the stage than the aristocratic Congreve. Farquhar stands above his contemporaries by reason of his realism. He did not go to other dramatists for his characters, but went straight to life. Indeed, in several cases his plays seem to have been in part autobiographical; the bard was the hero of the story. His plots are well constructed, especially his later ones. His characters are most of them genial rogues, and while he is no Puritan his morality compares very favourably with the cynical indecency of his contemporaries. His influence upon Fielding, and therefore upon the rise and development of the English novel, was great, as he introduced a return to real models, and eschewed artificiality. Personally Farquhar was a most loveable man, and he appears to have lived and died a very gallant gentleman.

FAR'RAGUT, David Glascoe, admiral of the United States, born in 1801, died 13th Aug., 1870. He entered the navy as midshipman at the age of eleven, was promoted to a lieutenancy in 1821, and was actively engaged in his profession up till 1851, when he was appointed assistant inspector of ordnance. In 1855 he received a commission as captain. In 1861 he was appointed to command the expedition against New Orleans, undertaken on the formation of the Confederacy, and sailed in January of the following year. New Orleans surrendered to the combined attack of the land and naval forces on 28th April, and Farragut proceeded to Vicksburg, which he attacked unsuccessfully. In consequence of his success at New Orleans he was promoted to the rank of vice-admiral, and placed in command of the blockading squadron of the Gulf of Mexico. In Aug., 1864, he attacked the Confederate fleet in the Bay of Mobile, and forced it to surrender, thus making the fall of Mobile merely a question of time. After this exploit he was made admiral, a grade which had not hitherto existed in the United States navy.

FAR'RANT, Richard, one of the earliest English composers of music. Very little is known of his history. He was a gentleman of the Chapel Royal in 1564, and subsequently organist and choir-master. He is supposed to have died about 1580. His music, which is ecclesiastical, is distinguished by purity, simplicity, tenderness, and elevation. The anthems *Call to Remembrance*, and *Hide not Thou Thy Face*, composed by him, are well known.

FARRAR, Frederic William, English divine, son of a clergyman, born in Bombay, 7th Aug., 1831, died 22nd March, 1903. He graduated at Cambridge, 1854, was assistant master at Harrow in 1855, headmaster of Marlborough College in 1871, Archdeacon of Westminster, 1883, and Dean of Canterbury, 1895. He wrote various popular theological works and works of fiction, and was Bampton Lecturer in 1885. Among his principal works are: *The Life of Christ* (1874), *Life of St. Paul* (1879), *The Early Days of Christianity* (1882), *Lives of the Fathers* (1889), *Darkness and Dawn*.

FARREN, Elizabeth, English actress. Born about 1759, the daughter of a surgeon at Cork who took to the stage and left his family in poverty, Elizabeth made her first stage appearance in 1773. Four years later she played in London, at the Haymarket theatre, appearing as Miss Hardcastle in *She Stoops to Conquer*. From 1788 until her retirement in 1797, she played at Drury Lane, where she was a great success as the impersonator of the fine ladies in the works of Sheridan and Congreve. She married the 12th Earl of Derby in 1797 and she died April 23, 1829.

FARS, or **FARSISTAN,** a maritime province in the south-west of Persia, abutting on the Persian Gulf. It is mountainous, but has many rich and well-cultivated districts. The most important products are grain, fruit, wine, oil, cotton, tobacco, silk, cochineal, and attar of roses. The manufactures include woollen, silk, and cotton goods; and in these and other articles



Farthingale

an active trade is carried on, chiefly with Hindustan. Pop. estimated at 750,000.

FARSAN, two islands on the east side of the Red Sea on the coast of Yemen, called respectively Farsan Kebir and Farsan Segir.

FARTHINGALE, or **FARDINGALE,** an article of ladies' attire worn in the days of Queen Elizabeth, and closely resembling the more recent crinoline. It was formed of circles of whalebone hoops, and protruded more at the waist than the Victorian crinoline.

FARUKHABAD, or **FARRAKHABAD** (*far-ak-ä-bäd'*), a city in Agra



Fasces

division, United Provinces of British India, 2 or 3 miles from the Ganges, a handsome, well-built town, with avenues of trees in many of its streets. Pop. 51,567.

FASCES (*fas'sēz*), in Roman antiquities, a bundle of polished rods, in the middle of which was an axe, carried by lictors before the superior magistrates. The number of fasces and lictors varied with the dignity of the magistrate. In the city the axe was laid aside.

FAS'CIA (Lat., a bandage), in anatomy, signifies any thin sheet of fibrous tissue, such, for example, as the covering which surrounds the muscles of the limbs and binds them in their places.

FASCINATION (Lat. *fascinare*, to charm), the exercise of an overpowering and paralysing influence upon some animals attributed to certain snakes. Squirrels, mice, and the smaller birds are said to be the most subject to this power; but the fact is far from clearly explained, and is not perhaps even sufficiently demonstrated. Most of the accounts agree in describing the animal fascinated as having a painful consciousness of its danger, and the power exercised over it, but to be unable to resist the desire to approach the fascinator. It is probable that the real explanation of the phenomenon is in the influence of the intense emotion of fear upon the muscles.

FASCISM. The crisis succeeding the European War was in Italy much more severe than in other countries, partly because the nation lacked strong political organizations and constitutional traditions, and partly because there was no ruling middle class such as economic and political conditions had formed elsewhere. In 1919–20 the severity of industrial unrest was such that a revolution seemed imminent, especially after the Communists had seized certain factories. The lower middle class, being economically impotent, and being sandwiched between the rich upper class and the proletariat, resented the progress made

by the workers and allied themselves to the capitalists. The result was the movement known as Fascism (Lat. *fasces* = the bundle of rods carried by the lictors in ancient Rome), the distinctive dress of which is the black shirt.

To the world at large Fascism appeared as the force which had saved Italy from revolution. The leader was a lower middle-class school-master, Benito Mussolini, who had dominated the Socialist party from 1912 to 1914. In the autumn of 1920 the numbers of the Fascisti grew enormously, ex-soldiers, land-owners, men of Mussolini's own class, and industrial magnates joined the movement.

In Oct. 1922, there took place the march on Rome, a great event in the history of Fascism. The city was entered by 200,000 armed fascists, the government was overthrown and a new one under Mussolini set up. Otherwise civil war would have broken out. Since then Fascism has been supreme in Italy and Mussolini far more a dictator than a premier.

Fascism has consolidated its power by altering its constitution more than once. In 1924 and again in 1928, by changing the electoral law, Mussolini secured a majority in the Chamber and this he has since retained. Only those are eligible for election to the Chamber who are on a roll prepared by the Grand Council of the Fascists, and there is a similar grip upon the minor governing bodies. In much the same way industry is controlled by Fascist organization. Although antagonistic to all ideas of constitutional government, Fascism has undoubtedly done a great deal to make Italy prosperous. There is a society of British Fascists at 99 Buckingham Palace Road, London, S.W. 1 and the movement has adherents in other countries. The British Fascisti movement is royalist and anti-communist.

FASHO'DA, a station in the Anglo-Egyptian Sudan, on the Bahr-el-Abiad or White Nile, 400 miles south of Khartoum. In July, 1898, it was occupied by a French force under Colonel Marchand, but some months later was claimed by the British for Egypt. The affair threatened to involve the two countries in war, but ultimately the French evacuated the place, which was then formally occupied by Sudanese troops. It has been renamed Kodok.

FAST, ruined castle of Berwickshire. It is situated on a promontory of the cliffs near St. Abb's head, and was once a fortress, accessible only by a drawbridge over a chasm which separated it from the mainland. Garrisoned by English troops in 1410, it was retaken by one of the Dunbars. At the time of the Gowrie conspiracy it was intended to imprison James VI. of Scotland in the fortress, which was at that time in the possession of Logan of Restalrig, one of the conspirators. In Scott's *Bride of Lammermoor* it figures as Wolf's Crag, the residence of the Master of Ravenswood.

FASTI (Lat.), among the Romans, registers of various kinds; as, *fasti sacri*, calendars of the year, giving the days for festivals or courts, being a sort of almanac.

FASTS, temporary abstentions from food, especially on religious grounds. Abstinence from food, accompanied by signs of humiliation and repentance or grief, is to be found more or less in almost all religions. Among the Jews fasts were numerous, and we find many instances of occasional fasting in the Old Testament. Herodotus says that the Egyptians prepared themselves by fasting for the celebration of the great festival of Isis. So in the Thesmophoria at Athens, and in the rites of Ceres at Rome, it was practised.

The Church of Rome distinguishes between days of fasting and of abstinence. The former are: (1) the forty days of Lent; (2) the Ember days, being the Wednesday, Friday, and Saturday of the first week in Lent, of Whitsun week, of the third week in September, and of the third week in Advent; (3) the Wednesdays and Thursdays of the four weeks in Advent (4) the vigils or eves of Whitsuntide, of the feasts of St. Peter and St. Paul, of the Assumption of the Virgin, of All Saints, and of Christmas Day. When any fasting day falls upon Sunday, it is observed on the Saturday before.

The Greek Church observes four principal fasts: that of Lent, one beginning in the week after Whitsuntide, one for a fortnight before the Assumption, one forty days before Christmas. In the East, however, the strict idea of a fast is more preserved than in the West.

The Church of England appoints the following fixed days for fasting and abstinence, between which no difference is made: (1) the forty days of Lent; (2) the Ember days at the four seasons; (3) the three Rogation days before Holy Thursday; (4) every Friday except Christmas Day. The Church, however, gives no directions concerning fasting.—BIBLIOGRAPHY: L. Duchesne, *Christian Worship*; J. Dowden, *The Church Year and Kalendar*; article *Fasting* in Hastings' *Encyclopædia of Ethics and Religion*.

FAT, an oily concrete substance, a

compound of carbon, hydrogen, and oxygen, deposited in the cells of the adipose or cellular membrane of animal bodies. In most parts of the body the fat lies immediately under the skin. Fat is of various degrees of consistence, as in tallow, lard, and oil. It is generally white or yellowish, with little smell or taste. It consists of esters of glycerine with fatty and other acids, and these are generally termed glycerides. The commonest of these are stearin, a waxy solid, palmutin, a softer solid, and olein, an oil. Fats are insoluble in water. When boiled with caustic alkalies, e.g. caustic soda, they are decomposed (saponified, yielding an alkali salt of the fatty acid (soap) and glycerine. The consistency of any natural fat depends on the proportions in which these three substances are present, e.g. mutton suet consists mainly of stearin, and olive oil of olein. In the body fat serves as a packing, and helps to give roundness of contour. Being a bad conductor of heat, it is useful in retaining warmth, but its chief function is that of nutrition.

FATALISM, the belief in fate, or an unchangeable destiny, to which everything is subject, unmoved by reason, and pre-established either by chance or the Creator. Fatalism existed among the Hebrews, Greeks, and Romans, and is still prevalent among Mohammedans. The fact that many events in man's life seemed to be inevitable gave rise to the belief in fatalism. Amongst notable historical examples of the belief in fate may be mentioned the old Greek conception of a fate which stood behind the gods themselves as a controlling power; the Mohammedan fatalism, which regards all things great and small as inexorably predetermined, so that no accident is possible. Fatalism is to be distinguished both from *determinism* and *predestination*.

FATA MORGANA, kind of mirage. Specifically it is that seen across calm water in the Messina Strait which separates Sicily and Italy. Inverted images as of ships appear in the sky above actual objects. Norman settlers associated it with the mediæval fairy Morgana, who, according to to mediæval romances, was King Arthur's sister.

FATEGARH (*fat-e-gar'*), a town, United Provinces of India, on the Ganges, now municipally united with Fazukbabad; the scene of a massacre of upwards of 200 Europeans during the Mutiny of 1857. Pop. 20,000.

FATEHPUR (*fat-e-pör'*), a town of India, in district of the same name, Allahabad division, United Provinces, 50 miles S.E. of Cawnpore. Pop. 15,000.—The district has an area of 1,618 sq. miles, and a pop. of 686,409.

FATEHPUR SIKRI, a town of India, district of Agra, United Provinces. It was the favourite residence of the Emperor Akbar, who enclosed and fortified it. It now chiefly consists of a vast expanse of magnificent ruins enclosed by a high stone wall some 5 miles in circuit. Pop. 6,132.

FATES (in Lat. *Parcæ*, in Gr. *Moirai*), in Greek and Latin mythology, the inexorable sisters who spin the thread of human life. The appellation *Clotho* (the spinner) was probably at first common to them all among the Greeks. As they were three in number, and poetry endeavoured to designate them more precisely, *Clotho* became a proper name, as did also *Atrōpos* and *Lachesis*. Clotho means she who spins (the thread of life); Atropos signifies unalterable fate; Lachesis, lot or chance; so that all three refer to the same subject from different points of view. They know and predict what is yet to happen. Lachesis is represented with a spindle, Clotho with the thread, and Atropos with shears, with which she cuts it off. We find also in the northern mythology three beautiful virgins, the *Nornen*, who determine the fate of men. Their names are *Urd* (the past), *Varandé* (the present), and *Skuld* (the future).

FATHER, a male parent. In English law a father is responsible for the maintenance of his offspring until they can maintain themselves. By analogy the word is used for God, especially as the first person of the Trinity, and Christianity teaches the doctrine of the fatherhood of God, that He is the lover and protector of His children, to whom He has revealed Himself in Jesus Christ.

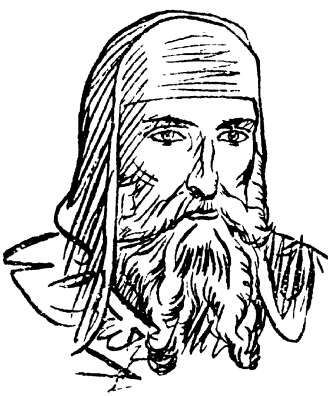
Father is used for priests and members of monastic orders in the Roman Catholic and to some extent in the Anglican Church. It is also used for the senators of Rome, for any venerable person, and for the first or oldest person in a community, as the father of the chapel in the printing industry and the father of the House of Commons.

FATHERLASHER, or BULL-HEAD, a fish of the genus Cottus (*Cottus bubălis*), from 8 to 10 inches in length. The head is large, and is furnished with several formidable spines. The fish is found on the rocky coasts of Britain, and near Newfoundland and Greenland. In the latter regions it attains a much larger size, and is a considerable article of food.

FATHERS OF THE CHURCH, THE.

1. **The term 'Fathers.'** This term,

as used in the sense of spiritual parents of the Christian faith and life, appears to have become current in the fourth century. It was so used by Christian teachers, who cited as authoritative the great teachers and guides who were their predecessors. By the 'Fathers' they meant, specifically, the earlier writers who carried on the work of instruction which was begun by Peter and John and the rest of the Apostles. As employed nowadays, the term has a great fluidity of meaning. In the widest sense it signifies all ecclesiastical writers (i.e. all writers within the Christian Church who treat of matters of Christian belief and practice) belonging to the older post-Apostolic period. In the narrower and more frequent sense it signifies only those ecclesiastical writers of the older



Fathers of the Church, St. Jerome

post-Apostolic period who conform, more or less, to the Catholic tradition. As St. Vincent of Lérins lays it down, "Those alone should be named 'Fathers' who have been staunch in the communion and faith of the One Catholic Church, and have received ecclesiastical approbation as teachers."

2. **Fathers and Doctors.** To such among the Fathers as were regarded as the most eminent the distinguishing title of 'Teachers' (*doctores*) was given. Thus in the Western Church Ambrose, Jerome, Augustine, and Gregory I were the four great Teachers or Doctors; while in the Eastern Church a similar position was assigned to Athanasius, Basil, Gregory of Nazianzus, and Chrysostom. But others also have been acknowledged as Doctors, as Hilary of Poitiers, Cyril of Alexandria, John of Damascus, and our one English Father (born out of due season) the Venerable Bede—not to speak of the application of the term to some of the mediæval Schoolmen.

3. **The Patristic Period.** While it is universally agreed that the Apostolic Age is succeeded by the Age of the Fathers, there is a difference of view as to when the Age of the Fathers terminates. Gregory I (the Great) is usually regarded as the last of the Latin or Western Fathers and the first of the Schoolmen, and John of Damascus as the last of the Greek or Eastern Fathers. But where the term 'Fathers' is broadly used to designate the older Church writers in general, the tendency is—and it is logically defensible—to extend the Patristic period far beyond the Age of the Great Fathers (325–451), and to include among the later Fathers many mediæval writers. Thus the Abbé Migne, who in the middle of last century issued a monumental edition of the original Greek and Latin texts of the Fathers, carried the Latin Fathers as far as Innocent III in the beginning of the thirteenth century, and the Greek Fathers down to the Council of Florence and the fall of Constantinople in the middle of the fifteenth century.

4. **Division and Classification.** The broadest division of the Fathers is according to locality, and is into Eastern and Western. To this the division according to language, into Greek and Latin, largely corresponds. But it is to be remembered that in the early Patristic Age, or before Tertullian, Latin was not used by ecclesiastical writers. It is also to be remembered that among the Eastern Fathers there were writers in Syriac, Armenian, and Coptic, as well as Greek. Another broad and general division is into ante-Nicene, Nicene, and post-Nicene; which is according to the principle that the Council of Nicæa (A.D. 325) marks the transition from a simple and unsystematized to a unified doctrinal testimony. But it is usual in Church history, while observing the aforesaid general divisions, to arrange the Fathers in certain historical groups, representing for the most part distinct schools of thought. There are, however, great names that cannot be conveniently treated under any historical group, such names as Irenæus, Athanasius, Jerome, Leo the Great, and Gregory the Great. Keeping this in view, we might classify the Fathers in accordance with the following scheme (1) the *Apostolic Fathers* (the best known of whom are Clement of Rome, Ignatius, and Polycarp), who received their title not only as being younger contemporaries and perhaps personal disciples of Apostles, but also for their nearness and faithfulness to the Apos-

tolic tradition; (2) the *Greek Apologists* (the most notable of whom is Justin Martyr), who sought to defend Christian truth on rational and philosophical grounds against both Jew and pagan; (3) the *Alexandrians* (outstanding among whom are Clement and Origen), who greatly furthered the development of Christian theology in general, but whose names are specially associated with the allegorical and mystical type of Scriptural interpretation; (4) the *North African School* (to which Tertullian and Cyprian belong), who shaped Christian Latinity, as well as the theology and ecclesiastical polity of the West; (5) the *Cappadocians* (in which group the most prominent members are Basil, Gregory of Nazianzus, and Gregory of Nyssa), who caught up the theology of Athanasius, providing it with well-defined terms, and so laying broad the foundations of the Greek orthodoxy; (6) the *Antiochians* (among whom Chrysostom, Theodore of Mopsuestia, and Theodoret are the greatest), who were opposed to the Alexandrian mysticism and held by the literal and historical mode of Scriptural interpretation; (7) the *Western Nicene Group* (counting in their number eminent teachers like Hilary of Poitiers and Ambrose), who followed the Alexandrians in their exegetical method, and in their dogmatic theology Athanasius and the Cappadocians; (8) the *School of Augustine*, in which the Western theological tradition set by Tertullian and Cyprian culminated; (9) the *School of Lérins* (leading members of which are Hilary of Arles and Vincentius), which attempted to mitigate the extreme Augustinian doctrines of sin and grace.

5. **Value of Patristic Study.** Among the Fathers are many great thinkers and writers (not to say orators, organizers, and statesmen) who should be studied for their own sake, and for the influence they have wielded. We would only indicate here some of the various uses of patristic study. (1) The *student of the Bible* turns to the Fathers, and especially the earlier of them, for light upon the problem of the true or original text of the Bible—although very few of the Fathers knew the Hebrew tongue, and only Origen and Jerome can throw direct light upon the Old Testament text. To the Fathers also, especially great exegetes like Origen, Chrysostom, Jerome, and Augustine, the Biblical student turns for light upon the meaning of the sacred text, and for knowledge of the history of its interpretation. (2) The *student of Church history* finds first-hand material in the Fathers for the older post-Apostolic period. This material is supplied in the tractates and letters of the Fathers generally. But patristic writers from Eusebius downwards furnish us also with formal histories of the Church of both a general and special character. Patristic histories, as indeed all histories, are to be used with critical caution. And not only do the Fathers inform us as to the course of events; we are dependent upon them for our knowledge of the development of creed and liturgy, ritual and order, and other Christian institutions. (3) The *student of ecclesiastical dogma and Christian theology in general* cannot dispense with the study of the Fathers. The patristic was the formative and, in a sense, conclusive period of Christian theology. In the ancient Greek theology the idea of God was developed, and in the so-called Nicene Creed and the Chalcedonian Definition the doctrines of the Trinity and the Person of Christ respectively received their final Greek dogmatic expression. Landmarks in the history of this dogmatic development are the names of Origen, Athanasius, Basil and the Gregories, Theodore of Mopsuestia, and Leo the Great. In the ancient Latin theology, in accordance with the more practical genius of the Westerns, the doctrine of man was developed, and of sin and grace. With this anthropological or soteriological, as distinguished from the other more strictly theological movement, the names of Tertullian, Cyprian, and Augustine are principally associated. It was left to the mediæval theologians to work out the doctrine of the Work of Christ.—BIBLIOGRAPHY: F. W. Farrar, *Lives of the Fathers*; E. Leigh-Bennett, *Handbook of the Early Christian Fathers*; S.P.C.K., *The Fathers for English Readers* (a series of biographies); also *Early Church Classics* (a series of translations); H. B. Swete, *Patristic Study* (1902; an excellent introduction to the field of patristic learning, with useful bibliographies); W. Bright, *The Age of the Fathers*.

FATHOM, linear measure used only for nautical purposes, especially sounding. Originally the distance a man could stretch with his arms spread, it is now 6 ft.

FATIGUE, condition resulting from prolonged muscular or mental activity. As this condition affects the nervous system, fatigue is characterised by inability to work, pay attention or think, and by a failing memory. The study of industrial fatigue, which results in diminished capacity for work due to excessive labour, monotony and other factors, has become one of great importance. A good deal of research work has been done on this subject by the Home Office and the Institute of Industrial Psychology.

FATIGUE IN METAL, responsible in many instances for fracture of parts of machines, is the result of local deformation of the metal when subjected to prolonged vibratory stress.

The word is also used for military duties, especially those connected with routine work of a camp or barracks.

FATIMA, daughter of Mahomet. The child of his first wife, Kadijah, she was born about 606 and was called by the prophet one of the world's four perfect women. She married Ali, and bore him three sons, Al-Hasan, Al-Husein and Al-Huhsin. From the first two sons the Fatimite caliphs were descended. She died in 632.

FAT'IMITE DYNASTY, a line of caliphs claiming descent from Fatima, the favourite daughter of Mohammed, and of Ali her cousin, to whom she was married. In the year 909 Abu-Mohammed Obeidalla, giving himself out as the grandson of Fatima, endeavoured to pass himself off as the Mahdi or Messiah predicted by the *Koran*. Denounced as an impostor by the reigning Caliph of Baghdad, he fled into Egypt, became Caliph of Tunis, and soon conquered all Northern Africa from the Straits of Gibraltar to the borders of Egypt. His son wrested Egypt from the Abbasides in 970 and founded Cairo. The Fatimite dynasty was extinguished in 1171, on the death of Al Adid, the fourteenth caliph, and a new line began with Saladin.

FATTY ACIDS, the homologues of formic and acetic acid; so called because the members first studied were obtained from fats and oils, e.g. butyric acid from butter, stearic acid from stearin, palmitic acid from palm-oil. These acids are present united with glycerol in the fats as glycerides, and are obtained from them by saponification with superheated steam or mineral acids, when the fatty acid is liberated, floats to the surface, and glycerol remains in solution. They are all monobasic acids; the lower members are colourless liquids, and the higher members from $C_7H_{15}COOH$ upwards are colourless solids. The general formula for the series is $C_nH_{2n+1}COOH$ (where n = the number of carbon atoms in the alkyl group).

FATTY DEGENERATION, an abnormal condition found in the tissues of the animal body, in which the healthy protoplasm is replaced by fatty granules. It is a sign of defective nutrition, and is common in old age, affecting the muscles, the heart, arteries, kidneys, &c. It is accompanied by great muscular flabbiness and want of energy, the sufferer looking at the same time fat and comparatively well.

FATTY TISSUE, in anatomy, the adipose tissue, a tissue composed of minute cells or vesicles, having no communication with each other, but lying side by side in the meshes of the cellular tissue, which serves to hold them together, and through which also the blood-vessels find their way to them. In the cells of this tissue the animal matter called fat is deposited.

FAUBOURG (fō-bör; Lat. *foris*, outside, beyond, and *burgus*, borough), a suburb of French cities; the name is also given to districts now within the city, but which were formerly suburbs without it. Thus the *Faubourg St. Germain* is a fashionable quarter of Paris in which the ancient nobility still resides.

FAU'CES (Lat., 'jaws'), in anatomy, the throat, the slightly constricted communication between the posterior part of the mouth cavity and the pharynx. The tonsils are lodged in the fauces at the sides of the root of the tongue.

FAUCIGNY (fō-sē-nyē), a district of France, department of Haute Savoie, one of the loftiest districts of Europe, being partly traversed by the Pennine Alps.

FAU'CIT, Helena, Lady Martin, was born in 1816, died in 1898. She was the daughter of Mrs. Faucit the actress, and made her début at the Theatre Royal, Richmond, in 1833, as Juliet in *Romeo and Juliet*. She first appeared in London at Covent Garden as Julia in *The Hunchback*, in which she gained a decided success. One of the most important members of Macready's company during the Shakespearean revivals of 1837, she created the heroine's part in Lord Lytton's *Lady of Lyons*, *Money*, and *Richelieu*, and in Browning's *Strafford*, *Blot on the Scutcheon*, and *Colombe's Birthday*. She was married to Sir Theodore (then Mr.) Martin in 1851, after which she but rarely appeared on the stage except for charitable purposes. In 1879 she appeared as Beatrice at the opening of the Shakespeare Memorial Theatre at Stratford-on-Avon. Lady Martin wrote a volume *On Some of Shakespeare's Female Characters*.

FAULT, in geology, a fracture of strata, accompanied by a sliding down or an upheaval of the deposits on the one side of the fracture to a greater distance than the other. Faults are frequently recognizable in coal-beds, the miner coming unexpectedly upon an abrupt wall cutting off the seam. The angle this makes with the plane of the bed he is working usually indicates whether he must look up or down for its continuation on the other side of the fracture; but *reversed*

faults occur, in which the strata on one side have been pushed up the slope of the plane of fracture. In mines these faults often serve for natural drains. The change of position in strata caused by a fault called the *throw*, and is measured vertically.

FAUN, one of a kind or rural deities or demigods believed in among the Romans, inhabiting the forests and groves, and differing little from satyrs. Their form was principally human, but with a short goat's tail, pointed ears, and projecting horns; sometimes also with cloven feet. There are some famous antique statues of fauns, *The Dancing Faun* at the Uffizi in Florence (restored by Michel Angelo); *The Dancing Faun* at Naples; *The Faun (of Praxiteles?)* at the Capitoline Museum, Rome; and *The Sleeping Faun.*

FAUNA (from *faun*, q.v.), a collective word signifying all the animals of a certain region, and also the description of them, corresponding to the word *flora* in respect to plants.

FAURE, Francois Felix, French statesman. Born in Paris, 30th Jan., 1841, he became a merchant and shipowner at Havre. As a volunteer officer he fought throughout the Franco-Prussian War. In 1881 he became a member of the National Assembly, and in 1882 Under-Secretary for the Colonies. On the resignation of Casimir-Périer in 1895, Faure was elected President. The chief events during his administration were the Franco-Russian Alliance, the Fashoda affair, and, in 1898, the re-trial of Dreyfus. He died 16th Feb., 1899.

FAUST, or FAUSTUS, Doctor John, a celebrated dealer in the black art, who lived in Germany, early in the sixteenth century. There is really a substratum of fact beneath the Faust legend; there actually was a charlatan of this name who lived in the sixteenth century. He seems to have been a pretentious and vicious egomaniac. A vast amount of legend, however, has gathered round his name in Germany.

According to some accounts he was born in Suabia, others make him a native of Anhalt, others of Brandenburg. In his sixteenth year he went to Ingolstadt and studied theology, became in three years a *magister*, but abandoned theology, and began the study of medicine, astrology, and magic, in which he likewise instructed his familiar Johann Wagner, the son of a clergyman at Wasserburg. After Dr. Faust had spent a rich inheritance, he, according to tradition, made use of his power to conjure up spirits, and entered into a contract with the devil for twenty-four years. A spirit called *Mephistopheles* was given him as a servant, with whom he travelled about, enjoying life in all its forms, but the evil spirit finally carried him off. Even yet Dr. Faustus and his familiar Wagner play a conspicuous part in the puppet-shows of Germany, and the legend forms the basis of Goethe's well-known drama *Faust*, and furnishes the libretto for Gounod's famous opera of the same name. As early as 1590 Christopher Marlowe made the legend the subject of his masterpiece *Doctor Faustus*, the last



Faun, from Roman bas-relief

scene of which is one of the most dramatic in all literature.—Cf. H. B. Cotterill, *The Faust-legend and Goethe's Faust.*

FAUSTI'NA, the name of two Roman ladies: (1) Annia Galeria Faustina (died A.D. 141), the wife of the Emperor Antoninus Pius; and (2) her daughter, who was married to the Emperor Marcus Aurelius (died A.D. 175). Both were accused of dissolute conduct.

FAVART (fä-vär), **Charles Simon,** creator of the serio-comic opera in France, born 1710, died in 1792, the

son of a pastry-cook. His poetical reputation rests principally on his numerous productions for the *opéra œux Italiens*, and the comic opera. He also wrote *Mémoires et correspondance littéraires* (1808) He was the director of a company of itinerant actors which followed Marshal Saxe into Flanders. His wife, Madame Favart, was a famous singer, comic actress, and dancer, and helped in the composition of her husband's plays.

FA'VERSHAM, municipal borough and seaport of England, Kent, on a branch of the Swale, giving name to a parliamentary division. It is a very ancient place, and has manufactures of brick, cement, and gunpowder. Faversham Creek is navigable up to the town for vessels of 200 tons. Pop. (1931), 10,091.

FAVRE (fävr), **Jules,** a French politician, born 21st March, 1809, at Lyons, died in 1880. He studied law, and after distinguishing himself at the Lyons Bar came to Paris in 1835, where he became famous as a defender of political prisoners. On the outbreak of the revolution of 1848 he became secretary to Ledru-Rollin. He was a leader of the party of opposition to the President Louis Napoleon; and after the *coup d'état* (1851) he retired from political life for six years, till in 1858 his defence of Orsini for the attempt on the life of the emperor again brought him forward. From this time he again became an active leader of the Republican opposition to the emperor. On the fall of the empire he became Vice-President of the Government of National Defence and Minister of Foreign Affairs. As such he conducted the negotiations for peace with Prince Bismarck, and signed the Treaty of Paris at Frankfurt on 10th May, 1871. But though he showed great energy, and was very eloquent, his operations both in the matter of the armistice and the peace showed a lack of skill and judgment He resigned his office in July, 1871.

FAVUS is a disease due to a fungus, and affects the hair, hair-follicles, and skin, usually of the scalp. It produces rounded cup-shaped crusts, and may lead to very extensive destruction of the hair. Cats and mice are affected by the disease, and are frequently responsible for spreading it. The X-rays are the most effective treatment.

FAW'CETT, Henry, an English politician and economist, born at Salisbury in 1833, died 6th Nov., 1884. He was educated at Cambridge, studied law for a while at the Middle Temple, but soon renounced it. In 1858, when out partridge shooting, he met with an accident which inflicted on him total blindness. Undiscouraged, however, by his deprivation, he gave his attention to economic studies. In 1863 he was elected to the chair of political economy at Cambridge. In 1865 he was elected member of Parliament for Brighton, which he represented till the general election of 1874, when he was elected for Hackney. He became Postmaster-General in the second Gladstone administration, and effected many reforms in his department. In 1883 he was made Lord Rector of Glasgow University. Amongst his principal writings are: *A Manual of Political Economy, Lectures on the Economic Position of the British Labourer,* and articles on Indian finances.

FAWCETT, Millicent Garrett, wife of the preceding, born 1847, shared her husband's studies, and published: *Political Economy for Beginners, Some Eminent Women of Our Time, Life of Queen Victoria,* and *Five Famous French Women.* She is also known as a prominent advocate of all measures for the educational and political advancement of women, and wrote *Women's Suffrage* (1912). She was made a Dame of the British Empire. She died 5th Aug., 1929.

FAYAL (fī-äl'), an island belonging to Portugal, one of the Azores. It is of a circular form, about 10 miles in diameter. The climate is good, and the air always mild and pure. The soil is very fertile, producing in abundance wheat, maize, flax, and almost all the fruits of Europe. It exports a great quantity of oranges and lemons. The chief place is Villa Horta or Orta. Pop. about 27,000.

FAYOUM (fä-yöm'), or Faiyûm a province of Middle Egypt, a little to the west of the Nile, surrounded by the Libyan Desert; area 670 sq. miles. The soil is alluvial, and, in the north, particularly fertile. Faiyûm is irrigated by canals coming from the Canal of Joseph, and that from the Nile, and is one of the most fertile provinces of Egypt. Here lay the ancient Labyrinth and the artificial Lake Moeris. On the west lies Lake Birket-el-Kurun. The chief town, Medinet-el-Faiyûm, is connected with Cairo by a railway. Pop. of province (1927), 554,040.

FEAST OF THE DEDICATION OF THE TEMPLE, a Jewish feast instituted by Judas Maccabæus in 164 B.C. It lasted eight days, and was a time of general rejoicing, when the people—old and young—carrying palm branches, met together in their synagogues to hold services of thanksgiving and commemoration. Every house was illuminated, and even the temple at Jerusalem was lighted up. In certain of its observances it

resembles the Feast of the Tabernacles. Some authorities think that Christmas was celebrated in December by the ancient Church because that was the date of the Feast of Dedication. It is mentioned in *John* x, 22.

FEATHER-GRASS, the popular name of *Stipa pennata*, a native of dry places in the south of Europe. The rigid leaves roll up in dry air like those of marram-grass; the awns are exceedingly long, feathered to the point, and hygroscopic, curling up spirally when dry, and uncurling when moistened; these movements of the awn serve to bury the fruit. *S. tenacissima* is the esparto-grass used in paper-making.

FEATHERS, the form which the dermal appendages assume in birds, agreeing in mode of development, but differing in form from hairs and scales. The feather consists of a stem, horny, round, strong, and hollow in the lower part, called the *quill*, and in the upper part, called the *shaft*, filled with pith. On each side of the shaft is a web composed of a series of regularly arranged fibres called *barbs*. The barbs and shaft constitute the *vane*. On the edges of the barbs are set the *barbules*, which interlock with those of adjacent barbs, and thus give strength to the vane.

Feathers are of four chief kinds. (1) *Quill feathers* of the wing (*remiges*) and tail (*rectrices*); the former are attached to the hand and forearm. (2) *Contour feathers*, which determine the external form and are attached to certain areas of the skin; those overlapping the quills are known as *wing-coverts* and *tail-coverts*. (3) Small soft *down feathers*. (4) *Hair-like feathers* (*filoplumes*).

The plumage of birds is of characteristic colours, due either to pigments or physical structure (metallic feathers), and commonly having a protective function by harmonizing with the surroundings (especially in females), or, when of bright kind, playing a part in courtship (especially in males). The feathers of birds are periodically changed, generally once, but in some species twice a year. This is called *moulting*. When feathers have reached their full growth they become dry, and only the tube, or the vascular substance which it contains, continues to absorb moisture or fat. When, therefore, part of a feather is cut off, it does not grow out again; and a bird whose wings have been clipped remains in that condition till the next moulting season, when the old stumps are shed and new feathers grow out. If, however, the stumps are pulled out sooner (by which operation the bird suffers nothing), the feathers will be renewed in a few weeks or even days.

The feather is a very strong formation, not readily damaged, the arch of the shaft resisting pressure, while the web and fine fibres yield without suffering. Being a bad conductor of heat, it preserves the high temperature of the bird, while it is so light as to be easily carried in flight. It is rendered almost impervious to wet by oily fluid which most birds secrete at the base of the tail. Feathers form a considerable article of commerce, particularly those of the ostrich, heron, swan, peacock, and goose, for plumes, ornaments, filling of beds, pens, and other purposes.

FEATHER-STAR, one of the stalkless echinoderms belonging to the Crinoidea. A well-known type is the rosy feather-star (*Antedon rosacea*), not uncommon in British seas, and consisting of a central body or disc, from which proceed five radiating arms, each dividing into two secondary branches, so that ultimately there are ten slender rays. Each arm is furnished on both sides with lateral processes so as to assume a feather-like appearance. It is fixed when young by a short stalk, but exists in a free condition in its adult state.

FEATHERSTONE, an urban district or town in the W. Riding of Yorks, England, 2 miles west by south of Pontefract; inhabitants work chiefly in the collieries. Pop. (1931), 14,952.

FEB'RIFUGE is an agent used to lessen fever. Antipyrine, quinine, and salicylic acid, are well-known examples of drugs used as febrifuges, while cold baths and cold sponging are the most effective of other methods.

FEBRO'NIANISM, in Roman Catholic theology, a system of doctrines antagonistic to the admitted claims of the Pope, and asserting the independence of national Churches, and the rights of bishops to unrestricted action in matters of discipline and Church government within their own dioceses. The term is derived from Justinus *Febronius*, a *nom de plume* assumed by John Nicholas von Hontheim, Archbishop of Trèves, in a work entitled *De Statu Ecclesiæ et legitima Potestate Romani Pontificis* (On the State of the Church and the Legitimate Power of the Roman Pontiff), published in 1763.

FEB'RUARY (from the Roman *Februa*, a festival of expiation or purification), the second month in the year, having twenty-eight days, except in leap-year, when it has twenty-nine. This latter number of days it had originally among the Romans, until the Senate decreed

that the seventh month should bear the name of Augustus, when a day was taken from February and added to August to make it equal to July in number of days.

FÉCAMP (fā-kän; Lat. *Fiscanum*, derived from *Ficus Campus*, Fig Plain), a seaport of France, department of Seine-Inférieure, 22 miles north-east of Hâvre. It is one of the best ports in the Channel, and has many vessels employed in the cod, herring, and mackerel fisheries. Pop. 17,262.

FECHTER (fesk-tār), **Charles Albert,** French actor and dramatist, born in 1824, died in America in 1879. His first appearance on the stage was at the Salle Molière, after which he made a short tour of Italy with a travelling French company. Returning to Paris, he appeared between 1844 and 1856 at different Parisian theatres, and in 1857 he was joint-director of the Odéon. In 1860 he came to London, and at once achieved great success as Ruy Blas and Hamlet at the Princess's Theatre, characters in which he departed widely from stage traditions. He subsequently leased the Lyceum, and afterwards the Adelphi, acting youthful and melodramatic parts with striking power. From 1870 to 1878 he lived in the United States, but his experiences as a manager in New York were not successful.

FED'ERAL, or **FEDERALIST,** an appellation in America given to those politicians who wanted to strengthen the central government, in opposition to those who wished to extend the separate authority of each individual state. Hence in the Civil Wars of 1861–5 the term *Federals* was applied to the Northern party.

FEDERALGOVERNMENT, government by the confederation of several united states, self-governing in local matters, but subject in matters of general polity to a central authority, as, for instance, the Swiss Republic, the United States of North America, Mexico, Argentine, Brazil, The Union of South Africa, and Russia since the revolution of 1917. The degree to which such states give up their individual rights as sovereign bodies may be very different.—BIBLIOGRAPHY: Viscount Bryce, *The American Commonwealth*; Freeman, *History of Federal Government.*

FEDERAL RESERVE SYSTEM, banking system of the U.S.A. designed as a means of bank control, it was instituted in 1914, when it was considered necessary to take control out of the hands of the Government. There is a board of seven directors, and under them a chain of twelve local banks. All national banks must subscribe for, and between them hold, all the stock. These banks, which have wide powers of authority, issue currency and paper money at their discretion

FEDERATED MALAY STATES. —*See* MALAYA.

FEE, or **FIEF** (A.S. *feoh*, cattle, property), in law, primarily meant a loan of land, an estate held in trust on condition of the grantee giving personal or other service to the prince or lord who granted it. Feudal estates, however, soon came to be regarded as inalienable heritages held on various tenures; hence the term fee came to be equivalent to an estate of inheritance, that is, an interest in land which passes to heirs if the owner die intestate. The amplest estate or interest in land is that of a *fee-simple*, which is also called an absolute fee, in contradistinction to a fee limited or clogged with certain conditions. A fee-simple means the entire and absolute possession of land, with full power to alienate it by deed, gift, or will. It is the estate out of which other lesser estates are said to be carved; such as *a fee-tail* (*see* ENTAIL), which is limited to particular heirs, and subject to certain restrictions of use; and a *base fee*, which ceases with the existence of certain conditions.

FEE-FARM, in law, a kind of tenure of land without homage, fealty, or other service, except that mentioned in the feoffment, which is usually the full rent.

FEELING is properly a synonym for sensation, or that state of consciousness which results from the application of a stimulus to some sensory nerve. It is the most universal of the senses, existing wherever there are nerves; and they are distributed over all parts of the body, though most numerous in such parts as the finger-tips and the lines where skin and mucous membrane pass into each other. This universal distribution of feeling is necessary, otherwise parts of the body might be destroyed without our knowledge. The structures which thus apprehend the impressions of contact are papillæ or conical elevations of the skin in which the nerves end, and which are richly supplied with blood-vessels. The term feeling is also used for a general sense of comfort or discomfort which cannot be localized, and it designates states of consciousness which are either agreeable or disagreeable. In a figurative sense the term is also applied to a mental emotion, or even to a moral conception; thus we may speak of a friendly feeling, a feeling of freedom. *See* EMOTION.—BIBLIOGRAPHY: A.

Bain, *The Emotions and the Will*; T. Ribot, *Psychology of the Emotions*.

FEGATELLA, a genus of Liverworts, family Marchantiales. *F. conica* is common on moist banks.

FEIJOA, a genus of Myrtaceæ, natives of Brazil. The flowers are pollinated by birds, which feed on the juicy petals, a very unusual method.

FEISUL, or FEISAL, Emir, King of Iraq (Mesopotamia), born in 1887, the third surviving son of Hussein, King of Hejaz. Educated at Constantinople, Feisul held several posts under the Turkish Government, but took an active part in the revolutionary movement which resulted in the deposition of Sultan Abdul Hamid. He then returned to Arabia, where he commanded the Arabs against Ibn Saud, the head of a new religious sect, who threatened his father's emirate.

During the European War Hussein sided with the Allies, and Feisul organized and commanded a regular Arab army, which formed Lord Allenby's right wing, and took part in the latter's operations in Palestine. As a reward for his services an independent, or semi-independent, state was established at Damascus under Feisul, and the prince was proclaimed King of Syria in March, 1920. Serious friction, however, arose between the French authorities and the Arabs, and hostilities broke out in July. The French, under General Gourand, occupied Damascus, compelled the Arabs to recognize the French mandate for Syria, and deposed the new King of Syria.

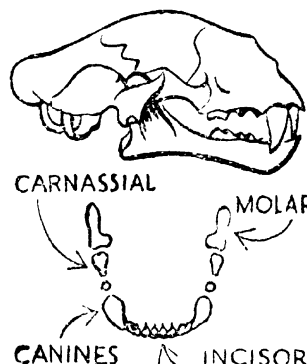
In August, 1921, Feisul became the first Arab king of the new state of Iraq (Mesopotamia), set up by the British Government. He was crowned with great splendour at Bagdad on the 23rd of Aug., in the presence of a great gathering of his people and the representatives of the British Government. A personal message from King George V was handed to Feisul, and the British High Commissioner, Sir Percy Cox, formally announced the recognition by Great Britain of the new ruler of Iraq.

FELANICHE (fel-à-nē'chā), or **FELANITX,** a town in the Island of Majorca, a very ancient place with Moorish remains. Pop. (commune), 11,400.

FELEGYHAZA (fā'led-yä-zä), a town of Hungary, 66 miles S.E. of Budapest, with large cattle-markets and an extensive trade in corn, wine, and fruit. Pop. 34,924.

FELICU'DI, one of the Lipari Isles, off the north coast of Sicily, 10 miles west of Salina. It is about 9 miles in circuit. The soil is both fertile and well cultivated. Pop. 800.

FE'LIDÆ, animals of the cat kind, a family of Carnivora in which the predaceous instincts reach their highest development. They are among the quadrupeds what the Falconidæ are among the birds. The teeth and claws are the principal instruments of the destructive energy in these animals. The incisor teeth are equal; the third tooth behind the large canine in either jaw is narrow and sharp, and these, the carnassial or sectorial teeth, work against each other like scissors in cutting flesh; the claws are sheathed and retractile. They all approach their prey stealthily, seize it with a spring, and devour it fresh. The species are numerous in Europe, Asia, Africa, and America, but none are found in Australia. The family comprehends



Felidæ—Skull and teeth of a tiger

the lion, tiger, leopard, lynx, jaguar, panther, cheetah, ounce, serval, ocelot and cat.

FELIX, name of five popes. **Felix I.** was Pope, A.D. 269–274, and **Felix II.** from 356–58. **Felix III.** reigned from 483–92 and **Felix IV.** from 526–30. **Felix V.** was Duke of Savoy from 1416 to 1434, and in 1439, although still a layman, was chosen Pope in opposition to Eugenius IV. He was never recognized in Rome and was the last of the anti-Popes. He died 7th Jan., 1451.

FELIX, a monk who came to England in the 7th century and was made Bishop of Dunwich. Felixstowe is named after him. The word means happy or fortunate.

FELIX, Antonius or Claudius, procurator of Judæa and freedman of the Emperor Claudius, is described by Tacitus as unscrupulous and profligate both in his public and private conduct. It was before this Felix

that Paul's discourse (*Acts* xxiv, 25) was spoken. He was recalled A.D. 62 and narrowly escaped condemnation at Rome, on charges which the Jews had lodged against him.

FELIX, Marcus Minucius, a distinguished Roman lawyer, who embraced Christianity, and wrote a defence of it in a dialogue entitled *Octavius*. The period when he flourished is uncertain; but Jerome is probably right in placing him about A.D. 230.

FELIXSTOWE, a watering-place in England, on the Suffolk coast, 11¼ miles south-east of Ipswich, between the mouths of the Orwell and Deben. The steamers which ply between Ipswich and Harwich on the Orwell call at Felixstowe Pier, which is opposite Harwich. Pop. (urban district), (1931), 12,037.

FELLAH (pl. *fellahin*), an Arabian word meaning 'peasant,' and used for the labouring class in Egypt. The fellahs or *fellahin* constitute about three-fourths of the population of Egypt, and are mostly the direct descendants of the old Egyptians, although both their language and religion are now that of their Arabian conquerors. They live in rude huts by the banks of the Nile, and in past times have suffered much from over-taxation and oppressive rule at the hands of a succession of tyrants, and especially of the Turks before the British occupation of Egypt.

FELLA'TAH, FULBE, or **FULAHS,** a remarkable African race of the negro type, the original locality of which is unknown, but which is now widely diffused throughout the Sudan, where they are the predominant people in the states of Futa-Toro, Futa-Jalen, Bondu, and Sokoto. Though of the negro family, they have neither the deep jet colour, the crisped hair, flat nose, nor thick lips of the negro. In person they are decidedly handsome, and mostly of a light copper colour. They are shrewd, intelligent, and brave, and are mostly Mohammedans. Their influence is continually spreading.

FEL'LENBERG, Philip Emanuel von, Swiss educationalist, born in 1771, died in 1844. Having devoted himself to the social and intellectual improvement of the peasantry, he purchased the estate of Hofwyl, and established successively an institution for instructing the children of the poorer classes, a seminary for children in the higher grades of life, and a normal school. The pupils were all trained to work in the fields or at the bench, and the product of their labour was sufficient to cover the expenses of their education. Fellenberg's scheme was ultimately so successful as to attract the attention even of foreign Governments. The institutions established by him still exist in a modified form.

FELLING, a populous locality in Durham, a little to the south-east of Newcastle, and adjoining Gateshead, consisting of the combined villages of High and Low Felling, and forming an urban district. It contains chemical and other industrial works. Pop. (1931), 27,041.

FEL'LOWS, Sir Charles, traveller and antiquarian, was born in 1799 at Nottingham, died in 1860. He first explored the valley of the Xanthus in Lycia, in 1838, and discovered the remains of the cities Xanthus and Teos. Under the auspices of the trustees of the British Museum he made further explorations in 1839 and 1841, and succeeded in obtaining the marbles now in the Lycian saloon of the museum. He was knighted by the queen in 1845. His principal works are: *The Xanthian Marbles: their Acquisition and Transmission to England; Travels and Researches in Asia Minor;* and *Coins of Ancient Lycia before the Reign of Alexander.*

FELLOWSHIP, a distinction conferred by some universities, especially those of Oxford and Cambridge, which entitles the holder, called a fellow, to an annual stipend for a certain period. Fellowships in the English colleges commonly range in value from about £150 to £250 or £300 a year, and they all confer upon their holders the right to apartments in the college, and certain privileges as to commons or meals. Formerly they were usually tenable for life or till the attainment of a certain position in the Church or at the Bar, or till marriage; but six or seven years is now a common period during which they may be held, though this may be prolonged in certain circumstances. At Dublin University senior fellows hold their office for life.

FELO DE SE (Lat., 'a felon in regard to himself'), in law, a person who, being of sound mind and of the age of discretion, deliberately causes his own death. Formerly, in England, the goods of such a person were forfeited to the Crown, and his body interred in an ignominious manner; that is, unless the coroner's jury gave a verdict of unsound mind; but these penalties have been abolished.

FEL'ONY, in law, includes generally all crimes below treason and of greater gravity than misdemeanours. Formerly it was applied to those crimes which entailed forfeiture of lands or goods as part of the punishment.

FELSITE, or **FELSTONE,** a hard, compact igneous rock of somewhat flinty appearance, composed usually of quartz and orthoclase felspar intimately mixed, but sometimes of less highly siliceous minerals.

FEL'SPAR, or **FELDSPAR,** a very important group of mineral silicates of aluminium, with potassium, sodium, or calcium, ranging from orthoclase, the potassium species, with 64·7 per cent of silica, to anorthite, the calcium species, with only 43·3. Albite, the sodium felspar, has 68·8 per cent of silica, and the species between this and anorthite are regarded as mixtures of albite and anorthite molecules. These molecules probably do not exist as such within the crystals; but the various characters of the species graduate into one another in agreement with the chemical constitution, so that the felspars form an admirable example of the relation of chemical composition, specific gravity, and crystalline and optical features. At the same time orthoclase and microcline are both potassium felspars; yet the former crystallizes in the monoclinic, and the latter in the triclinic system. All the sodium, sodium-calcium, and calcium species are triclinic, except the rare monoclinic sodium felspar barbierite. The forms throughout the felspar series are closely similar, and the hardness is uniform, being just below that of quartz, and about that of a steel file. Felspar is one of the principal constituents of almost all igneous rocks, such as granite, diorite, and basalt. The alkali species yield kaolin by alteration, and are thus the source of china-clay.

FELT, a kind of cloth made of wool, or of wool and cotton united by rolling, beating, and pressure. The materials to be felted are carded and placed in a machine, where they are kept wet and intimately mixed together by a process of beating. Pressure then unites the whole into a compact mass. The use of felt as a material for hats, tents, or cloaks is very ancient. For hat-making the fur of rabbits, beavers, raccoons, and the wool of sheep is generally used. Felt, being a good non-conductor of heat, is much used for roofing, sheathing boilers, hot-water reservoirs, &c. The felt for such purposes is made from the coarsest woollen refuse from paper-mills.—Cf. Murphy, *The Textile Industries.*

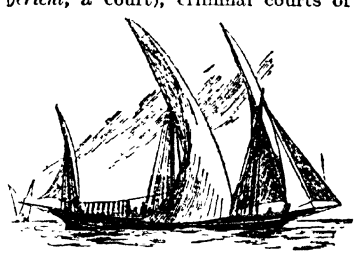
FELTHAM, urban district of Middlesex. It is 13¼ miles from London, on the S. Rly. There are many market gardens in this neighbourhood, and here the London County Council has an industrial school. Pop. (1931), 16,316.

FELTRE (fel'trā), a town in Northern Italy, about 44 miles N.N.W. of Venice, with cathedral, and episcopal seminary. Captured by Austrian troops during the European War, the town was reoccupied in Oct., 1918. Pop. 19,000.

FELUC'CA, a long narrow vessel, generally undecked, of light draught, and rigged with large lateen sails. They also carry from eight to twelve large oars. They are common in the Mediterranean.

FEMERN (fā'mĕrn), an island of Prussia, province of Schleswig-Holstein, separated from the mainland by a shallow strait about 1 mile broad. The island has a fertile but marshy soil. The inhabitants are chiefly agriculturists and fishers. Pop. 9,800.

FEMGERICHTE, FEHMGERICHTE or **VEHMGERICHTE** (fām'ge-*rih*-te; from O.Ger. *fem,* punishment, and *gericht,* a court), criminal courts of



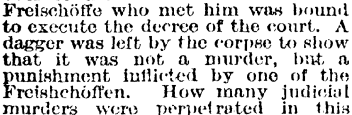
Feluca

Germany in the Middle Ages, which took the place of the regular administration of justice (then fallen into decay), especially in criminal cases. These courts originated and had their chief jurisdiction in Westphalia, and their proceedings were conducted with the most profound secrecy. They seem to have been a survival of old territorial jurisdictions which, on the general distraction and lawlessness prevalent after the fall of Henry the Lion (1182), acquired an extensive and tremendous authority. In process of time, however, they degenerated, and no longer confined themselves to law and precedent, so that the secrecy in which they enveloped themselves only served as a cloak to their criminal purposes. The flagrant abuse of their power brought about their fall. In 1461 various princes and cities of Germany, as well as the Swiss confederates, united in a league against them, but their influence was not entirely destroyed until an amended form of trial and penal judicature was introduced. The last Femgericht was held at Zell in 1568.

The president of the secret tribunal was called the *Freigraf*, and was generally a prince or count. His associates, who concurred in and executed the sentence, were called *Freischöffen*. These were scattered through all the provinces of Germany, and recognized one another by certain signs and watchwords. They acknowledged the emperor as their superior, and for this reason generally made him one of their number at his coronation at Aix-la-Chapelle.

The assemblies of the tribunal were open or secret. The former were held by day, in the open air; the latter by night, in a forest or in concealed and subterranean places. In these different cases the circumstances of judgment and the process of trial were different.

The crimes of which the secret tribunal usurped cognizance were heresy, sorcery, rape, theft, robbery, and murder. The accusation was made by one of the Freischöffen, who, without further proof, declared upon oath that the accused had committed the crime. The accused was now thrice summoned to appear before the secret tribunal, and the citation was secretly affixed to the door of his dwelling or some neighbouring place;



A Section across the Fens

the accuser remained unknown. If, after the third summons, the accused did not appear, he was once more cited in a solemn session of the court, and if still contumacious, was given over to the Freischöffen. The first Freischöffe who met him was bound to execute the decree of the court. A dagger was left by the corpse to show that it was not a murder, but a punishment inflicted by one of the Freischöffen. How many judicial murders were perpetrated in this manner from revenge, interested motives, or malice, may well be imagined.

FEM'INISM (Lat. *femina*, a woman). Term used for the movement that aims at putting woman on an equality, politically, legally and economically, with men. It began in the 19th century, and soon after the Great War its advocates had achieved most of their aims. In Great Britain women were given educational advantages, hitherto confined to men; they secured the vote and with it equal rights of citizenship. The learned professions were opened to them, save only the ministry of the Church of England and some other churches. A woman can sit in Parliament and in the Cabinet, and can hold most public offices. In other countries the amount of freedom given to women varies, but in practically all feminism has made enormous strides since about 1900.

The aims of the feminists to-day are to break down the few remaining barriers to their entrance into public life and to secure economic equality with men, not only in the civil service, but throughout professional and industrial life. To secure this involves the abandonment of a principle, hitherto regarded as fundamental, that the wages of a man are not individual, but family wages.

FE'MUR, in vertebrate animals the first bone of the leg, situated next the trunk of the body, and in man popularly called the thigh-bone. The term is also applied to the third joint (counting from the base) of an insect's leg.

FEN, a marsh or stretch of wet boggy land often containing extensive pools. The *Fens*, or the *Fen District*, is a special term for a marshy district of England, extending into the counties of Cambridge, Lincoln, Huntingdon, Northampton, Norfolk, and Suffolk. A great part of the district is known as the Bedford Level. Much of the land has been reclaimed at vast expense. The soil of fen lands is generally black and rich to a depth of 2 or 3 feet, and with proper management in the matter of draining they will produce heavy crops of grass and corn.

FENCES, continuous lines of obstacles artificially interposed between one portion of the surface of the land and another for the purpose of separation or exclusion. Live fences are made of hawthorn, holly, box, beech, &c.; dead fences of stone, wood, and in recent times of iron or wire. In agriculture fences are necessary both for restricting the tenant's own animals to their pasture, and for protecting his land from straying animals. The general erection of fences on farms is one of the improvements of modern agriculture.

FEN'CIBLES, a sort of local militia raised for defence in case of invasion, and not liable to be sent to serve out of the country. The term *volunteers* was afterwards applied to those who undertook this kind of service.

FENCING, the art of attack and defence with sword or rapier, no shield being used. It was in Italy in the sixteenth century that the skilful use of the small sword first became common. The art spread to Spain and then to France, where, on account of the prevalence of duelling, it was brought

to a high degree of development. The small sword or rapier (which was adopted for duelling) has a point, but no edge, and therefore demands the highest degree of adroitness in its use. In the fencing schools the instrument adopted for exercise is called a foil; it has a guard of metal or leather between the handle and blade, which is made of pliant steel and has a button at the end in place of a point.

The parries are made with the weapon itself by opposing the *forte* of the foil (i.e. the strong part from the handle to the centre) to the *feeble* of the adversary's foil (i.e. the part from centre to point); the upper part of the body to the right is defended by the parry called *tierce*, the upper part to the left by the *carte*, and the lower part by the *seconde*. In all parrying care must be taken that in covering the side attacked the other side is not too carelessly exposed to the enemy. After every parry a return should be made with rapidity and decision.

The fencer should rely more upon his sword hand for protection than upon his agility of leg; yet he must be active on his legs so as to advance, retreat, or lunge with effect. The knees should therefore be somewhat bent when the fencer is on guard, that he may be light and elastic in his movements. An attack may be made by the mere extension of the arm, or accompanied by a lunge, that is, by advancing the body, stepping forward with the right foot without moving the left. An *engagement* means the crossing of the blades; a *disengagement* slipping your foil under the opponents and then pressing in the opposite direction; *riposte*, the attack without pause by a fencer who has parried.

Fencing with the broadsword differs essentially from that with the foil, as the former has an edge as well as a point and is therefore meant to cut as well as thrust. According to the instructions of drill-masters there are seven cuts, with corresponding guards, and three thrusts. Cut *one* is a diagonal, downward cut at the left cheek of the adversary; cut *three* is delivered with an upward slope at the left leg, and cut *five* horizontally at the right side; cuts *two*, *four*, and *six* attack the right cheek, right side, and right leg respectively; and cut *seven* is directed vertically at the head. Guards *one* and *two* defend the upper portion of the body, the sword sloping upwards in an opposite direction to the opponent's; guards *three* and *four* protect the legs, the sword sloping downwards; guards *five* and *six* defend the sides, when the sword is held vertically, point downwards; and guard *seven* protects the head, the blade meeting the enemy's almost at a right angle.—BIBLIOGRAPHY: Egerton Castle, *Schools and Masters of Fence*; C. A. Thimm, *A Bibliography of Fencing and Duelling*.

FENDER, in domestic use, a low metal guard placed round the hearth to prevent hot cinders or ashes from falling into the room.

A ship's fender is a bundle of rope or wood suspended over the side of a vessel to protect the hull from damage at the wharfs. A large ball of rope used for this purpose is called a pudding fender. The name is also given to a contrivance on railway engines and tramcars to prevent loss of life in the event of an accidental collision with pedestrians.

FÉNELON (fan-lōn), **François de Salignac de la Mothe**, one of the most venerable of the French clergy, born in 1651 at the Château Fénelon, in Périgord, of a family illustrious in Church and State, died in 1715. A gentle disposition, united with great vivacity of mind and a feeble delicate constitution, characterized his youth. He was educated under the eye of his uncle, the Marquis de Fénelon, and afterwards at St. Sulpice, Paris. He took orders at the age of twenty-four, and distinguished himself in the work of converting Protestants. In 1681 his uncle conferred on him the priory of Carennac. Soon after he wrote his first work, *Traité de l'Education des Filles*, which was the basis of his future reputation. In 1689 Louis XIV entrusted to him the education of his grandsons, the Dukes of Burgundy, Anjou, and Berri. During his preceptorship he became acquainted with Mme. Guyon (q.v.)

In 1694 he was created Archbishop of Cambrai. A theological dispute (*see* QUIETISM) with Bossuet, the virtual head of the French Church, terminated in his condemnation by Pope Innocent XII, and his banishment to his diocese by Louis XIV. Fénelon submitted without the least hesitation, and thenceforward lived contentedly in his diocese, sustaining the venerable character of a Christian philosopher. He left numerous works in philosophy, theology, and belles-lettres. The most celebrated is *Les Aventures de Télémaque*, in which he endeavoured to exhibit a model for the education of a prince.—BIBLIOGRAPHY: E. K. Sanders, *Fénelon: his Friends and his Enemies*; P. Janet, *Fénelon: his Life and Works*.

FENGTIEN, or **LIAONING**, a dependency of China, one of three provinces of Manchuria. It lies between Chili and Korea, and includes the Liaotung Peninsula with Port Arthur at its extremity. The capital is Mukden. Area, 56,000 sq. miles; pop. 15,000,000.

FENG YU-HSIANG, Chinese General,

known as the "Christian general," Born at Chaohsien, Nganhwei province in 1880, he was trained for the army, and adopted Baptist Christianity. He first saw active service in Tibet in 1909, and since has had a distinguished career, holding important military and civil posts. A stern disciplinarian, he has earned high praise for the excellence of his civil administration and the thorough training of his troops.

FE'NIANS, a name usually derived from Fionn or Finn, the name given to a semi-mythical class of Irish warriors famous for their prowess. The name has been assumed by those Irish conspirators who formed a brotherhood in their own country and in America, with the intention of delivering Ireland from the sovereignty of



Fennec or Sahara Fox

England, and establishing an Irish republic. About the end of 1861 the Fenian Brotherhood was regularly organized in America; and its chief council, consisting of a 'head-centre,' John O'Mahoney, and five other members, which had its seat at New York, soon had branches in every state of the Union; while at the same time large numbers joined the cause in Ireland, where James Stephens was 'head-centre.'

The close of the American Civil War, when large numbers of trained Irish soldiers who had taken part in the war were released from service, was thought to be a convenient time for taking some decisive steps. Two risings were planned in Ireland, but they were both frustrated by the energetic measures of the British Government, the first, in Sept., 1865, by the seizure of the office of the *Irish People*, the Fenian journal published at Dublin, in which papers were found which revealed to the Government the secrets of the conspiracy, and which led to the capture of the ringleaders, Luby, O'Leary, O'Donovan Rossa, and others; the second, in Feb., 1866, was as speedily suppressed by the suspension of the Habeas Corpus Act in Ireland.

An invasion of Canada, attempted in the same year, failed as miserably as the attempt in Ireland, and convinced the Irish that they could not expect the aid from the United States on which they had hitherto counted. At last, on 5th March, 1867, the long prepared insurrection broke out almost simultaneously in the districts of Dublin, Drogheda, and Kerry. The number of insurgents in the field, however, did not exceed 3,000, and though they burned some police stations, they nowhere faced the troops sent after them. About the same time some forty or fifty Irish-Americans landed in a steamer near Waterford, but soon after fell into the hands of the police.

In 1870 and 1871 two raids were again made on Canada, but both were ridiculous failures, the first being repulsed by the Canadian Volunteers, and the second suppressed by the United States Government.—BIBLIOGRAPHY: J. Rutherford, *Secret History of the Fenian Conspiracy*; Justin McCarthy, *A History of Our Own Times*; J. O'Leary, *Recollections of Fenians and Fenianism.*

FENLAND. *See* FEN.

FENN, George Manville, novelist, born in 1831, died in 1909. He became a teacher, but afterwards turned to literature, and contributed short sketches to *All the Year Round*, *Chambers's Journal*, *Once a Week* (of which he became proprietor), and to the *Star* newspaper. In 1867 he published *Hollowdell Grange*, a story for boys, which was followed by a long series of tales and novels, many of them boys' stories. They include: *Bent, not Broken* (1867); *The Parson o' Dumford*; *Eli's Children*; *The New Mistress*; *Double Cunning*; *The Master of the Ceremonies*; *The Man with a Shadow*; *A Double Knot*; *The Mynns Mystery*; *King of the Castle*; *In an Alpine Valley*; *Bluejackets*; *High Play.* Several of his tales were specially written for Christmas. His boys' books include: *In the King's Name*, *Nat the Naturalist*, *Bunyip Land*, *Menhardoc*, *Patience Wins*, *Brownsmith's Boy*, *Commodore Junk*, *The Crystal Hunters*, *The Grand Chaco*, and *Fire Island.*

FENNEC (*Canis zerda*), a small animal allied to the dog and fox, and sometimes called the Sahara fox, being a native of that region. It lives on birds, jerboas, lizards, dates, &c., burrows with great facility, and is easily

tamed. It is fox-like in appearance, and is remarkable for the great size of its ears.

FENNEL, a fragrant plant, *Fœniculum officinale*, cultivated in gardens, belonging to the nat. ord. Umbelliferæ. It bears umbels of small yellow flowers, and has finely divided leaves. The fruits, or in common language the seeds, are carminative, and frequently employed in medicine.—*Giant fennel* is a popular name for *Ferula communis*, which attains sometimes a height of 15 feet.

FENNY STRATFORD, urban district of Buckinghamshire. An agricultural centre, it is 44¾ miles from London, by the L.M.S. Rly., and is situated on the Ouzel. Pop. 4,305.

FENTON, Lavinia, English actress. Born in 1708, she made her first stage appearance in 1726 at the new Haymarket Theatre. Rapidly she attained great popularity. In Jan., 1728, she created the character of Polly in Gay's *Beggar's Opera*. Nevertheless, she left the stage in June of that year, becoming the mistress of the 3rd Duke of Bolton, whom she married on the death of his wife in 1751. She died at Greenwich, 24th Jan, 1760.

FENTON, a town of England, in the north of Staffordshire, immediately south-east of Stoke-upon-Trent, in the bounds of which borough it is included. The industries include china and earthenware, brick-making, coal-mining, and iron-founding.

FEN'UGREEK, a leguminous plant, *Trigonella Fœnum græcum*, whose butter and mucilaginous seeds are used in veterinary practice. It is an erect annual, about 2 feet high, a native of the south of Europe and of some parts of Asia.

FE'ODOR, the name of three Russian princes.—**Feodor I,** son of Ivan the Terrible, reigned from 1584 to 1598. He was a feeble prince, who allowed himself to be entirely governed by his brother-in-law, Boris Godunov. With him the Russian dynasty of Rurik became extinct. —**Feodor II,** son of Boris Godunov, reigned only for a short time in 1605.—**Feodor III,** the son of Tsar Alexis, reigned from 1676 to 1682, warred with the Poles and Turks, and, by the Peace of Baktchisarai, obtained possession of Kiev and some other towns of the Ukraine.

FEODO'SIA (formerly *Kaffa*), or **THEODOSIA,** a town in the south-east of the Crimea. From 1266 to 1474 this town was in possession of the Genoese, in whose hands it became the seat of an extensive commerce with the East, and is said to have had a population of 80,000. It is still one of the most important towns in the Crimea. Pop. 27,500.

FEOFFMENT (fef'ment), in law, that mode of conveying property in land where the land passes by livery in deed, that is, actual delivery of a portion of the land, as a twig or a turf; or when the parties, being on the land, the feoffer expressly gives it to the feoffee. As the statute of uses has introduced a more convenient mode of conveyance, feoffments are now rarely used except by corporations. Further, they are now of no effect unless accompanied by deed. *See* SEIZIN; SASINE.

FERÆ NATURÆ ('of a wild nature'), the name given in the Roman law to beasts and birds that live in a wild state, as distinguished from those which are *domitæ naturæ*, that is, tame animals such as horses and sheep. The right of property in such animals exists only as long as they are in a state of confinement or within the boundaries of the possessor's lands, unless it can be proved that any special animal had been trained to return to its master's property.

FER-DE-LANCE (fer-de-lans), the lance-headed viper of *Craspedocephălus* (*Bothrops*) *lanceolātus*, a serpent common in Brazil and some of the West Indian Islands, and one of the most terrible members of the rattlesnake family (Crotalidæ). It is 5 to 7 feet in length. The tail ends in a horny spine which scrapes harshly against rough objects but does not rattle. Its bite is almost certainly fatal.

FERDINAND, ex-Tsar of Bulgaria born in Vienna 26th Feb., 1861, the son of the Prince of Saxe-Coburg-Gotha and the Princess of Orléans. He was chosen Prince of Bulgaria in July, 1887, but when Austria seized Bosnia and Herzegovina, in 1908, Ferdinand declared the complete independence of Bulgaria and assumed the title of Tsar of the Bulgars. Closely allied with Austria and Germany, he at first observed a strict neutrality at the beginning of the European War, but in October, 1915, joined the Central Powers. After the final defeat of Germany, and at the outbreak of revolution in his own country, he abdicated the throne on 4th Oct., 1918, in favour of his son, Boris. He was married twice, his first wife being Princess Marie-Louise of Bourbon-Parma, by whom he had four children, and his second, Princess Eleonora of Reuss, who died in 1916.

FER'DINAND, German emperors; —1. **Ferdinand I,** brother of Charles V, and born at Alcala, in Spain, 10th March, 1503. In 1522 he received the Austrian lands of the House of

Habsburg from the emperor, to which were afterwards added the kingdoms of Hungary and Bohemia in right of his wife, Anna of Hungary. On the abdication of Charles he succeeded to the imperial title. He died 25th July, 1564.

2. **Ferdinand II** was born in 1578, and succeeded his uncle Matthias as Emperor of Germany in 1619. He was of a dark and reserved character, and had been brought up by his mother and the Jesuits bitterly to hate Protestantism. The result was a quarrel with his Bohemian subjects, who openly revolted and offered the Bohemian crown to the Elector Palatine, a step which led in 1619 to the outbreak of the Thirty Years' War. With the help of the Catholic League and John George, Elector of Saxony, he was placed firmly on the throne of Bohemia, where he relentlessly persecuted the Protestants. He died 15th Feb., 1637.

3. **Ferdinand III,** son of the preceding, was born in 1608, and succeeded his father in 1637. He had served in the Thirty Years' War, and had seen the miseries which it occasioned, and was reluctant to continue it. There were eleven years more of it, however, before the Peace of Westphalia was concluded in 1648. Ferdinand died in 1657.

FERDINAND, King of Rumania. Born at Sigmaringen, 24th Aug., 1865, he was the son of Prince Leopold of Hohenzollern-Sigmaringen and a nephew of Charles, first King of Rumania. Ferdinand was declared heir presumptive in Mar., 1889, and on 10th June, 1893, married Marie, daughter of the Duke of Edinburgh and grand-daughter of Queen Victoria. He came to the throne in 1914, and in 1916 entered the Great War and led his army against the invading Austro-Germans. He died at Sinaia, 20th July, 1927, and was succeeded by his grandson, Michael, a child, who, three years later, was deposed in favour of his father, Carol II.

FERDINAND V, King of Aragon, who received from the Pope the title of *the Catholic,* on account of the expulsion of the Moors from Spain, was the son of King John II, and was born 10th March, 1453. On the 18th of Oct., 1469, he married Isabella of Castile, and thus brought about that close connection between Aragon and Castile which became the basis of a united Spanish monarchy and raised Spain to pre-eminence amongst European states. After a bloody war of ten years, they conquered Granada from the Moors (1491); but the most brilliant event of their reign was the discovery of America, which made them sovereigns of a new world. (*See* COLUMBUS.)

This politic prince laid the foundation of the Spanish ascendancy in Europe by the acquisition of Naples (1503), and by the conquest of Navarre (1512); but his policy was deceitful and despotic. He instituted the Court of the Inquisition at Seville in 1480, and, to the great injury of Spanish commerce, expelled the Jews (1492) and Moors (1501). He died in 1516.—Cf. W. H. Prescott, *Ferdinand and Isabella.*

FERDINAND I, of Bourbon, King of the Two Sicilies (previously Ferdinand IV of Naples), born 12th Jan., 1751, died in Jan., 1825. He was the third son of Charles III, King of Spain, whom he succeeded, in 1759, on the throne of Naples, on the accession of the latter to that of Spain. In 1768 he married Maria Caroline Louisa, daughter of the Empress Maria Theresa, who soon acquired a decided influence over him. After the death of Louis XVI, Ferdinand joined the coalition against France, and took part in the general war from 1793 to 1796; but in 1799, after the defeat of the Neapolitans under General Mack, the French took possession of the whole kingdom, and proclaimed the Parthenopean Republic.

The new republic did not last long, Ferdinand returned to Naples in 1800. Six years later he was again driven from Naples by the French, and compelled to take refuge in Sicily, where he maintained himself by the aid of the British. The Congress of Vienna finally re-established Ferdinand IV in all his rights as King of the Two Sicilies in 1814, while Naples was still occupied by Murat. But after the flight of the latter in March, 1815, Ferdinand once more entered Naples, 17th June, 1815. In 1816 he assumed the title of Ferdinand I, King of the Two Sicilies. In 1820, in consequence of a revolution, Ferdinand was obliged to swear to support a new and more liberal constitution. The Austrians, however, came to his help, and re-established him in possession of absolute power. He was succeeded by his son, Francis I.—Cf. R. H. Johnston, *The Napoleonic Empire in Southern Italy.*

FERDINAND II, King of the Two Sicilies, born in 1810, died 22nd May, 1859. He succeeded his father, Francis I, on the 8th of Nov., 1830. The revolution of France in this year had unsettled the minds of men throughout the Continent generally, and Ferdinand was at first forced to make some concessions to his subjects, but soon recalled them, determining thenceforward to make his

will the only law. The result was a series of popular outbreaks, culminating in the year 1848, when Ferdinand earned the nickname of King Bomba by bombarding his capital from the forts. Despotism was again established by force of arms, and when Bomba died his prisons were crowded with the best and bravest of his subjects. He was succeeded by his son, Francis II, who lost his crown when Italy was united in 1860 under Victor Emmanuel.—Cf. H. R. Whitehouse, *The Collapse of the Kingdom of Naples*.

FERDINAND VII, King of Spain, eldest son of Charles IV, and of Maria Louisa of Parma, born in 1784; ascended the throne in March, 1808, when a popular rising forced his father to abdicate in his favour. A month later he himself abdicated in favour of Napoleon, who conferred the crown on his brother Joseph. Ferdinand returned to Spain in March, 1814. His arbitrary conduct caused an insurrection in 1820, which was at first successful, but Louis XVIII of France having sent an army to his aid, his authority was once more made absolute in Spain. Having no sons, he abolished the Act of 1713 by which Philip V had excluded women from the throne of Spain, and then left his crown to his daughter Isabella to the exclusion of his brother, Don Carlos. It was during the reign of this king that the Spanish colonies in America broke away from the mother country.

FERDINANDEA. *See* GRAHAM ISLAND.

FÈRE (fâr) **EN TARDENOIS,** a town of N.E. France, department of Aisne, at the confluence of the Serre and the Oise, a fortress of the second rank. Taken by the Germans during the European War, the town was recaptured by the French in July, 1918. Pop. 2,530.

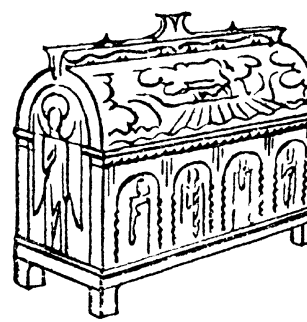
FERENTI'NO, a town in Central Italy, 6 miles north-west of Fresinone. It has remains of ancient walls, built of hewn stone without mortar. Pop. 12,390.

FER'ETORY, a kind of box made of gold or other metal, or of wood variously adorned, and usually in the shape of a ridged chest, with a roof-like top, for containing the relics of saints. It is borne in processions.

FERGHANA', a province of Soviet Central Asia, formed in 1876 out of the conquered khanate of Khoqand. It consists mainly of a valley surrounded by high ranges of mountains and traversed by the Sir Darya and its tributaries; area, 35,446 sq. miles. The climate is warm, and the soil in part fertile, but a considerable portion of the country is desert. Pop. about 2,169,600. Khoqand is the capital.

FER'GUSON, Adam, Scottish historical and political writer, born in 1724, died in 1816. In 1757 he succeeded David Hume as Keeper of the Advocates' Library, Edinburgh, in 1759 was made professor of natural philosophy in the university, and in 1764 of moral philosophy. He resigned his chair in 1784. Among his chief works are an *Essay on Civil Society* (1767), *Institutes of Moral Philosophy* (1769), *History of the Roman Republic* (1783), *Moral and Political Science* (1792).

FERGUSON, James, an eminent experimental philosopher, mechanist, and astronomer, was born of poor parents at Keith, in Banffshire, in 1710, died in 1776. While a boy tending sheep he acquired a know-



Feretory

ledge of the stars, and constructed a celestial globe. With the help of friends he went to Edinburgh, where he studied mathematics and drawing, making such rapid progress in the latter that he was able to support himself by painting miniatures. In 1743 he went to London, where he painted and gave lectures in experimental philosophy. Amongst his hearers was George III, then Prince of Wales, who afterwards settled on him a pension of £50 a year. His principal works are: *Astronomy Explained upon Sir Isaac Newton's Principles* (1756); *Lectures on Mechanics, Hydrostatics, &c.* (1760); *Select Mechanical Exercises* (1773).

FERGUSSON, Sir Charles, British soldier, born in Edinburgh, 17th Jan., 1865, he became the 7th baronet in 1907. Educated at Eton and Sandhurst, he joined the Grenadier Guards in 1883. In 1895 he joined the Egyptian army and saw service in the campaigns of 1896–99.

A brigadier-general in 1907, in the Great War he commanded the 5th division at Mons, and subsequently the 2nd and 17th army corps. Military governor of the occupied German territory, 1918–19, he was Governor-General of New Zealand, 1924–30.

FERGUSSON, James, a writer on architecture, born at Ayr in 1808, died in 1886. He went out to India as partner of an important commercial house, but after some years retired from business to devote himself to the study of architecture and early civilizations. In 1845 he published *Illustrations of the Rock-cut Temples of India*; in 1849, *A Historical Enquiry into the True Principles of Beauty in Art*; in 1851, *The Palaces of Nineveh and Persepolis Restored*; in 1855, *Illustrated Handbook of Architecture*; in 1862, *History of the Modern Styles of Architecture*, a sequel to the handbook, both being afterwards combined in *History of Architecture in All Countries* (3 vols., 1865–7), and completed by a *History of Indian and Eastern Architecture* (1876). He also wrote *Notes on the Site of the Holy Sepulchre at Jerusalem*, *Tree and Serpent Worship*, and *Rude Stone Monuments in all Countries*.

FERGUSSON, Robert, Scottish poet, was born at Edinburgh 17th Oct., 1750, died 16th Oct., 1774. He was educated at St. Andrews University, and became clerk to a writer of the signet in Edinburgh. He wrote poems, of which those in the Scottish dialect have genuine poetic excellence. His convivial habits undermined his health, and he died at the early age of twenty-four, after being confined in a lunatic asylum for two months. He was buried in the Canongate Churchyard, Edinburgh, where Burns erected a monument to the memory of this kindred genius, to whom he owed suggestions for several of his own poems.

FERISH'TA, more properly Mohammed Qasim, a Persian historian, born at Astrabad about 1550, died about 1612. He went to India with his father, and was for some time the tutor of a native prince. He wrote a *History of the Mohammedan Power in India*, which is the best yet written on the period which it embraces.

FERMANAGH (fer-mă'nâ), an inland county, Northern Ireland, province of Ulster; area, 715 sq. miles, or 417,912 acres exclusive of water. The county is divided lengthwise into two nearly equal portions by Lough Erne, and exhibits a succession of abrupt eminences of slight elevation, but is mountainous towards its western boundary. The soil is variable, and not remarkably fertile. The manufactures are unimportant. Politically it is divided into North Fermanagh and South Fermanagh, each sending one member to Parliament. Pop. (1926), 57,981. County town, Enniskillen.

FERMENTATION is a general term applied to changes in organic compounds by the action of bodies called ferments. These are: (*a*) micro-organisms, or distinctly organized ferments; (*b*) enzymes, or unorganized ferments.

Micro-organisms may secrete enzymes, and the products formed by the action of the micro-organism depend upon the kind of organism predominating. The fermentation is called alcoholic, acetic, lactic, butyric, &c., according to the substance which predominates in the liquor after fermentation.

Enzymes include such bodies as diastase, invertase, pepsin, ptyalin, emulsin, glucase, &c. Their action is hydrolytic.

The organized vegetable ferments are: (1) mould growth (Hyphomycetes), (2) yeast plants (Saccharomycetes), (3) bacteria (Schizomycetes).

The moulds (Hyphomycetes) are thread-like plants, devoid of chlorophyll, and form a somewhat felted mass called the mycelium. They grow upon damp organic matter where ventilation is faulty, and are injurious in fermenting processes, developing musty or sour odours and taste in the nutrient medium. Thus *Penicillium Glaucum*, a green mould, *Aspergillus Glaucus*, also green, and *Aspergillus Niger*, a dark mould, oxidize sugar to organic acids.

The bacteria, splitting ferments, or Schizomycetes, are rods, spirals, threadlike or rounded cells, and propagate by fission, i.e. splitting into parts, with great rapidity. They cause oxidation and decomposition, and often putrification, producing extremely poisonous end products. Many of the 'diseases' of wine and beer, as well as acetic, lactic, butyric, and other fermentations, are caused by them. Pasteurization, or heating to 70° C., is not a sure protection against their action, but steam at 100° C., or superheated steam, kills them instantaneously. The following varieties of bacteria are of great use industrially:

Acetic Acid Bacteria. These cause the oxidation of alcohol thus: $CH_3 \cdot CH_2OH + O_2 = CH_3COOH + H_2O$. There are various kinds of this class of bacterium, they grow in dilute alcoholic fluids, and mineral and nitrogenous matter is necessary

for their nutrition. They are used in vinegar manufacture (q.v.).

Lactic Acid Bacteria. These split sugar into lactic acid thus: $C_6H_{12}O_6 = 2C_2H_4(OH)COOH$, and cause the souring of milk. They occur in fruit, corn, grain, &c., and are used in lactic acid manufacture (q.v.).

Butyric Acid Bacteria ferment sugar and other carbohydrates and lactic acid into butyric acid thus: $2C_3H_6O_3 = C_3H_7COOH + 2CO_2 + 2H_2$. Many kinds exist, and cause the souring of cut beet, the ripening of cheese, the retting of flax, &c. They may do great damage in the brewery, however.

Proteolytic Bacteria are used in the tannery in the 'bating' or 'pueing' process. The bacteria produce enzymes having a solvent action on the fibres of the skin, making it supple.

Nitrogen-fixing Bacteria are of great importance to agriculturists. The nitrosomonas and the nitrosococcus convert ammonia into nitrites. The nitric organism converts nitrites to nitrates.

Other Bacteria are used technically in the dairy, in the preparation of indigo, tobacco, tea, &c., and especially in the modern method of sewage disposal, where noxious substances are converted into harmless carbon dioxide and water by special bacteria cultivated on the filter beds. Sulphur bacteria absorb sulphuretted hydrogen and other sulphur compounds, producing sulphates and even sulphuric acid; some will give fusel-oil and acetone, some glycerine, &c.

The yeasts (Saccharomycetes) are single-cell Fungi, and are of great technical importance. *Saccharomyces cerevisiæ* is the ferment in beer; *S. ellipsoideus* is the ferment in wine, and causes spontaneous fermentation of fruit juices.

Biology of Yeast. The Saccharomycetes belong to a sub-group in the Fungi division of the Thallophyta. The Fungi class is divided into two divisions: (*a*) Phycomycetes or Algæ group; (*b*) Mycomycetes. The latter group is divided into two divisions: (*a*) true Ascomycetes, which include moulds like Eurotium and Penicillium; (*b*) Hemiasci, which includes yeast.

The Saccharomycetes propagate either by budding—e.g. during vigorous fermentation of a saccharine solution—or by fission and endogenous spore formation, which is characteristic of the Schizomycetes; or by endospore formation, which is affected by temperature, amount of air present, amount of moisture present, age of cells, and the food-supply available.

Yeast consists of an aggregation of plant cells, forming a slimy yellow mass of peculiar odour and with an acid reaction. The most favourable temperature for propagation is 6° to 25° C., and the substances necessary for a growing plant must be present, i.e. a fermentable sugar, nitrogenous matter, phosphates and sulphates of calcium, potassium, and magnesium.

Yeasts are also grouped into two classes: (*a*) top yeasts; (*b*) bottom yeasts. The former require a temperature of 15° to 30° C., the fermentation being very active, and the carbon dioxide which is rapidly evolved carries the yeast to the surface. It is used for heavy ale and beer, for alcohol and high wines. Bottom yeast acts between 4° to 10° C.; the fermentation is slow, the evolution of carbon dioxide is gradual, and the yeast remains at the bottom of the vat.

Saccharomycetes can be also divided into eight classes:

Saccharomyces cerevisiæ, a top and bottom ferment depending upon circumstances.

S. Pasteurianus I, a bottom beer ferment which gives an unpleasant taste, but has no apparent action on beer.

S. Pasteurianus II, a top ferment in beer.

S. Pasteurianus III, a top ferment in beer, producing cloudiness and disease in beer.

S. ellipsoideus I, a bottom yeast, the true wine ferment.

S. ellipsoideus II, a bottom yeast causing cloudiness in turbid beer.

Carlsburg No. 1 yields a beer with less carbon dioxide than No. 2, and is used for bottled beers.

Carlsberg No. 2 is used for export beers.

It is consequently best to use a pure culture, and this is obtained by propagating from a single plant in the presence of sterilized nutrient material.

Structure and Life Conditions of Yeast. The minute egg-shaped single cells in beer are about 0·01 mm. in diameter. The cell consists of protoplasm enclosed by a cellulose wall, and containing a spherical nucleus which becomes visible on staining. At the end of the fermentation, vacuoles appear filled with a low refractory liquid and granules, which are highly refractory bodies. The yeast propagates by budding, and under special conditions forms endospores, the cell dividing into two or four spores, which then germinate into new yeast cells. The spores of culture yeast appear empty; those of wild yeast are strongly refractive.

When heated in water at 75° C., yeast is killed, but when dry, can live from −130° C. to +100° C. Alcoholic fermentation occurs between 0° to

50° C., the optimum temperature being 28° to 34° C. Yeasts retain vitality longest in a 10 per cent solution of sucrose. Most yeast races completely ferment a 25 per cent sugar solution, but a 60 per cent solution is unattacked. Yeasts require amides, peptones, phosphates, sulphates, and salts of potassium and magnesium for their growth. Oxygen is also necessary.

Most yeast cells cease to propagate in a solution containing over 5 per cent by volume of alcohol, although powerful yeasts can generate a solution containing 25 per cent alcohol.

Yeasts may be divided into culture and wild yeasts, and culture yeasts include: (*a*) *Saccharomyces cerevisiæ*, both top and bottom yeasts; and (*b*) *Saccharomyces ellipsoideus*, the wine ferment.

Brewery yeast must generate the characteristic aromatic taste and odour, and must separate from the fluid. A distillery yeast must have a high fermenting power to produce the maximum amount of alcohol. A bakery yeast should be rapid in action, and generate much alcohol and carbon dioxide to raise the dough.

English brewers use *high* or top fermentation yeast, working between 28 to 31° C. Porter, stout, ale, Weissbiere, Braunbiere, &c., are made thus. For lager beers low or bottom fermentation yeasts are used, working at 4° to 10° C.

Wine yeasts belong to *Saccharomyces ellipsoideus*; each different wine district produces distinct and characteristic *ellipsoideus* races, and hence experts can distinguish wines from different districts by the various tastes and bouquets.

Other Yeasts. *Saccharomyces pyriformis* produces alcoholic fermentations of ginger beer.

Schizosaccharomyces pombe ferments dextrose in negro millet beer, and is used in South America.

Schizosaccharomyces mellacei occurs in Jamaica rum.

Wild yeasts are not cultivated, because they produce unpleasant effects.

See BREWING, DISTILLATION, and articles on alcoholic liquors, e.g. WINES, WHISKY; VINEGAR (lactic acid and butyric acid); YEAST.

The Enzymes or Unorganized Ferments. The enzymes are complex nitrogenous substances of high molecular weight, similar in elementary composition to albumen, and soluble in cold water, from which they are easily precipitated by alcohol. Their activity falls with rise in temperature, whilst at 80° C. most enzymes are destroyed. Their aqueous solutions rapidly putrify. Antiseptics and strong mineral poisons, such as formaldehyde, phenol, strong mineral acids or bases, lead, copper, mercury, and zinc salts, destroy enzymes.

These substances attack complex molecules, splitting or 'hydrolyzing' them into simpler substances, usually with the addition of water. Hence starch, fats, and albumen become soluble. The action of the enzyme is often reversible. It is by the aid of enzymes that food-stuffs are rendered soluble and are digested.

Since each enzyme is characterized by its capacity of performing one specific action, they are classified according to the action they perform.

1. *Diastatic enzymes* convert insoluble carbohydrates like starch and cellulose into soluble sugars. Diastase occurs in malt, ptyalin in saliva, cellulase dissolves cellulose, inulase dissolves inulin.

2. *Inverting enzymes* transform disaccharides into simpler sugars, usually hexoses. Sucrase hydrolyzes cane-sugar; maltase converts maltose into two molecules of glucose; lactase converts milk-sugar into *d*-glucose and *d*-galactose; melibiase occurs in bottom fermentation yeasts, and converts melibiose into *d*-glucose and *d*-galactose.

3. *Enzymes decomposing glucosides.* Emulsin decomposes amygdalin into grape sugar, benzal-dehyde, and hydrocyanic acid.

4. *Proteolytic enzymes* decompose various proteids into simpler bodies, even into the simple amino-acids. Pepsin decomposes albuminous bodies into peptones, trypsin decomposes albuminous substances into leucin, tyrosin, and other amino-acids, and papain acts on flesh.

5. *Clotting enzymes* coagulate milk, precipitating the casein and leaving the milk-sugar in solution. Thrombase coagulates blood, and pectase produces vegetable jellies.

6. *The lipases* split fats into glycerine and fatty acids.

7. *The oxidases* oxidize various substances, e.g. laccase, tyrosinase.

8. *Enzymes decomposing amides*, e.g. urase in urine, decomposing urea into carbon dioxide and ammonia.

9. *Enzymes producing alcohol.*

FERMO, a town of Middle Italy, province of Ascoli Piceno, on a height about 4 miles from the Adriatic, on which is its port, Porto di Fermo. Pop. (commune), 20,000.

FERMOY', a town, County Cork, Irish Free State, on the Blackwater, here crossed by a fine bridge. It contains Fermoy College and St. Colman's Roman Catholic College,

and has barracks accommodating 3,000 men. It has large flour-mills and a trade in corn. Pop. (1926), 4,505.

FERNANDEZ, Juan, Spanish navigator. Born in Cartagena, he attained distinction as a navigator by observing the course of the trade winds and the currents off the west coast of South America. During one of his voyages, he discovered, in the S. Pacific, the islands now bearing his name, one of which became famous as the residence of Alexander Selkirk. He obtained a concession of them in 1572 and attempted unsuccessfully to found there a colony of Indians.

FERNAN'DO NORONHA (no-ron' yà), a small island in the Atlantic, forming one of a small group of the same name about 210 miles northeast of the coast of Brazil, to which it belongs, and by which it is used as a penal settlement. It is defended by forts. The group is essentially volcanic in character; the vegetation of the tropical American type, remarkable for the immense number of creepers which festoon the trees. The population is about 2,000, 1,100 of whom are criminals.

FERNAN'DO PO, a Spanish island in the Bight of Biafra, off the west coast of Africa, about 20 miles from the mainland. It is of volcanic origin, and is of an oblong form, broadest at the south extremity. The area is 780 sq. miles. It is traversed from north to south by a ridge of mountains terminating in a magnificent cone, 11,040 feet high, called Clarence Peak. The island is picturesquely covered with forests and luxuriant vegetation, chiefly palms and the bombax or silk-cotton tree. There are several harbours in the island. The population is about 20,873, partly a mixture of negroes, Portuguese, and other Europeans, partly native-born negroes (Bubis). The capital is Clarence Town.

FERNDALE, market town of Glamorganshire. Near Pontypridd, it is in a coal mining district, and is 167 miles from London, by the Great Western Railway. Pop. 18,144.

FERNEY, village of France, 4 miles from Geneva, being just over the French frontier. It is famous for its associations with Voltaire and is now called Ferney-Voltaire. The château which he built, and where he lived from 1758 to 1778, contains memorials of his life there. Pop. 1270.

FERNS (Filices or Filicales), a nat. ord. of cryptogamous or flowerless plants, forming the largest group of the Pteridophyta. The familiar fern-plant is the *sporophyte*; its leaves—often called fronds—arise from a rhizome or rootstock, or from an arborescent trunk, and are circinate in vernation, a term descriptive of the manner in which the fronds are rolled up before they are developed in spring, when they have the appearance of a bishop's crosier.

On the veins of their lower surface, or their margins, the fronds bear small vessels named *sporangia*, containing spores. These spore-cases are arranged in clusters, named *sori*, which are either naked or covered with a layer of the epidermis, which forms an involucre or *indusium*. When the spores germinate, they produce a delicate cellular *gametophyte*, called the *prothallus*, which in due course bears sexual organs, the *antheridia* and *archegonia*. The antheridia give rise to a number of spirally coiled *spermatozoids*, which swim about by means of numerous flagella. The archegonia resemble those of Bryophytes, but are more or less sunk in the prothallus and have but a short neck. Spermatozoids are attracted to the archegonia by the malic acid which these secrete when ripe. The oospore produced by fertilization quickly develops into a new sporophyte, which soon establishes itself as an independent plant.

Ferns have a wide geographical range, but are most abundant in humid, temperate, and tropical regions. In the tropical forests the tree-ferns rival the palms, rising sometimes to a height of 50 or 60 feet. Ferns are very abundant as fossil plants. The earliest-known forms occur in Devonian rocks.

Various systems of classification for ferns have been proposed. At present the order is usually divided into about a dozen families distinguished by differences in the structure and arrangement of the sporangia. It is customary to separate the more primitive families with large massive sporangia, such as the Botryopterideæ (extinct) and Marattiaceæ, as *Eusporangiate* ferns from the more advanced *Leptosporangiate* types with small delicate sporangia. The Leptosporangiate families conform to one of three types, as regards the arrangement and succession of the sporangia in the sorus. In the Simplices (e.g. Gleicheniaceæ) all the sporangia of a sorus are produced simultaneously; in the Gradatæ (e.g. Hymenophyllaceæ) they arise in basipetal order, i.e. there is a definite succession in both space and time; in the Mixtæ (including the Polypodiaceæ and some more primitive genera) they arise successively, but in no definite order.

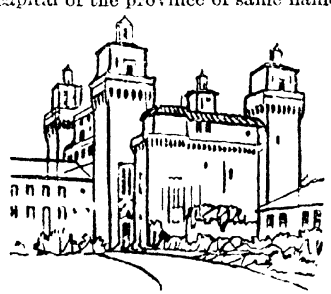
The generic characters are founded on the position and direction of the sori and on the venation. The largest

division is that of the **Polypodiaceæ**, to which nearly all British ferns belong, such as the polypody, the lady-fern, the bracken, the hard-fern, the spleenwort, the maiden-hair, the hart's-tongue fern, &c. The royal fern, however, belongs to the Osmundaceæ. A few of the ferns are used medicinally, mostly as demulcents and astringents. Some yield food. *Pteris esculenta* is the edible bracken of New Zealand.

FERNS, town of Wexford, Irish Free State. It is 74 miles from Dublin, on the G.S. Rly. Ferns was once an important place, being the residence of the kings of Leinster and the seat of a bishop, whilst for 200 years it sent two members to the Irish Parliament. Pop. (1926), 1,576.

FEROZEPOOR. *See* FIROZPUR.

FERRA'RA, a city of N. Italy, capital of the province of same name,



Ferrara, the old Castle

28 miles N.N.E. of Bologna, in a fertile but unhealthy plain. It is a well-built town with many remains of the splendour and commercial prosperity it enjoyed under the House of Este. Under the Papal rule it fell into decay, and has now a deserted appearance. The old ducal castle or palace (now occupied by public offices), several other palaces, the cathedral, the public picture-gallery, the houses where Ariosto and Guarini lived, the cell in which Tasso was imprisoned, a monument to Savonarola, who was born there, the university (founded in 1264, and reopened in 1815), the public library, the old walls, &c., deserve mention. Pop. (1931), 115,883.

The province was formerly a duchy of Italy held by the House of Este as a Papal fief from 1471 till 1597, when it fell to the Pope. At the unification of Italy under Victor Emmanuel in 1860 it gave its name to a province bounded on the north by the Po, east by the Adriatic, south and west by Ravenna, Bologna, and Modena; area, 1,013 sq. miles; pop. 366,611 (1931).

FERRA'RI, Giuseppe, an Italian philosopher, born 1812, at Milan, died at Rome in 1876. He studied law at Pavia, but afterwards devoted himself to literature. He first won notice by his edition of Vico's works (1836–7). Having gone to France, he was professor of philosophy at Strasbourg for a number of years. In 1859 he returned to Italy, becoming successively professor at Turin and Milan. Amongst his principal writings are: *Essai sur le Principe et les Limites de la Philosophie de l'Histoire* (1847), *Filosofia della Rivoluzione* (1851), *Corso di Lezioni sugli Scrittori Politici Italiani* (1862).

FERREIRA (fer-ā i-rā), **Antonio,** Portuguese poet, born at Lisbon 1528, died in 1569. He carried to perfection the elegiac and epistolary style, and added to Portuguese poetry the epithalamium, the epigram, ode, and tragedy. His tragedy of *Ines de Castro* is still considered by the Portuguese as one of the finest monuments of their literature.

FERRER, Francisco, Spanish revolutionist, born in 1859, died in 1909. He founded lay schools for the purpose of advancing rationalist and socialist teaching, and in 1909 he participated in the insurrections at Barcelona. His activities were directed against Roman Catholic influence in Spanish politics. He was condemned for his revolutionary agitation, and shot on 13th Oct., 1909. The execution of Ferrer excited much indignation, not only in Spain, but also in France.

FER'RET, a domesticated albino variety of the polecat (*Putorius fœtidus*), about 14 inches in length, of a pale-yellow colour, with red eyes. It is a native of Africa, but has been introduced into Europe. It cannot, however, bear cold, and cannot subsist even in France except in a domestic state. Ferrets are used in catching rabbits, to drive them out of their holes.

FER'RIER, Sir David, a distinguished authority on the physiology of the brain, was born near Aberdeen in 1843. He studied at Aberdeen University, graduating with distinction in 1863, and in the same year he carried off the Ferguson inter-university scholarship in classics and philosophy. After studying for a short time at Heidelberg, he took the medical course at Edinburgh, and graduated M.D. in 1870, with very high distinction. In 1872 he became professor of forensic medicine in King's College, London, a chair which

he exchanged in 1889 for that of neuro-pathology, specially founded for him, a position which he long held. He became F.R.S. in 1876, in 1880 received a royal medal, and was knighted in 1911.

His researches on the brain necessitated a large number of experiments on living animals, and he was, in consequence, attacked by the anti-vivisectionists. His results are stated in his works on *The Functions of the Brain* (1876), and *Cerebral Localization* (1878–90). He was also the founder and editor of *Brain: a Journal of Neurology*. He died in 1928.

FERRIER, James Frederick, a Scottish metaphysician, born at Edinburgh in 1808, died at St. Andrews 11th June, 1864. After studying at Edinburgh and Oxford, he was admitted to the Scottish Bar in 1832, but gave his attention more to literature than to law. His contributions to *Blackwood's Magazine*, then at the height of its fame, brought him into notice, and in 1845 he was appointed to the chair of moral philosophy at St. Andrews. His chief work is *The Institutes of Metaphysics*, in which he attempts to build up in a rigorously logical and deductive method a complete system of knowing and being.

FERRIER, Susan Edmonstone, novelist, the aunt of the preceding, was born in Edinburgh in 1782, died at Edinburgh in 1854. Her life was chiefly spent in her native town. In 1818 she made her first appearance as an authoress by the publication of the novel *Marriage*, which acquired great popularity. *The Inheritance* appeared in 1824; and *Destiny, or the Chief's Daughter*, in 1831. The novels of Miss Ferrier are full of a genial humour, and no one has succeeded better in depicting the manners of the upper middle class in Scotland at a time when the national peculiarities were still in a great measure intact.

FERRO, or **HIERRO,** the most south-western and smallest of the Canary Islands, about 18 miles long and 9 miles broad. This island, having once been supposed the most western point of the Old World, was formerly employed by all geographers to fix their first meridian, and the longitude reckoned from it. As first meridian its conventional place is 20° W. of Paris and 17° 40′ W. of Greenwich. Pop. 7,667.

FERROL' (Lat. *Ardobrica*), a fortified seaport of Northern Spain, in the province and about 12 miles N.E. of the town of Corunna, on a fine inland bay, connected with the sea by a channel so narrow as to admit only one ship-of-the-line at a time. The chief naval arsenal of Spain, established by Ferdinand VI in 1752 on a magnificent scale, is here. The manufactures consist chiefly of swords, cutlery, and military and naval equipments. Pop. 30,500.

FERRY, a particular part of a river, lake, arm of the sea, &c., where a boat or other conveyance plies to carry passengers or goods from the one side to the other. The right of establishing a public ferry is usually the prerogative of a Government or Legislature. The person who has a right of ferry is required to keep a boat or boats suitable for the conveyance of



Ferret (*Putorius furo*)

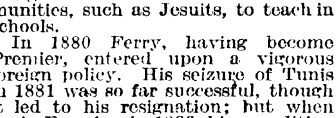
passengers, to charge a reasonable fare, and to provide the requisite landing-places on either bank of the river. No one is allowed to establish a rival ferry so near the original one as to destroy its custom. Common rowing-boats, sailing-boats, large flat-bottomed barges pulled along a rope stretched from bank to bank for horses and carriages, and steam and motor ferry-boats are among the conveyances.

During the European War a train ferry across the English Channel was constructed in 1918. The services were organized from Richborough and Southampton to Calais, Dunkirk, Dieppe and Cherbourg, and the ferries used only for military purposes.

FERRY, Jules Francois Camille, French statesman and writer, born at St. Dié in the Vosges, 5th April, 1832, died in 1893. He became a barrister at Paris, but devoted himself almost entirely to journalism. His articles in the *Presse*, *Courrier de Paris*,

and *Temps*, from 1856 to 1869, brought him much into notice, and in 1869 he was returned as Deputy for the sixth arrondissement of Paris and took his seat among the members of the 'Left.' After the fall of Sedan he became a member of the Government of the National Defence. In 1872 Thiers appointed him Minister-Resident at Athens. In 1879 he became Minister of Public Instruction, and as such introduced an Education Bill, which amongst other things forbade unauthorized communities, such as Jesuits, to teach in schools.

In 1880 Ferry, having become Premier, entered upon a vigorous foreign policy. His seizure of Tunis in 1881 was so far successful, though it led to his resignation; but when again Premier, in 1883, his expedition to Tonquin landed France in troubles through which (1885) he was driven from office. In 1893 he was elected President of the Senate, but soon after he was shot by a madman and died.—Cf. A. Rambaud, *Jules Ferry*.



Fesse—Lozenge, Simple, Chequée

FERTÉ-SOUS-JOUARRE (fer-tā-sö-zhö-ār), **LA**, a town of France, department of Seine-et-Marne, 37 miles E.N.E. of Paris. Pop. 5,000.

FER'ULA, a genus of umbelliferous plants, whose species often yield a powerful stimulating gum resin, employed in medicine. The species are natives of the shores of the Mediterranean and Persia, and are characterized by tall-growing pithy stems, and deeply divided leaves, the segments of which are frequently linear. *F. communis* of English gardens is called giant fennel. *F. orientālis* and *F. tingitāna* are said to yield African ammoniacum, a gum resin like asafœtida, but less powerful.

FESCEN'NINE VERSES, rude Latin verses in the form of a dialogue between two persons, who satirized and ridiculed each other's failings and vices with great freedom of speech. They originated in country districts in ancient Italy, but were ultimately introduced into the towns, and formed part of the ceremony at marriages and on other occasions of festivity. The name is probably derived from *fascinum*, fascination, although the origin of the verses has been ascribed to the Etruscan town of Fescennia.

FESCH (fesh), **Joseph**, half-brother of Napoleon's mother, was born at Ajaccio in 1763, died in 1839. He had devoted himself to an ecclesiastical life, but quitted it on the outbreak of the French revolution, and became commissary of war to the army of the Alps. After the restoration of Catholic worship he resumed his ecclesiastical status, and became in 1802 Archbishop of Lyons, and next year a cardinal. After the fall of Napoleon he retired to Rome, where he died.

FES'CUE, the popular name of a genus of grasses (Festūca) belonging to the division with many-flowered spikelets on long stalks. Amongst the numerous species are some of the most valuable meadow and pasture grasses of Britain. *F. pratensis*, or meadow fescue, and *F. duriuscula* or hard fescue, are both highly prized for agricultural purposes. *F. ovina*, or sheep's fescue, is much smaller than either of these, and is useful for lawns. It is abundant in mountain pastures. *F. elatior*, the tall fescue, is a coarse reedy grass with stem usually 4 or 5 feet high. All these species are perennial.

FESSE (fes), in heraldry, a band or girdle comprising the centre third part of the shield, and formed by two horizontal lines drawn across it: it is one of the nine honourable ordinaries. The fesse-point is the exact centre of the escutcheon.

FES'TIVALS, or **FEASTS**, certain days or longer periods consecrated to particular celebrations either in honour of some god or in commemoration of some important event. Such festivals have prevailed among nearly all nations, both ancient and modern.

Jewish. Amongst the Jews there are festivals prescribed in the Scriptures (*Lev.* xxiii), and thence called sacred feasts. These are the weekly feast of the Sabbath; the Passover, or Feast of Unleavened Bread; Pentecost, or the Feast of Weeks; the Feast of Trumpets, or New Moon; the Feast of the Atonement; and the Feast of Tabernacles. Afterwards the Feast of Purim (to commemorate the failure of Haman's machinations) and the Dedication of the Temple (after its profanation by Antiochus Epiphanes) were added.

Greek. Amongst the ancient Greeks were celebrated the Dionysia; the Eleusinia; the four great national games, the Olympic, the Isthmian, the Nemean, and the Pythian. But each community and city had its own local festivals in addition, such as the Panathenæa, held by the tribes of Attica, whose union it was intended to celebrate. Among Roman festivals were

the Saturnalia, Cerealia, Lupercalia, and others.

Christian. The festivals of the Christian Church owe their origin partly to those of the Jewish religion, such as Easter, which corresponds to the Passover of the Jews, and Whitsuntide, which corresponds to Pentecost; partly also to pagan festivals, which the Christian hierarchy, finding it impossible to abolish them, applied to Christian uses by converting them into festivals of the Church. These festivals are divided into movable and immovable; the former those which in different years fall on different days, the latter those which always fall upon the same day.

The chief of the movable feasts is Easter, the one on which the position of all the others, except that of Advent Sunday, depends. Septuagesima Sunday falls nine weeks before Easter, Sexagesima Sunday eight weeks, Quinquagesima Sunday seven weeks, the first Sunday in Lent six weeks, and Palm Sunday one week before Easter. Rogation Sunday falls five weeks, Ascension Day forty days, Whitsunday seven weeks, and Trinity Sunday eight weeks after Easter. Ash Wednesday is the Wednesday before the first Sunday in Lent, Maundy Thursday the Thursday, and Good Friday the Friday before Easter, and Corpus Christi is the Thursday after Trinity Sunday. Advent Sunday is the nearest Sunday to the feast of St. Andrew, 30th Nov., whether before or after.

The chief immovable feasts are the feast of the Circumcision on the 1st of Jan., Epiphany on the 6th of Jan., the Annunciation of the Blessed Virgin on the 25th of March, the Transfiguration of Christ on the 6th of Aug.; the feast of St. Michael (Michaelmas) and All the Angels on the 29th of Sept., the feast of All-Saints on the 1st of Nov., the festival of All-Souls on the 2nd of Nov., and Christmas Day or the feast of the Nativity of Our Lord on the 25th of Dec. The festivals relating to the Virgin Mary in the Roman Catholic Church include: the feast of the Annunciation; the Purification of the Virgin, or Candlemas; the feast of the Visitation of Our Lady; the feast of the Immaculate Conception; the Nativity of the Virgin; the Martyrdom of the Virgin Mary; the Assumption of the Virgin (6th Aug.); and several smaller ones. The worship of the Cross introduced two festivals: that of the Invention of the Holy Cross (3rd May), and that of the Exaltation of the Cross (1st Sept.).

The saints' days that are still held as festivals, and have religious services connected with them in the Church of England, are called *red-letter* days, because they used to be printed with red letters in the Church calendar; while the saints' days which were still retained in the calendar at the Reformation, but had no services connected with them, are called *black-letter* days, because they were printed in black letters.—BIBLIOGRAPHY: Sir J. G. Frazer, *The Golden Bough*; L. Duchesne, *Christian Worship*; J. Dowden, *The Church and Kalendar*. *See also* J. Rendel Harris, *The Cult of the Heavenly Twins*.

FESTUBERT, village of France. It is 3 miles from La Bassée, and here there was much fighting during the Great War. On 23rd Nov., 1914, the Germans stormed some trenches held by the British, but later in the day the lost ground was regained. On 15th May, 1915, a British attack was delivered at Festubert, and some ground won by the 2nd and 7th Divisions. Fighting continued for some days after, and in this the Canadians took part.

FESTUS, Porcius, Roman procurator of Judæa A.D. 61–62, successor of Felix. The Apostle Paul appeared before him, and was sent by him to Rome at his own request.

FESTUS, Sextus Pompeius, a Roman grammarian belonging to the second or third century of our era, author of an abridgment of a work by Verrius Flaccus called *De Verborum Significatione*, a kind of dictionary, which is very valuable for the information it contains about the Latin language. The work of Festus was still further abridged in the eighth century by Paulus Diaconus. The one MS. of the original work of Festus is now at Naples.

FÉTIS (fā'tēs), **François Joseph,** a Belgian musical composer and writer on music, born 1784, died 1871. He was educated at the Paris Conservatoire; was professor there from 1818 to 1833, when he was appointed director of the Conservatoire at Brussels. Among his works may be mentioned: *Traité de la Fugue* (1825), *Biographie Universelle des Musiciens* (1835–44), *Traité Complet de la Théorie et de la Pratique de l'Harmonie*. His musical compositions include operas, sacred music, and instrumental pieces for the piano and the violin.

FE'TISH, or **FETICH,** a word first brought into use by De Brosses, in his work *Du Culte des Dieux Fétiches* (1760), who was the first to draw attention to fetishism as a branch of the study of religion. The term is derived from the Portuguese *feitiço*, magic, a word which expressed the Portuguese opinion of the religion of the natives of the west coast of Africa. The Portuguese gave this name to the idols of the negroes of the Senegal,

and afterwards the word received a more extensive meaning.

A fetish is any object which is regarded with a feeling of awe, as having mysterious powers residing in it, but without any consciousness in the exercise of them. The fetish may be animate, as a cock, a serpent, &c.; or inanimate, as a river, a tooth, a shell. Fetish worship prevails in Guinea and other parts of the west coast of Africa. In addition to the common fetish of the tribe every individual may have one of his own. To this he offers up prayers, and if they are not heard he punishes it, or perhaps throws it away, or breaks it in pieces. —BIBLIOGRAPHY: E. B. Tylor, *Primitive Culture*; F. Schultze, *Fetichism*; R. H. Nassau, *Fetichism in West Africa*; Sir J. G. Frazer, *The Golden Bough*.

FETTES COLLEGE, public school of Scotland. It is in Inverleith Park, Edinburgh, and was founded by Sir William Fettes (1750–1836), Lord Provost of that city. It was opened in 1870, and has extensive buildings with accommodation for about 250 boys.

FETUS, or **FŒTUS,** the young viviparous animals in the womb, and of oviparous animals in the egg, after it is perfectly formed; before which time it is called *embryo*.

FEU, FEU-HOLDING, or **FEU-FARM,** in Scots law, the usual mode of tenure by an owner of land in Scotland, a perpetual holding from a superior on payment of an annual sum, the *feu-duty*. The King is paramount superior. Those holding from him, his vassals, are in turn superiors of those who hold from them. *See* SUPERIOR.

FEUCHTWANGER, Lion. German author. Born in Munich, 7th July, 1884, he soon began to write plays and became a successful dramatist. He became known in Britain in 1926 when his novel, *Jew Süss*, was translated into English. In 1927 came another, *The Ugly Duchess*, and in 1928 a volume of plays, including one on Warren Hastings.

FEUDAL SYSTEM, that system by which land (a *fief*) is held by a vassal on condition of fidelity, that is, in consideration of services to be rendered to his superior or feudal lord. The nature of the feudal system is to be explained by its origin amongst the Germanic tribes. In the earliest times the relation of superior and vassal did not exist in connection with the ownership of land. Each freeman had his share of the tribe lands, which were held simply on condition of his fulfilling his public duties of attendance at the councils of the mark or township and performing his share of military service in the wars or musters decreed at such councils. The noble had, of course, more land and more influence than the simple free man, but there need be no tie of vassalage between them. This seems to have been the primitive social organization of the Anglo-Saxons and other German tribes.

The lands held by all freemen, whether noble or ordinary freemen, under this system, are said to be *allodial*, as distinguished from *feudal* lands, which imply service to a superior lord. By the close of the tenth century, however, this system had undergone considerable modifications. The masses of Teutonic invaders who overran Gaul and England had necessarily to confer exceptional powers on their leaders; and as they were for long very much in the position of military in an enemy's country, these powers were naturally continued. Thus it was that kings, before unknown to the Anglo-Saxons, make their appearance immediately after their descent upon Britian.

It was common for a chief or great man to have a retinue or body-guard composed of valiant youths, who were furnished by the chief with arms and provisions, and who in return devoted themselves to his service. These companions (O.E. *Gesithas*; Ger. *Gesellen*) originally received no pay except their arms, horses, and provisions, and the portion of the spoils which remained after the chieftain had taken his own share. But when conquered lands came to be apportioned and large districts fell into the hands of kings or dukes and their subordinates, they gave certain portions of the territory to their attendants to enjoy for life.

These estates were called *beneficia* or fiefs, because they were only lent to their possessors, to revert after their death to the grantor, who immediately gave them to another of his servants on the same terms. As the son commonly esteemed it his duty, or was forced by necessity, to devote his arm to the lord in whose service his father had lived, he also received his father's fief; or rather, he was invested with it anew. By the usage of centuries this custom became a right and the fief became hereditary. A fief rendered vacant by the death of the holder was at once taken possession of by his son, on the sole condition of paying homage to the feudal superior.

Thus a feudal nobility and a feudal system arose and for a time existed alongside of the old allodial system. But gradually the greater security to be got by putting one's self under the protection of some powerful ruler or leader gave the feudal system the pre-

dominance. The free proprietor of landed property, oppressed by powerful neighbours, sought refuge in submitting to some more powerful nobleman, to whom he surrendered his land, receiving it back as a vassal. Even the inferior nobility found it to be to their advantage to have themselves recognized as feudatories of the nearest duke or earl; and as the royal power steadily advanced, the offices of duke, caldorman, gerefa, &c., were always bestowed by the king.

Thus the Crown became the source of all authority and possession in the country. The land which had once been 'folcland,' or the land of the people, became the land of the king, from whom all titles to it were held to be derived. Such at least was the development of feudalism in England, where its centralizing tendencies, especially in the matter of holding land from the Crown, were strongly reinforced by the circumstances of the conquest under William the Norman. Under him and his immediate successors there was a struggle between royalty and the nobility, which ended in the power of the latter sinking before that of the kings.

On the other hand, in Germany, France, and elsewhere on the Continent the disintegrating tendencies of feudalism as a system of government had full play. In these countries the weakening of the kingly authority encouraged the great feudal dukes and counts to set up in an almost absolute independence, which in France was afterwards gradually lost as the monarchy grew stronger, but in Germany continued to divide the land down almost to our own times into a number of petty principalities.

Among the chief agencies that overthrew the feudal system were the rise of cities, the change in modes of warfare, and the spread of knowledge and civilization. The spirit of the feudal system, grounded on the prevalence of landed property, was necessarily foreign to cities which owed their origin to industry and personal property, and founded thereon a new sort of power. The growth of this new class, with its wealth and industrial importance, has contributed more than anything else to a social and political development before which the old feudal relations of society have almost totally disappeared. Even yet, however, the laws relating to land still bear the stamp of feudalism in various countries. In England, for instance, all land-owners are theoretically regarded as tenants holding from some superior or lord, though the lord may be quite unknown. *See* MIDDLE AGES.

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FEUERBACH (foi'er-bâh), **Ludwig Andreas,** a German metaphysician, son of the celebrated jurist, was born at Landshut in Bavaria in 1804, died in 1872. After studying theology and philosophy at Heidelberg and Berlin, he became a tutor (Privatdozent) at Erlangen University in 1828. As his negative views in theology were obnoxious to the Government, and thus deprived him of all chance of a professorship, he resigned, and the latter part of his life was passed in straitened circumstances. All transcendental ideas, such as God, immortality, &c., Feuerbach came to regard as deleterious illusions, and considered that the direct contact of the senses with things alone gave the full truth. The conception of God is, according to Feuerbach, merely the projection of man's ideal into the objective world. His works include a *Critique of Hegel* (1839); *The Essence of Christianity* (1841; translated by George Eliot, 1854); *The Essence of Religion* (1849); *Godhead, Freedom, and Immortality* (1866).

FEUERBACH, Paul Johann Anselm, father of the preceding, German criminal jurist, was born at Jena in 1775, died in 1833. Having published his first work, entitled *Anti-Hobbes*, in 1798, he began in 1799 to deliver lectures on law at Jena as Privatdozent. In 1801 he became an ordinary professor of jurisprudence at Jena, but the following year accepted a chair at Keil. In 1804 he obtained an appointment in the University of Landshut, where he was employed to draw up the plan of a criminal code for Bavaria, which received the royal assent in 1813. In 1814 he was appointed second president of the Appeal Court at Bamberg, and in 1817 first president of the Appeal Court for the circle of Rezat at Anspach. Among his most interesting and important works are: *Merkwürdige Criminal-fälle* and *Themis, or Contributions to the Art of Law-making*.

FEUILLANTS (*feu*-yän), a religious order which arose as a reform of the order of Bernardins, and took origin in the abbey of Feuillants, near Toulouse, established in 1577. There were also convents of nuns who followed the same reform, called *Feuillantines*. They were suppressed by the revolution of 1789, and their convent in Paris taken possession of by a political club named the Feuillants, of which Mirabeau was a member. This

club consisted of moderate men, who were considered almost as bad as aristocrats by the Sansculotte party. It was broken up after the insurrection of 10th Aug., 1792.

FEUILLET (*feu*-yä), **Octave**, a French novelist and dramatist, born at Saint Lô, department of La Manche, 11th Aug., 1812, died in 1890. He came into notice about 1846 with his novels of *Le Fruit Défundu*, *Le Conte de Polichinelle*, and a series of comedies and tales which was published in the *Revue des deux Mondes*. In 1857 the appearance of *Le Roman d'un Jeune Homme Pauvre* raised Feuillet to the first rank of the novelists of the day. Amongst his other numerous novels are: *Monsieur de Camors* (1867), *Julia de Trécœur* (1872), *Le Sphinx* (1874), and *Histoire d'une Parisienne* (1881). His works have a refined humour, and are remarkable for their acute character-drawing and extraordinary penetration. His style is admirably witty and restrained, and perfectly suited to his subject.

FEUILLETON (*feu*-i-ton), that part of a French newspaper devoted to light literature or criticism, and generally marked off from the rest of the page by a line. The feuilleton very commonly contains a tale. The idea originated with the editor of the *Journal des Débats* early in the nineteenth century, and several novels of Dumas, Eugène Sue, and others first appeared as feuilletons. The term is now applied loosely to the serial stories which appear in English newspapers, and which are not uncommonly sensational, often containing a strong love-interest and including marquesses and earls among their characters.

FEVER (Lat. *fébris*), a diseased condition of the body characterized by an accelerated pulse, with increase of heat, deranged functions, diminished strength, and often with excessive thirst. Fevers usually commence with chills or rigors, known as the *cold stage* of the disease, although the temperature of the body is really increased. There are also a feeling of lassitude, pains in the back and limbs, loss of appetite, and nausea. This soon develops into the *hot stage*, in which the pulse quickens and the skin becomes hot and dry.

These phenomena are accompanied by thirst, headache, a furred tongue, a constipated state of the bowels, and a deficiency in the urinary secretion. The symptoms are generally aggravated at night, and may even be accompanied by slight delirium.

After a time the *crisis* is reached, when the patient either dies from gradual exhaustion or from hyperpyrexia, or he begins to recover, the febrile symptoms disappearing sometimes quite suddenly, sometimes very slowly. The loss of strength in fever due to the waste of tissue (caused by the abnormal temperature) being greatly in excess of the nutritive supply, together with the general disturbance of functions, often brings about fatal results. In many cases fever is only an accompanying symptom of some specific disorder, but in others it is the primary and predominant element, apparently due to some poison operating in the blood). (*See* GERM THEORY OF DISEASE.) These primary or specific fevers may be classified as follows: —

1. **Continued fever**, in which there is no intermission of the febrile symptoms till the crisis is reached. Simple fever, or febricula, typhus, typhoid (enteric or gastric) fever are examples. *Relapsing fever* also comes under this head; its chief feature is the recurrence of fever about a week after the subsidence of the symptoms.

2. **Intermittent fever or ague**, in which there is a periodic cessation of the symptoms. The varieties are the *quotidian*, occurring every day; the *tertian*, recurring in forty-eight hours; *quartan*, recurring in seventy-two hours or every three days.

3. **Remittent fever**, in which there is a short daily diminution of the symptoms. The condition known as hectic fever and yellow fever belong to this class.

4. **Eruptive fevers** (1) smallpox; (2) cow-pox; (3) chicken-pox; (4) measles; (5) scarlet fever; (6) erysipelas; (7) plague; (8) dengue fever. *See* the separate articles.

FE'VERFEW (*Pyrethrum Parthenium* or *Matricaria Parthenium*), a British composite biennial, frequent in waste places and near hedges. It has a tapering root, an erect, branching stem about 2 feet high, and stalked compound leaves of a hoary green colour, and ovate cut leaflets. The plant possesses tonic and bitter qualities, and was supposed to be a valuable febrifuge, whence its name.

FEZ, town of French Morocco, 160 miles east of the Atlantic and 85 miles south of the Mediterranean. It is finely situated on the hilly slopes of a valley, on the River Fez, which divides Old Fez from New Fez. Both parts are surrounded by walls now in very bad repair. The streets are narrow, dark, and extremely dirty; the houses two or three stories high, and without windows to the street. The interiors, however, are often handsome, the courtyards being paved and provided with fountains. There are many mosques, one of them the largest in North Africa. The Sultan's palace is a large but somewhat dilapidated structure.

Fez is a place of considerable commercial importance, being the depot for the caravan trade from the south and east and having extensive dealings with Europe. The manufactures consist of woollen cloaks, silk handkerchiefs, leather, the red caps named *fezes*, carpets and pottery. Fez was at one time famous as a seat of Arabian learning. It is considered a holy town by the Western Arabs, and was resorted to by them as a place of pilgrimage when the way to Mecca was obstructed. Founded in 793, Fez was the capital of an independent state from 1202 to 1548, attaining a high state of prosperity. The population in 1931 was 107,843.

FEZ (from *Fez*, the above town), a red cap of fine cloth, with a tassel of blue silk or wool on the crown, much worn in Turkey, on the shores of the Levant, in Egypt, and North Africa generally. The core or central part of a turban usually consists of a fez. The fez is also called *tarbûsh* in Africa.

FEZZAN', in the Sahara, formerly a lieutenant-governorship of Tripoli, and thus dependent on Turkey, it forms since 1912 a political division of the Italian province of Tripoli. It is surrounded by mountain chains, and consists of a great number of small oases. There are no rivers or brooks, and few natural springs; but water is found in abundance at various depths, generally from 10 to 20 feet. Rain seldom falls; in some districts it does not rain for years together, and but little at a time.

Wheat, barley, millet, figs, melons, and other fruits, tobacco, cotton, &c., are cultivated, but the chief wealth of the country is in its date-palms. With exception of goats and camels, and in some districts sheep and cattle, few domestic animals are reared. There are few manufactures, but there is a considerable caravan trade, Mourzuk, the capital, being the point of junction for caravans from Timbuctoo, Cairo, Tripoli, Sudan, &c. The natives are a mixed race of Arabs, Berbers, and negroes. Pop. estimated at 70,000.

FFESTINIOG, urban district and town of Merionethshire. It is 16 miles from Dolgelley and 223¼ from London, and is served by the G.W. Rly. It is famous for its slate quarries, the slate being taken by a narrow gauge railway to Portmadoc. The town stands amidst magnificent scenery, which attracts visitors. A noted beauty spot is the Cynfael Falls. Pop. (1931) 9,072, Blaenau Ffestiniog is 3 miles away.

FIACRE (fē-ā-kr), in France, a small four-wheeled carriage or hackney coach, so called from the Hotel St. *Fiacre*, where Sauvage, the inventor of these carriages, established in 1640 an office for the hire of them.

FIARS PRICES, or **FIARS** (fē'ārz), in Scotland, the prices of grain for the current year in the different counties, fixed (in accordance with the Act of Sederunt, 1723) by the sheriffs with the assistance of juries, and accepted in certain contracts or agreements where no price has been fixed otherwise.

FI'AT (Lat., 'let it be done'), in English law, a short order or warrant from a judge for making out and allowing certain processes.

FIBRES, in botany, the principal strengthening tissues of plants, usually consisting of very long, thick-walled cells with pointed, interlocking ends. Many, such as flax, hemp, jute, ramie, coir, and esparto, are used in the arts for spinning, or for making mats, brushes, paper, &c. Cotton, consisting of the seed-hairs of the cotton plant, is not a fibre in the botanical sense.

FIBRES USED IN MANUFACTURE. The particular classification of fibres depends partly upon the source from which they are obtained, and partly upon the use to which the fibres are to be put. In the former case the first division is that which separates the animal fibres from the vegetable fibres, and each of these general groups is capable of extensive subdivision. The mineral fibres would also form a class, although a small one, in this division. In the second case, the division is considered from the point of view of the application of the fibres to wholly or partly manufactured products.

Most animal and vegetable fibres, including all those of finer quality, are utilized for one or other of the textile industries, while the brushmaking industry, which also absorbs a considerable amount of the coarser types of animal and vegetable fibres, as well as some of the finest hairs, is capable of subdivision according to the particular operations involved.

With perhaps the exception of natural silk, which is due to the coagulation of a viscous liquid as the latter emerges into the air from the orifices of the caterpillar, all the animal fibres formed originally the outer covering of the skins of various animals.

There is a great variety of wools, from the softest fleece obtained from lambs and from sheep raised on rich soil, to the hard stiff hairs with which deer and similar animals are covered. From the various kinds of sheep alone is derived a very extensive range of wools; indeed, several qualities are obtained from the fleece of every individual sheep, such qualities being sorted out by the wool-sorter and de-

pending chiefly upon the part of the fleece from which the wool is clipped.

Considered from the point of view of the fleece, there are the Australian, New Zealand, African, and American wools, each country of which provides many varieties; there are, in addition, numerous European wools, while in Great Britain alone there are varieties which include many types, from the fine valuable South Down wool to the long fibres obtained from the Leicester fleeces, and the useful wools from the highland and mountain sheep.

All typical wools have a natural curl or twist, but when the fibre is straight, it is termed a hair. In this latter category one may include the outer covering of the Angora and other goats, which provide us with Mohair, Alpaca, and Cashmere, and finally the camel, cattle, and calves yield valuable hairs for the manufacture of various textile products.

There is quite as much diversity, if not more, in connection with vegetable fibres, which are obtained from three distinct sources: (*a*) the pod or boll, (*b*) the stem or stalk, and (*c*) the leaf. The bolls yield the short fibres of which cotton is the prototype; the second supplies us with the long soft fibres, or bast fibres, such as flax, hemp, jute, and ramie; while the long hard fibres, e.g. manila, sisal, phormium, are obtained from leaves.

Cotton fibres are really seed hairs, and they vary in length from about 1 inch to 1¾ inches, while the finest kinds reach 2 inches and a little over. These, as indicated, are obtained from the seed-bolls. Cotton fibres resemble closely a tube flattened centrally in the longitudinal direction, and they have a natural twist which facilitates the spinning process and imparts a valuable resiliency to the finished yarns.

The finest and longest fibres are Sea Island and Egyptian, but the great bulk of cotton is grown in the southern states of North America—Georgia, Florida, Texas, Louisiana, and several other states. A considerable quantity of cotton is grown in India, while Central Asia, Africa, and South America help to swell the total crop.

The most valuable long soft vegetable fibres are obtained from the fibrous layer of the flax plant. The stems or stalks are first pulled, then retted, and afterwards dried and broken in order to obtain the bast layer. Then follows the scutching operation, after which the fibre is ready for the first operation in the preparing department of a flax-spinning mill. The length of the flax fibre may be anything from about 2 feet to 3 or 4 feet. In normal times Russia grew and exported by far the largest quantity of flax in the world, and although the quality was very good, it was inferior to that obtained from plants grown and retted in Belgium, Holland, and Ireland.

Italian hemp closely resembles the lower grades of flax in fineness, but it is usually much longer, coarser, and stronger than most kinds of flax. Russian hemp is about the same length as flax, and is a valuable fibre for several textile products. Jute, which is also a bast fibre, is coarser still, and grows to a height of 10 to 12 feet and even more. It is a valuable fibre for use in the manufacture of all kinds of fabrics to be used for covering and carrying merchandise; it is also largely used for the foundation of linoleum, and for the manufacture of coal-bags and the like.

Artificial silk, or rayon, is a fibre artificially produced from wood pulp and other vegetable substances, and is of great importance industrially. (*See* SILK, ARTIFICIAL.)

Ramie, also called rhea and China grass, is a strong fibre, but rather brittle after it has been made up into yarns for textile purposes. It is whitish in colour, is dyed easily, but often deteriorates in use; it is also hairy, and possesses a good lustre. The chief difficulty in regard to this fibre appears to be that of decortication. One of its chief applications is in the manufacture of gas-mantles, although several kinds of fabrics have been made from yarns spun from this fibre.

The hard vegetable fibres, which are usually very long, are obtained from the large leaves of the agave, musa, and other tropical plants, and occasionally from plants grown in semi-tropical areas. The chief use for these fibres is in the manufacture of ropes and cordage generally. It must be understood, however, that cotton, hemp, and flax, especially the two former, are used extensively for cordage purposes as well as for the usual fine weaving yarns. On the other hand, the hard vegetable fibres are unsuitable for being introduced into fine yarns—indeed they cannot be used for this purpose—but they are admirable for the spinning of binder twine and similar coarse yarns.

The best known long hard vegetable fibres are Manila, sisal, New Zealand flax or hemp (phormium), Mauritius, and bow-string hemps; the last three are leaf fibres, and must not be confused with the real hemps obtained from the bast layers of stems or stalks such as Italian hemp, Russian hemp, Indian hemp, and Sunn hemp. The leaves in which the hard vegetable fibres are embedded have to be scraped, either by hand or by semi-mechanical or mechanical means, to remove the vegetable matter from the fibrous

layer. The weight of fibre removed equals only about 5 per cent of the total weight of the leaves, and hence there is a considerable number of leaves to be treated for every ton of extracted fibre.

Although Manila and sisal fibres are excellent for the rope and coarse twine-making industry, they are not used in the manufacture of textile fabrics; on the other hand, the better class of phormium (New Zealand hemp) is occasionally prepared and spun into heavy yarns, and subsequently woven into comparatively coarse fabrics resembling the coarse linens made from the lower qualities of flax fibre yarns.

There are several varieties of hard vegetable fibres which are somewhat similar in staple to the above-mentioned chief types, and which are used, either alone or mixed with other varieties, in the cordage industry. The fibre known as coir, obtained from the husks or outer covering of coco-nuts, is used in the making of coarse mats and carpetings, while nettle fibre, which came into more or less prominence during the European War, and particularly in Germany, has been utilized, but is comparatively weak.

The successful prosecution of the fibre trade depends partly upon the facilities for growing the plants, but perhaps more on the treatment which is necessary to extract the fibre from its natural covering, while preserving the innate constituents which facilitate the subsequent processes of preparing, spinning and weaving.

In addition to the valuable animal and vegetable fibres, there are mineral fibres, the best known of which is asbestos. In its natural state, the fibre is closely associated with a rock-like substance, and special treatment is necessary to separate the hard substances from the fibre in order to make the latter suitable for conversion into yarns, and ultimately into cloth, which serves its own particular purposes in the textile world.—BIBLIOGRAPHY: F. H. Bowman, *The Structure of the Wool Fibre*; *The Structure of Cotton Fibre*; W. I. Hannam, *The Textile Fibres of Commerce*; J. Jackson, *Commercial Botany*.

FIBRIN, a peculiar organic compound substance found in animals and vegetables. Animal fibrin constitutes the solid matter which deposits when blood coagulates, but it is also furnished by the chyle, lymph, saliva, and by pus and other pathological fluids. Fibrin is composed of carbon, nitrogen, hydrogen, and oxygen, and is closely allied to albumen and caseine. It is a very important element of nutrition.

In healthy venous blood there is about 2·3 per cent, but its percentage is slightly more in arterial blood. It is best obtained by switching newly drawn blood with a glass rod or bundle of twigs, when the fibrin adheres to the rod or twigs in threads, and is purified from colouring matter by prolonged washing and kneading with water, and then by treatment with alcohol and ether to remove fat and other substances.

FIBROUS TISSUE, an animal tissue with a shining silvery lustre, used to connect or support other parts. It is of two kinds, white and yellow (elastic). It forms the ligaments, tendons of muscles, &c.

FIBULA, brooch or buckle, especially one dating from the early metal ages. Neolithic bone pins were later reproduced in bronze: by looping one end and bending the other until the point reached the loop, safety pins arose. The Hallstatt period developed bold decorative forms, succeeded by a series of La Tène designs, which are invaluable for dating antiquities of the iron age.

The slender bone on the outside of the leg is called the fibula. It is bound by ligaments to the tibia or inner bone, its lower end forming a bony knob outside the ankle.

FICHTE (fĭk'tĕ), **Johann Gottlieb**, German philosopher, born of poor parents in 1762, died 27th Jan., 1814. After studying at Jena, Leipzig, and Wittenberg, he passed several years as a private tutor in Switzerland and in Prussia Proper, and in Königsberg made the acquaintance of Kant, who showed some appreciation of his talents. His *Versuch einer Kritik aller Offenbarung* (Essay towards a Criticism of all Revelation, 1792) attracted general attention, and procured him the professorship of philosophy in Jena in 1793.

In 1800 he was one of the most prominent professors of that university during its most brilliant period. Here he published, under the name of *Wissenschaftslehre* (Theory of Science), a philosophical system, which, though founded on Kant's system, gives the latter a highly idealistic development which was strongly repudiated by the Königsberg philosopher. On account of an article he had written to the *Philosophical Journal* (on the grounds of our belief in the divine government of the world), he fell under the suspicion of atheistical views. This gave rise to an inquiry, which ended in Fichte losing his chair. He then went to Prussia, where he was appointed in 1805 professor of philosophy at Erlangen.

During the war between Prussia and France he went to Königsberg,

where he delivered lectures for a short time, returned to Berlin after the Peace of Tilsit, and in 1810, on the establishment of the university in that city, was appointed rector and professor of philosophy. Fichte's philosophy, though there are two distinct periods to be distinguished in it, is a consistent idealism, representing all that the individual perceives as distinct from himself, the *ego*, as a creation of this *I* or *ego*. This *ego*, however, is not the consciousness of the individual so much as the divine or universal consciousness of which the other is but a part. His philosophy thus came to assume a strongly moral and religious character. Amongst his best-known works, besides those already mentioned, are: *System der Sittenlehre* (Systematic Ethics), *Die Bestimmung des Menschen* (The Destination of Man), *Das Wesen des Gelehrten* (The Nature of the Scholar), *Grundzüge des Gegenwärtigen Zeitalters* (Characteristics of the Present Age), *Reden an die Deutsche Nation* (Addresses to the German Nation).—BIBLIOGRAPHY: R. Adamson, *Fichte*; C. C. Everett, *Fichte's Science of Knowledge*.

FICHTELGEBIRGE (fih'tĕl-ge-birge), a mountain range of Germany, in Bavaria; chief summit, Schneeberg, 3,448 feet.

FICINO (fi-chē'nō), Marsilio, an Italian philosopher of the Platonic school, born at Florence in 1433, died in 1499. His early display of talent attracted the notice of Cosmo de' Medici, who caused him to be instructed in the ancient languages and philosophy, and employed him to aid in establishing a Platonic Academy at Florence (about 1460).

FICKSBURG, a town of the Orange Free State, South Africa, 120 miles east of Bloemfontein. It has a large trade. Population 3,322 (of whom about 2,481 are white).

FICTION, in law, is an assumption made for the purposes of justice, though the fact assumed could not be proved, and may be literally untrue. Thus an heir is held to be the same person as the ancestor to the effect of making the heir liable for the debts of the ancestor. The rules by which the existence of legal fictions are limited have been stated as follows: (1) The fiction must have the semblance of truth. (2) It shall not be used to work a wrong. (3) It shall only be employed for the end for which it was introduced.

FIDDLE-WOOD, the common name of Citharoxylon, a genus of trees or shrubs with some twenty species, natives of tropical America, nat. ord. Verbenaceæ. Some of the species are ornamental timber trees; several yield a hard wood valuable for carpentry.

FIEF, name given to a landed estate in feudal times. It was land which was held on condition that the holder rendered certain services, usually in time of war, to his overlord. The word fee comes from it, as does the Scottish feu.

FIELD, in heraldry, the whole surface of the shield on which the charges are depicted, or of each separate coat when the shield contains quarterings.

FIELD, Cyrus West, an American merchant, born 1819, died in 1892. Having obtained a charter giving him exclusive right for fifty years of landing ocean telegraphs on the coast of Newfoundland, he organized an Atlantic telegraph company.

Attempts to lay cables were made in 1857 and 1858, but without permanent success, and the American War having broken out, it was not till 1866 that a cable was successfully laid by the *Great Eastern*. Field subsequently took an active part in establishing telegraphic communication with the West Indies, South America, and other places, and was connected with various important enterprises.

FIELD-ALLOWANCE, an extra payment made to officers of the British army on active service in the field, to compensate partly the enhanced price of all necessaries. These allowances are not made in India.

FIELD-CRICKET, *Gryllus campestris*, one of the most noisy of all the crickets, larger, but rarer, than the house-cricket. It frequents hot, sandy districts, in which it burrows to the depth of 6 to 12 inches, and sits at the mouth of the hole watching for its prey, which consists of insects.

FIELD ENGINEERING is the adaptation of engineering principles to certain of the requirements of an army in the field, viz.: (1) field fortification; (2) bridging; (3) road and rail communications; (4) demolitions; (5) camping arrangements.

Field Fortification. It is no longer possible, as it was before the European War, to draw a hard-and-fast distinction between field fortification and permanent fortification. On the one hand, the extensive use of such materials as steel and reinforced concrete has given a semi-permanent character to many field works; on the other hand, the power and accuracy of artillery-fire make it a comparatively easy matter to destroy, from a safe distance, a work of restricted extent and known position, no matter how strongly it may be constructed.

Entrenchments (q.v.) form the most important feature of the science of field fortification. Obstacles, concealment, and protection from shellfire are the other aspects of this subject.

Obstacles serve a twofold purpose. They enable the defence to exercise a definite (though limited) control over the movements of enemy troops advancing to the attack; and they facilitate the infliction of casualties by delaying the attackers at points swept by short-range fire. An obstacle is of little value unless fire can be directed at every part of it—especially the front edge For this reason the siting of machine-guns practically determines the siting of obstacles.

The function of an obstacle is to entangle and detain the attacker, whilst furnishing him with no cover, either from view or from fire. Barbed wire, being easily transported, quickly erected, and not readily discernible, is the material almost universally employed. When secured to pickets driven into the ground, it always has some value, even after severe bombardment.

The trace of an obstacle should not be parallel to the trenches, but arranged in bold zigzags. By this means the defence is enabled to sweep the front of the obstacle with fire; wire-cutting by the hostile artillery is made more difficult; and the enemy's attack formations are disorganized at the most critical moment.

Concealment may be achieved either by screening an object from view or by camouflage. Screening, being obvious to the enemy, is only effective when the track, trench, or position so concealed is of large extent, or is in periodic, rather than continuous, usage —provided always that the screen can be maintained in good repair. The tactical value of screening is proportionate to the extent to which the enemy's fire is thereby converted from aimed fire to unaimed fire.

Camouflage aims at concealing from the enemy the fact that an attractive target lies within his field of vision. A successfully camouflaged object will, from the enemy's point of view, either present the semblance of some innocent and familiar feature of the landscape, or will be indistinguishable from its surroundings.

Protection from shell-fire is provided in varying degrees. Splinter-proof shelters carry some two-feet thickness of earth overhead, and accommodate about six men apiece, giving them complete protection from shrapnel, but no protection against a direct hit by even a small shell. Twenty-feet thickness of earth is required to make a shelter proof against a direct hit. The labour involved limits the scale on which such accommodation can be provided.

Bridging. Most military bridges are built either to replace ones which have been destroyed, or to supplement existing bridges, so as to enable the roads to carry the increased military traffic. A comparatively small proportion are built, under fire, by an army engaged in forcing a crossing. For this latter purpose a light type of bridge is used, designed to carry infantry, cavalry, and field artillery; very light foot-bridges, for infantry only, are often made in the first instance. Medium and heavy bridges are designed to carry lorries, motor-buses, and heavy artillery; they require more deliberate construction, which cannot be done under close fire. Heavier types still are needed for large tanks and railways

The mobile (pontoon) bridging equipment of an army is intended, primarily, for light tactical bridges, but can also be used for medium and heavy types. A few steel bridges, especially designed for speedy erection and lightness of individual parts, are usually held in reserve for emergency use as medium and heavy bridges.

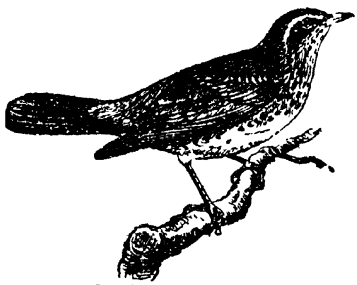
Siting of light bridges is determined by tactical considerations; that of heavier types by the requirements of traffic control. All military bridges are constructed, in the first instance, for single traffic; arrangements for traffic control are therefore necessary as soon as any bridge is completed. The approaches need careful preparation, to obviate any crowding on the bridge; they should be level for at least three yards, and well metalled or timbered. There are three kinds of bridges: (1) single-span; (2) those with floating intermediate piers of pontoons, boats, &c.; (3) those with fixed intermediate piers of trestles, piles, &c. The last two kinds are often combined.

The roadway consists of decking, carried on road-bearers, which rest on transoms (the top beams of the piers). The decking is held down at its edges by ribands, which also serve as wheel-guides. Hand-rails are always provided; screens also are necessary if the bridge crosses running water or a deep gap, and is to be used by transport animals. A plank, 2 inches thick, suffices to carry infantry across a gap of 8 feet; beyond this width intermediate supports are needed.

Floating bridges furnish the best means of getting troops across gaps more than 14 feet wide. Rafts are useful when the material available is insufficient to form a bridge. Fixed piers are generally timber trestles or cribs. The transom of a trestle is supported on timber uprights cross-

braced to one another; each trestle must also be cross-braced to the adjacent trestles. A crib-pier is a four-square stack of logs, built up after the fashion of a log-hut. It is easily made and needs no cross-bracing, but it requires an excessive amount of timber.

Road and Rail Communications. Existing railways and roads in a theatre of war are subjected to a vastly heavier traffic than that for which they were designed. Repairs become incessant and add to the congestion. New railway and road construction must usually be undertaken, but is slow in coming to fruition. Tramways and cross-country tracks are more quickly made, and will carry much of the traffic. Cross-country tracks are made for men, for pack-transport, and for horsed transport. Infantry tracks usually consist of the



Fieldfare (*Turdus pilaris*)

wooden gratings known as trench-boards, laid on small sleepers to form a pathway 3 feet wide. Mule tracks are made 5 feet wide on an earth formation. They must be sited well away from the infantry tracks, or the temptation to lead mules along the latter will be irresistible. Earthen tracks, 18 feet wide, are marked out for horsed transport on the best ground available; they can only be used in fine weather.

Demolitions.—Demolitions suggest explosives. These, indeed, furnish the best means of attacking roads and railways, but there are many other ways of destroying material which is in danger of falling into the hands of the enemy. Forage, &c., can be burnt; certain stores can be made useless by the application of water; machinery can be broken up with hammers, or rendered ineffective by the removal of important parts. Roads and railways are best attacked at bridges, causeways, tunnels, crossings, cuttings, and embankments. The easiest way of disabling rolling-stock is to remove or destroy the whole supply of one article which is essential to the working of the railway.

Effective damage to the permanent way can only be achieved at great expense of time and labour. Explosives must be placed in close contact with the object to be destroyed, and may be fired either electrically or by time-fuse. Tamping the charges by packing earth closely around them greatly increases the explosive effect. High explosives, like dynamite and T.N.T., have a shattering effect; low explosives, like gunpowder and cordite, have a lifting or propelling effect.

Camping Arrangements. Dry, grassy slopes furnish the best sites for encampments, but water-supply and tactical considerations usually determine the choice of site. Men and animals need protection, not only from the weather, but also from bombing aeroplanes. The latter form of protection is provided by low traverses or parapets, designed to limit the horizontal travel of bomb splinters. Water is derived from streams, wells, and ponds. The best supply is reserved for drinking and cooking purposes; watering of animals has the next claim; a supply for washing purposes has also to be found.

Drinking-water is purified by the addition of a small quantity of chloride of lime. A field kitchen is quickly made by scooping out a narrow trench and lighting a fire in it. The food is cooked in mess-tins, laid in a row on top of the trench. Sanitary measures are necessary to protect the water-supply and to prevent contamination of food by flies.

FIELDFARE, a bird of the thrush genus (*Turdus pilaris*), about 10 inches in length, the head ash-coloured, the back of a deep chestnut, and the tail black. They pass the summer in the northern parts of Europe and Asia, but visit Britain in the winter.

FIELD-GLASS, a short double telescope of which the two parts are the same in construction, and are placed parallel to each other so that the axes of the eye-lenses are at the same distance apart as the pupils of the observer's eyes. In the Galilean type of field-glass, the objectives are convex and the eyepieces concave lenses, and the distance between these in either tube is, when least, equal to the difference of their focal lengths; this accounts for the shortness of the instrument. In a telescope with a convex eyepiece, the minimum lens distance is the sum of the focal lengths. By the use of 90° prisms, however, employing double-internal reflection, the rays which enter the objective traverse the tube three times before issuing through the eyelens. This has the effect of shortening the instrument. Also the prisms cause a

double-lateral inversion, which produces an erect imago. The prismatic field-glass does not give such a bright image as the Galilean, partly on account of the loss of light by reflection at the glass surfaces, and partly because of the greater magnification employed.

FIELDING, Anthony Vandyke Copley, English painter in water-colours, born about 1787, died in 1855. He early attracted attention by his water-colour landscapes, and for fourteen years before his death was president of the Society of Painters in Water-colours. His pictures are chiefly taken from English scenery, the various features of which, both in rich woodland and open plain, he has represented with great delicacy and truth, although afterwards falling into mannerism and self-repetition. His oil-painting was not a success.

FIELDING, Henry, first in time and importance of British novelists, was born at Sharpham Park, near Glastonbury, in Somerset, on the 22nd April, 1707. His father was Edmund Fielding, afterwards a major-general, who belonged to a younger branch of the family of the Earl of Denbigh. He was educated at Eton, where he remained possibly until 1725. In that year he had a precocious love-affair with Miss Sarah Andrew of Lyme Regis; this lady married a Mr. Rhodes in the following year, and Fielding soothed his wounded feelings by translating parts of the Sixth Satire of Juvenal (The Legend of Bad Women).

Fielding began his literary career by writing a large number of farces, comedies, and burlesques. This work he frankly regarded as hack-work, and while almost all his plays have good passages in them, none are of great importance in comparison with his novels. His first comedy, *Love in Several Masques*, was produced at Drury Lane 12th Feb., 1728. Fielding then went to the University of Leyden where he was admitted 16th March, 1728, and where he remained until about Feb., 1730.

In 1730 one of his most successful burlesques, *Tom Thumb*, was produced at the Haymarket. A revised and enlarged version of it was brought out the next year, under the name of *The Tragedy of Tragedies*. Fielding based several of his plays on Molière —*The Mock Doctor* (1732) on *Le Médicin malgré lui*, and *The Miser* on *L'Avare*. In 1734 he produced *Don Quixote in England* at the Haymarket—a work unimportant in itself, but showing Fielding's keen appreciation of Cervantes.

On 28th Nov., 1734, he married Miss Charlotte Cradock of Salisbury, who was the original of Sophia Western in *Tom Jones*, and of the heroine in *Amelia*. For a while he seems to have lived beyond his means at East Stour, in Dorsetshire, but soon returned to his business of playwright. *Pasquin* (1736) and *The Historical Register* (1737) were two most successful burlesques which turned the ministry into ridicule. So successful were these pieces that the ministry hastened to pass a Licensing Act which effectually muzzled Fielding. He entered the Middle Temple on 1st Nov., 1737, and was called to the Bar in June, 1740.



Henry Fielding

We can infer that he was a diligent student of law, and was determined to succeed in his profession.

In 1740 Samuel Richardson published his novel *Pamela*. Fielding saw that it would be amusing to burlesque this novel by writing in a similar manner about a hero instead of about a heroine, and so ridicule Richardson's somewhat namby-pamby morality. It is possible that Fielding may have got a hint for the idea of his virtuous male from Aristophanes' *Plutus*, line 1,091. Fielding collaborated with Rev. William Young, the original of Parson Adams, in translating the *Plutus* (published June, 1742). At any rate *The History of the Adventures of Mr. Joseph Andrews, and of his friend Mr. Abraham Adams* appeared in Feb., 1742.

It ran far beyond its original design of being a burlesque, and became a novel of life and manners. Some of its characters, Mrs. Slipslop, Parson

Trulliber, and above all Parson Adams, are among the greatest characters in fiction. Joseph Andrews (who was named after the Biblical Joseph) and Fanny get pushed into the background to make way for characters of less importance to the plot. In *Joseph Andrews* Fielding was still feeling his way as a novelist, but it has an inimitable freshness and charm.

In 1743 Fielding published a volume of *Miscellanies*. This contained the Lucianic *Journey from this World to the Next*, and the much more memorable *History of the Life of the Late Mr. Jonathan Wild the Great*. The latter is probably the greatest piece of sustained irony in English literature, greater even than anything in Swift. It has always been caviare to the general, as irony in large doses does not entertain the majority of mankind. Fielding's wife died in 1743, and he married in 1747 one Mary Daniel, reputed to have been his first wife's maid. She made him a good wife. In 1748 he was appointed Justice of the Peace for the County of Middlesex, and for the City and Liberty of Westminster.

Fielding's career up to this point had fitted him to become a great novelist. He had lived a full life, and had seen the world from many different angles. He had been educated abroad, he had done useful journeyman work as a playwright, he had lived as a country squire, and he had become a lawyer. Also he had made himself familiar with the ancient and modern classics, and he admired what was best among them, Aristophanes, Lucian, Shakespeare, Molière, Cervantes, and Le Sage.

In 1749 (28th Feb.) he produced his masterpiece, *Tom Jones*. To praise this, "the labour of some years" as he called it, is superfluous. Coleridge said that it had one of the three best plots in the world; and Byron called its author "the prose Homer of human nature." It is, indeed, a vast sort of comic prose epic, varied as life itself is varied. The introductory chapters in particular are models of good style and good sense.

The third and last of the three great novels, *Amelia*, was published in Dec., 1751. It has a mellowness that is all its own, but it is hardly as good as *Tom Jones*. Even the mind of such a man as Fielding could only yield one such harvest. *Amelia*, however, is extremely good, and would probably be rated higher were it not overshadowed by its greater predecessor. Fielding did not write much more, save a few pamphlets mostly on economic or legal subjects. In one of them he defended the notorious Elizabeth Canning. His health began gradually to break up. In June, 1754, he left England and went to Lisbon to try to recover his health, but he did not succeed in so doing, and died 8th Oct., 1754. He was buried in the English cemetery at Lisbon, where a tomb was erected in 1830.

The Journal of a Voyage to Lisbon was posthumously published. It is a charming account of his last voyage, where we can see the indomitable pluck of the man who was dying when he left England, and who was always courteous and considerate of others.

Henry Fielding is not only witty in himself, but the cause that wit is in other men. His novels have been used as models by almost all the most distinguished of his successors. No one, however, has beaten him at his own game, although those who have loved him most have been most successful as novelists. In many respects he stands nearest to Shakespeare among English authors. Shakespeare, however, was not of an age, but for all time, while Fielding is more limited in his scope.

Fielding is a typical Englishman; he is English as good ale and roast-beef and fox-hunting are English. But in his breadth of view, in his kindly tolerance, and in his unfailing sympathy for human frailty he is Shakespearean. His novels have had a healthy influence on all subsequent fiction. His tolerance and his broad open-air humour are a sure cure for a mind diseased by the psycho-analytic and morbid fiction of a more recent period.

—BIBLIOGRAPHY: Austin Dobson, *Fielding* (English Men of Letters Series); G. M. Godden, *Henry Fielding: a Memoir*; W. L. Cross, *The History of Henry Fielding*; Sir Walter Raleigh, *The English Novel*; W. M. Thackeray, *The English Humourists of the Eighteenth Century*; W. Hazlitt, *Lectures on the English Comic Writers*: Sir L. Stephen, article *Fielding* in *Dictionary of National Biography*.

FIELD-MARSHAL, the highest military dignity in Britain, Germany, France, and other countries. In Britain the dignity is conferred by selection and enjoyed by but a very few officers, and chiefly for distinguished services or on the ground of royal descent. It was introduced into Britain by George II in 1736. In 1921 the following personages bore the title of field-marshal in the Army List: the Duke of Connaught, Lord Grenfell, Lord Methuen, Earl French, Earl Haig, Sir C. C. Egerton, the Emperor of Japan, Marshal Foch, Lord Plumer, Viscount Allenby, Sir H. H. Wilson, and Sir W. R. Robertson. In France the analogous dignity of maréchal de France was abolished in 1888, but was

again revived during the European War, when General Joffre was created a maréchal de France, as also were Foch and Pétain.

FIELD-MOUSE, popular name of several rodents which are not house mice. They include the long-tailed *mus sylvaticus,* and various species of voles, especially the short-tailed and the red field mouse or bank-vole, all very destructive to British field and forest produce.

FIELD-OFFICERS, in the army, those competent to command whole battalions—majors, lieutenant-colonels, colonels, as distinguished from those entrusted with company duties, as captains and lieutenants.

FIELD OF THE CLOTH OF GOLD, a spot in the valley of Andren, between the English castle of Guisnes and the French castle of Ardres, celebrated for the meeting (7th June, 1520) between Henry VIII of England and Francis I of France, attended by the flower of nobility of both nations. The diplomatic results were little or nothing and the event is now memorable only as a grand historic parade.

FIERASFER, a genus of small eel-like shore fishes of warm seas, often living as commensals within holothurians, star-fishes, and bivalve molluscs.

FI'ERI FA'CIAS, a writ in English law for enforcing judgment against the goods of a debtor. The term is commonly contracted *Fi. Fa.*

FIERY CROSS, among the Scottish Highlanders, a cross of light wood, the extremities of which were set fire to and then extinguished in the blood of a goat, sent from place to place as a summons to arms. Also known as the *Crantara.*

FIESCHI (fi-es'kē), **Joseph Marco,** conspirator, born at Murato, in Corsica, in 1790. He served for some years in the French army, and in the Neapolitan army of Murat. Having returned to his native land, he was convicted of robbery and sentenced to ten years' imprisonment. After the revolution of 1830 he appeared in Paris, and by means of forged papers obtained a small pension and an appointment under the pretence that he had been a victim of the Restoration. Being afterwards deprived of his appointment, he resolved to avenge the slight by assassinating Louis-Philippe, which he attempted by an 'infernal machine' on 28th July, 1835. The king escaped with a slight scratch, although a number of persons around him were killed. Fieschi was guillotined 19th Feb., 1836, along with two of his accomplices.

FIESOLE (fi-es'o-lā; anciently **FÆSULÆ),** a small town of Italy, 3 miles north-east of Florence, on the top of a steep hill. It has a cathedral and is the seat of a bishop. Anciently it was an important Etruscan city, and still has some Etruscan remains. Pop. of commune, 10,000.

FIESOLE, Fra Giovanni da. *See* FRA ANGELICO.

FIFE, a small instrument of the flute kind, pierced with six finger-holes, and usually having one key. Its ordinary compass is two octaves from D on the fourth line of the treble staff upwards.

FIFE, or **FIFESHIRE,** a maritime county, Scotland, forming the peninsula between the Firths of Forth and Tay; extreme length, 43 miles; extreme breadth, 17 miles; area, 322,844 acres. The surface is pleasantly undulating. The principal elevations are the Lomond Hills, whose highest summit is 1,720 feet above sea-level. The principal valley, called Strath Eden or the 'Howe (hollow) of Fife,' watered by the Eden, is very fertile, highly cultivated, and thickly studded with beautiful mansions and villas.

Very fertile also is the district lying along the shores of the Firth of Forth, and remarkable for the number of towns and villages with which it is lined. But the north-eastern part, between St. Andrews and the Tay, which is mostly a wet clayey soil, and the north-western part, mostly rock and moor, are in general cold and poor.

Fife is the second largest coal-producing county in Scotland. Iron, limestone, and freestone abound. The chief manufacture is linen, especially damasks, diapers, &c., principally at Dunfermline; floorcloth is largely made, more especially at Kirkcaldy. There are salmon and other fisheries. The principal towns are Kirkcaldy, Dunfermline, and St. Andrews; Cupar is the county town. Fife returns two members to the House of Commons, being divided into an eastern and a western division. Pop. (1931), 276,261.

FIFE, Duke of, British title held by the family of Duff. In 1735 William Duff, who had large estates in Banffshire and Aberdeenshire, was created an Irish baron, and in 1759 Earl Fife and Viscount Macduff. James, the 5th earl, was created a British peer in 1857 as Baron Skene. He died in 1879 and was succeeded by his son, Alexander William George, who, on his marriage in 1889, to Louise, eldest daughter of the Prince of Wales, was created Duke of Fife. On his death, 29th Jan., 1912, his Irish title, that of Earl Fife, became extinct, but the British dukedom and earldom, under the special remainder, passed to his elder daughter, Princess Alexandra.

who became Duchess of Fife. She was born 17th May, 1891, and in Oct. 1913, married her cousin, Prince Arthur of Connaught. Their son, the heir to the title, is known as the Earl



Fruiting Branch of Fig

of Macduff. The Princess Royal, wife of the duke, died 4th Jan., 1931

FIFE NESS, the eastern extremity of Fife, about 2 miles from Crail. Near it is a dangerous ridge of rocks known as the Carr Rocks, on which a beacon has been erected.

FIFTH, in music, an interval consisting of three tones and a semitone. Except the octave it is the most perfect of concords. Its ratio is 3 : 2. It is called the fifth, as it comes, by diatonic ascent, in the fifth place from the fundamental or tonic.

FIFTH-MONARCHY MEN, a sect of politico-religious enthusiasts who during the Protectorate of Cromwell assumed to be "subjects only of King Jesus." They considered the revolution as the introduction to the *fifth* great monarchy which was to succeed to the four great kingdoms of Antichrist mentioned by Daniel (the Assyrian, the Persian, the Grecian, and the Roman), and during which Christ was to reign on earth 1,000 years.

FIG (*Ficus Carica*), a deciduous tree belonging to the ord. Moraceæ (mulberries). It is indigenous to Asia Minor, but has been naturalized in all the countries round the Mediterranean. It grows from 15 to 20 or even 30 feet high. In congenial climates it bears two crops in a season, one in the early summer from the buds of the last year; the other (which is the chief harvest) in the autumn, from those on the spring growth. The fruit is a hollow receptacle produced in the axils of the leaves on small round peduncles, and containing a great multitude of minute flowers, the ripe carpels of which are embedded in the pulp. The flowers are male and female, the former situated near the orifice at the top, the latter in that part of the concavity next the stalk. Figs, particularly dried figs, form an important article of food in the countries of the Levant. The best come from Turkey.

FIG'ARO, a dramatic character first introduced on the French stage by Beaumarchais in his comedies *The Barber of Seville* and *The Marriage of Figaro.* Figaro is a barber remarkable for his shrewdness and dexterity in intrigue. The plays were adapted for Mozart's *Marriage of Figaro* and Rossini's *Barber of Seville.* The name is also well known as that of the famous French journal, started in 1826, suspended in 1833, and revived in 1854.

FIGEAC (fē-zhȧk), a town of France, department of Lot, 32 miles E.N.E. of Cahors by rail. It is an ancient place, and consists chiefly of



Figaro

narrow crooked streets and antiquated houses with quaint Gothic fronts. Pop. 5,860.

FIGHTING-FISH, (*Betta pugnax*), a small spiny-finned fish, native to the south-east of Asia, and remarkable for its pugnacious propensities. In Siam these fishes are kept in glass globes, as we keep gold-fish, for the purpose

of fighting, and an extravagant amount of gambling takes place about the result of the fights. When the fish is quiet, its colours are dull; but when it is irritated, it glows with metallic splendour.

FIGHTING TOP, term applied to a structure of varied character built high up on the mast of a war vessel. In ancient times it served as a place for archers and later for riflemen. In modern vessels the fighting top is used as a station for officers in charge of the fire control.

FIGUERAS (fi-gā'rās), a town of Spain, in the province of and 21 miles N.N.E. of Gerona, near the French frontier, defended by a fortress reputed the strongest in Spain. Pop. 13,500.

FIGURATE NUMBERS, in mathematics, series of numbers used by actuaries in calculations of annuities in which the annual payment is variable. The first set is $1+1+1+1+\ldots$, the second $1+2+3+4+\ldots$, the third $1+3+6+10+\ldots$; and generally the nth set is the series of coefficients of the successive powers of x in the expansion of $(1-x)^{-n}$ by the Binomial Theorem, viz.

$$1 + n + \frac{n(n+1)}{1\cdot 2} + \frac{n(n+1)(n+2)}{1.2.3} + \ldots.$$

The nth number in any set is the sum of the first n terms of the preceding set, e.g. $10=1+2+3+4$. The nth number in any set is also equal to the sum of the number before it in its own set and of the nth number in the preceding set, e.g. $10=6+4$.

FIG-WORTS, the common name of Scrophularia, and sometimes also applied to the Scrophulariaceæ, a large nat. ord. of gamopetalous Dicotyledons, represented by the calceolaria, fox-glove, veronica, &c.

FIJI, or **VITI, ISLANDS,** an island group, South Pacific Ocean, east of the New Hebrides, between lat. 15° 30′ and 19° 30′ S.; and long. 177° E. and 178° W. The entire group, which was discovered by Tasman in 1643, comprises altogether about 250 islands and



A Fiji Village

islets, eighty of which are inhabited; total area, about 7,083 sq. miles. Two of the islands only are of large size, namely, Viti Levu, 90 miles long by 60 miles wide; and Vanua Levu, rather longer but much narrower and more irregular. Next to these come Taviuni and Kandavu.

The islands are of volcanic origin, extremely fertile, and covered with a luxuriant foliage, especially on the east side. The peaks are usually basaltic cones or needles, some of which rise to the height of several thousand feet. The coasts are almost surrounded with coral reefs, and where the shore is not precipitous the beach is formed of fine coral sand. The coco-nut palm grows along the sea-coasts; the bread-fruit, banana, and pandanus are abundant; the orange, taro, yams, sweet-potato, and since the commencement

of European settlements, maize, tobacco, and the sugar-cane are cultivated; timber trees, including the chestnut, are plentiful; sandal-wood is now scarce.

The birds are wild ducks, pigeons, the domestic fowl, parrots, and other tropical species. Except the stock introduced there are hardly any animals. Fish are plentiful. The natives enclose and cultivate their lands, the women performing most of the manual labour. The climate on the whole is healthy and agreeable for Europeans.

The Fijians are a dark-coloured, frizzly-haired, bearded race of Melanesian extraction, although intermixed with the Polynesians of Tonga and Samoa. They are cleanly in their habits, and are generally regarded as superior to the Polynesians in intelligence. Their early character, however, was bad. Cannibalism was reduced to a system, and wives, children and friends were often sacrificed to the fondness for human flesh. Cannibalism, however, is now abolished. This result has been due to the Christian missions, mostly Wesleyan, which have been very successful, most of the native population having become professed Christians.

From 1866 onwards the influx of European settlers from New Zealand and the Australian colonies gradually brought the trade of Fiji into importance, and repeated applications were made to the British Government both by the settlers and the king, Thakombau, to annex the islands. At length in 1874 this was done, and the Fiji Islands were made a Crown colony, under a Governor, assisted by an executive council consisting of the Colonial Secretary, the Attorney-General, and members nominated by the Governor. The Legislative Council, which is presided over by the Governor, consists of twelve nominated members, seven elected members, and two native members. Native chiefs take part in the administration, the old customary law being still largely adhered to.

Since the annexation the prosperity of the colony has been remarkable. The revenue in 1931 was £565,393: the imports and exports in 1930 were £904,311 and £997,106 respectively.

The chief article of export is sugar; the next is copra, the dried kernels of the coco-nut. The other important exports are cotton, molasses, and coffee. The demand for labour led to the introduction of some 17,000 coolies from India. In 1931 the population was 185,573, of whom 5,058 were Europeans. The capital is Suva, on the south coast of Viti Levu. The Island of Rotuma, to the north, was annexed to Fiji in 1881.—BIBLIOGRAPHY: Calvert and Williams, *Fiji and the Fijians*; B. Thomson, *The Fijians*; Waterhouse, *Fiji: its King and People*.

FILANGIERI (fi-lân-ji-ā'rē), **Gaetano,** Italian writer, born of a noble family in 1752, died in 1788. He studied law, and soon became distinguished in his profession by his learning and eloquence. His life was mainly devoted to a great work, *La Scienza della Legislazione* (The Science of Legislation), which was characterized by great fearlessness of speech in the advocacy of reforms, and was condemned by an ecclesiastical decree in 1784.

FILBERT, the fruit of a cultivated variety of *Corylus Avellana* or hazel. *See* HAZEL.

FILDES, Sir Luke, portrait and genre painter, was born in Liverpool in 1844, and received his artistic education at the South Kensington and Royal Academy Art Schools. His earliest productions were sketches in black-and-white for the *Graphic*, *Illustrated London News*, *Cornhill Magazine*, and other periodicals, and after being chosen to illustrate the last works of Dickens and Samuel Lover, he took to painting.

His first picture was *Nightfall* (1868), and since then he has exhibited: *The Loosened Team*; *The Empty Chair*; *Fair, Quiet, and Sweet Rest*; *Simpletons*; *Applicants for Admission to a Casual Ward*; *The Widower*; *The Return of the Penitent*; *The Village Wedding*; *Venetian Life*; *The Al-Fresco Toilette*; *The Doctor*; *Portraits of the Duke and Duchess of York* (for the *Graphic*, 1893); also state portraits of the King (1902), and of the Queen (1905). Several of his paintings, and in particular the famous *Casual Ward*, show powers of realism in painting not unlike those of Dickens in fiction; but his later works are more striking from their colour-effects. R.A. in 1879, a full Academician in 1887, he was created a K.C.V.O. in 1918. He died in 1927.

FILE, a bar of cast steel with small sharp-edged elevations on its surface called teeth, the use of which is to cut into or abrade metals, wood, ivory, horn, &c. Files are of various shapes, as flat, half-round, three-sided, square, or round, and are generally thickest in the middle, while their teeth are of various degrees of fineness and of different forms.

A file whose teeth are in parallel ridges only is called *single-cut* or *float-cut*. Such are mostly used for brass and copper. When there are two series of ridges crossing each other, the file is *double-cut*, which is the file best suited for iron and steel. *Rasps* are files

which have isolated sharp teeth separated by comparatively wide spaces, and are used chiefly for soft materials such as wood and horn. Each of these three classes of files is made in six different degrees of fineness, the coarsest being called *rough*, the next *middle*, followed by *bastard*, *second-cut*, *smooth*, and *superfine* or *dead-smooth*, each a degree finer than that which precedes it.

FILE-FISH, the name applied to species of Balistus, which is the type of a family (Balistidæ) including marine fishes living in warm and tropical seas. They may attain a length of 3 feet, and are invested in an armour of lozenge-shaped bony plates. By means of their strong front teeth they can break off pieces of coral and crush the shells of bivalve molluscs. The first dorsal spine is roughened in front like a file, and the second spine is attached to it in a way suggesting the alternative name of 'trigger fish.'

FILEY, a watering-place of England, on the coast of the East Riding of Yorkshire, 7½ miles S.E. of Scarborough. It has a fine old Norman and Early English church, which stands on an eminence. The sands are very firm and good, and there are several salt springs. Pop. (1931), 3730.

FIL'IBUSTERS, a name given to those adventurers, chiefly from the United States, who endeavoured to effect settlements on the Spanish islands and colonies in Central America. The term is probably derived from the Dutch *vrij buiter*, English *freebooter*, through the Spanish *filibustero*. Among the most noted of the filibusters was William Walker, who made three expeditions to Nicaragua (1855, 1857, 1860).

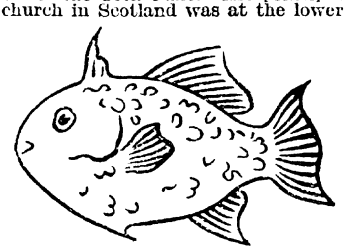
FILICAJA (fi-li-ka'yà), **Vincenzo da**, an Italian poet, born in 1642 at Florence of a noble family, died in 1707. The publication of his odes, sonnets, &c., in 1684 established Filicaja's fame as the first poet of his time in Italy. The Grand-Duke of Tuscany appointed him Governor of Volterra, and then of Pisa, in which posts he gained the esteem equally of people and sovereign. Among his most successful poems are the *Canzone to John Sobieski* on the occasion of the relief of Vienna from the Turks, and the celebrated sonnet on Italy, imitated by Byron in the 4th canto of *Childe Harold*, stanzas, 42, 43.

FILICALES, *See* FERNS.

FILIGREE', a kind of ornamental open work in gold or silver, wrought delicately in the manner of little threads or grains, or of both intermixed. The art was practised by the Etruscans and the Greeks of the Byzantine Empire. In the seventeenth century it was carried to great perfection in Italy, and silver filigree work is still largely manufactured in the south of Europe. Some of the Eastern nations, especially the Chinese and Malays, show great skill in the manufacture of silver filigree.

FILIPINOS, collective name for the Christianized natives of the Philippine Islands. Of Malay descent, they number 8,500,000; the remaining 3,500,000 inhabitants of the islands are largely Moslems and pagans. Before the American occupation, 1898, a Liga Filipina sought to improve their condition. *See* PHILIPPINE ISLANDS.

FILLAN, St., two saints of this name, who flourished in the seventh and eighth centuries, appear in the Church calendars.—(1) **St. Fillan**, or **Faolan**, the leper, whose annual festival is the 20th June. His principal church in Scotland was at the lower



File-Fish

end of Loch Earn, in Perthshire, where 'St. Fillan's Well' was long believed to have wonderful healing properties. —(2) **St. Fillan**, the abbot, the son of St. Kentigerna in Inchcailleach, in Loch Lomond, had his chief church also in Perthshire, in Strathfillan, the upper part of Glen Dochart. The silver head of this abbot's crozier, entrusted by King Robert Bruce to the Dewar family, is now in the Antiquarian Museum, Edinburgh.

FILLET, in architecture, a small moulding, generally rectangular in section, and having the appearance of a narrow band, generally used to separate ornaments and mouldings.

FILLMORE, Millard, thirteenth President of the United States, born 1800, died 1874. He began his political career in 1829; was member of Congress in 1832, and in 1848 became Vice-President of the United States. By the death of Zachary Taylor, Fillmore was raised to the office of President, which he held till 1853.

FILM in photography the flexible material used instead of glass in the making of negatives. It was

first introduced for general photographic work by the Eastman Co. in 1891. The particular value of the film for cinematographic work was soon recognized by Edison, who used it first in his kinetoscope, since when the cinematographic film has grown in importance. Celluloid was originally used as the material of films, but owing to its inflammability a non-inflammable film made from cellulose acetate is now in use.

The making of films for the cinema houses is an enormous industry, in which perhaps £400,000,000 is invested. Its chief centre is Los Angeles, but films are also made in the studios at Elstree, Shepherd's Bush, Ealing, and other places in England. A duty is charged on all films imported into Great Britain and since 1927 it has been compulsory for a certain proportion, increasing each year to 1936, of British films to be shown. Films are censored by a board appointed by the trade. In 1932 it was decided to establish a national film institute from funds obtained from the Sunday opening of cinemas. *See* CINEMATOGRAPH.

FILMY FERNS (Hymenophyllaceæ), an order of ferns requiring a damp and shady spot to live in. They are chiefly found in tropical regions, the two species (*Hymenophyllum tunbridgense* and *H. unilaterale*) found in Great Britain being the most widely distributed. They owe their filmy appearance to the fact that the tissue of their fronds is composed, as in mosses, of only a single layer of cells, and is being continually saturated with moisture. They are usually grown in bell-glasses, or in specially constructed cases.

FILTRA'TION, the process of freeing a liquid from solid matter suspended in it by causing it to pass through some pervious substance or substances which catch and retain the solid matter. The materials of which a filter is composed must have pores or interstices sufficiently coarse to allow the passage of the liquid, and yet sufficiently fine to prevent the passage of any solid particles. On a small scale unsized paper is often used; on a large scale various kinds of stone, sand, gravel, powdered glass, clay, charcoal, coke, &c., are employed.

In domestic filters the simplest forms are those in which the water passes down by gravity through the filtering medium to a reservoir below. Lateral and ascending filters are not uncommon. Filtration can be hastened by applying suction or pressure. The latter method is used in the Pasteur-Chamberland filter, consisting of a hollow cylinder of porous porcelain, which can be attached to an ordinary water-tap, the water being thus forced through the pores. The filters at waterworks are large tanks or beds, filled with layers of large stones, pebbles, coarse gravel, fine gravel, coarse sand and fine sand—the fine sand being at the top. Other materials are sometimes utilized, such as furnace cinders or clinkers, shells or shell-sand, and so forth. The water in the reservoir, collected from springs, streams, and rain, is allowed to deposit its suspended matter in settling-tanks, and then it is run into the filters. By percolation the rest of the mineral matter is removed, and the water that flows into the pipes which are to convey it to the locality where it is to be used.

Pressure filters are now in use by waterworks companies, consisting of large steel drums 6 to 10 feet in diameter, by 6 feet high, containing the filtering media on perforated trays, through which the water is forced. These filters have a high efficiency both as regards the quantity of water dealt with and the percentage of solids in suspension removed. They are cleaned by reversing the flow of water, and discharging through suitable drains.

FINANCE may cover either 'public finance' or 'commercial finance.' By public finance is meant the measures taken by Governments, whether national or local, for the purpose of raising money to pay for the national or local services run by governmental agencies. Public finance is, therefore, an essential part of the functions of any Government. Its sphere varies in accordance with the activities of the Government in question.

During a time of peace, and under an individualist régime, a national Government may have to find money only for the services of justice and order, for limited activities in the interests of public health and of national commerce and industry, and for a small army and navy. In such circumstances public finance will not play a large part in the life of the State. Such conditions, however, are now rare, and most Governments spend large sums on public education and health, and on works of public development, while the demands of national defence entail heavy expenditure. Such was the state of things in most civilized countries prior to 1914, when the problem of raising sufficient revenue to meet State expenditure was growing increasingly difficult, and was giving rise to vexed discussions as to the proportion of revenue which should be contributed by owners of wealth paying 'direct taxes,' levied on them in proportion to their capital wealth or money income, or by consumers paying 'indirect taxes' levied

on commodities, in the form of internal excise or of import duties.

In the United Kingdom 45 per cent of the national revenue was raised by direct taxation, and 43 per cent by indirect taxation in 1913, the proportion in 1920 being 48 per cent and 25 per cent respectively, in 1926 47 per cent and 36 per cent, and in 1927 budgeted at 46 per cent and 37 per cent. In 1930–31 direct taxation amounted to £462,781,000 and indirect taxation to £240,907,000. The gigantic expenditure caused by the war increased the size of the debt enormously. In 1914 the gross total of the debt amounted to £661,473,765; in 1920 £7,878,607,166; in 1927 £7,652,687,904; in 1928 £7,630,972,670; in 1929 £7,501,000,000; in 1932 £7,647,950,000. The cost of the debt itself increased from £24,500,000 in 1914–15 to £349,598,616 in 1920–21, and to £378,816,287 in 1927–28. In 1931–32 it amounted to £289,492,213.

The Budget. In this country national finance is regulated by the 'Budget,' a balance sheet of estimated revenue and expenditure presented to the House of Commons annually in April by the Chancellor of the Exchequer, and covering the financial year, which ends in March. The Budget contains estimates of the national expenditure and national revenue under various heads, and its introduction is made the opportunity of introducing changes in taxation. The Budget introduced in 1913 estimated an expenditure of £199,011,000 and a revenue of £194,825,000 in the financial year 1913–14. The 1921–2 Budget estimates were for an expenditure of £1,039,728,000 and a revenue of £1,216,650,000. In 1932–3 the corresponding figures were £766,004,000 and £766,800,000. Taxation per head of population in the United Kingdom amounted in 1914 to under £4, in 1930 to £14 15s. 10d., and in 1931, to £16 6s. 5d. The amount of money raised by local taxation is not included in this figure. Local authorities raised £84,500,000 in 1919; in 1932 the amount raised in England and Wales was £118,000,000 and in Scotland £16,915,000, local taxation taking the form of a tax on the annual value of real property within the area concerned.

Finance in the other sense covers all dealings in 'wealth' in the form of money and in credit instruments. In a sense all production is based on 'credit,' for things must be produced before they can be consumed, and their value during production is based on their anticipated value as finished articles. This theoretical conception corresponds with reality—for in many cases the actual expenses of production are borne during the period of production, not by the producer, but by other persons or institutions from which he borrows money, against the credit afforded by his personal reputation, the prospect of success of the production in question, and perhaps also the deposit of securities which can be realized in the event of his default.

The business of 'finance' then consists mainly in the collection from persons or businesses which are saving money, or holding it in reserve, of funds for which they have no immediate use, and the lending of the money thus obtained to persons or businesses engaging in enterprises which are sufficiently safe for them to be able to obtain loans, but for which they have not themselves sufficient money available. In internal trade this financing of businesses is largely done by banks, which collect money from the public on 'current account,' i.e. repayable on demand, and on 'deposit,' i.e. repayable only after a given period or after certain notice, and lend to businesses in the form of 'loans' or 'overdrafts' so much as they deem safe in view of their obligations.

Bills of Exchange. In foreign trade the most frequent method of financing is through the medium of 'bills of exchange,' ordering payments for goods at a future date, perhaps two, three, or six months ahead. A bill of exchange, if the names of the parties to it or some of them are satisfactory, will be discounted by a bank, or by a discounting house for the present value of the sum of money accruing when the bill falls due. The result of this operation is that the concern selling the goods can secure immediate payment, while the concern buying the goods, against which the bill is 'drawn,' does not require to make any payment until the maturity of the bill, the venture being financed in the intervening period by a bank or discounting house, which will frequently hold the bills of lading for the consignment, or other similar documents, as security. The bill of exchange has become the chief means of settling all forms of indebtedness between different countries, and the determination of the value of a bill drawn in the currency of one country in terms of another currency is dealt with under the heading FOREIGN EXCHANGES (q.v.).

Stocks and Shares. Yet another form of finance is the raising of capital for joint stock undertakings by public subscriptions, in return for which 'shares' or 'stocks' in the undertaking are given, which give a right to a certain proportion of the profits of the undertaking, together, in most cases, with a voice in its management.

Various types of shares and stocks are offered to the public, e.g. debentures, preference, and ordinary. Debentures carry practically no risk, preference shares or stock a limited risk, ordinary shares most of the risk of the undertaking. Holders of debentures receive a fixed rate of interest, and have priority over preference or ordinary shareholders, as well as having a charge on the assets of the company in case of default.

Preference shares rank for dividend before ordinary shares, and are also entitled to a fixed annual rate of interest. If the company is unable to pay the preference shareholders this fixed rate of interest in any year, the latter have the right to demand in succeeding years payment of arrears before anything is paid to holders of ordinary shares (except in the rare cases where the articles of association of the company otherwise specify). The surplus profits remaining after payment of interest on debentures and preference shares, if any, may then be divided amongst the ordinary shareholders to such an extent as the directors of the company deem advisable. Debentures and preference shares appeal to those investors who desire to have an assured income and a certain measure of security. Investors in ordinary shares are prepared to take more risk in the hope of obtaining a higher rate of interest on their holding.

When shares or stocks are being offered to the public for subscription, arrangements are frequently made for 'underwriting' the issue. In this way the company issuing the shares or stocks is guaranteed that the cash shall be forthcoming; for the 'underwriters,' in return for a small commission, agree to take up themselves any portion of the issue not subscribed for by the public. Should the underwriters have to take up some part of the issue, they await an opportunity of disposing of it in the ordinary market.

FIN-BACK, or **FINNER,** the name given to whales of the genus Balænoptera, also known as rorquals.

FINCH, one of the Fringillidæ, a large family of small seed-eating perching birds, inhabiting all parts of the globe. They are distinguished by having a sharply pointed, conical, and in most cases a strongly formed bill, suitable for crushing seeds and other hard objects. The species have been divided among several sub-families, as the haw-finches, the true finches, the buntings, and the bull-finches.

FIN'DEN, William, line-engraver, born in 1787, died in London 1852. He engraved many illustrations for the *Annuals* and other books. In conjunction with his younger brother Edward and assistants he produced several extensive series of engravings of great merit; the first and most successful of which was *Illustrations of the Life and Works of Lord Byron.* Other series followed, including the *Royal Gallery of British Art,* 1838–40, a very important publication, the engravings in which measure 13½ × 9½ inches, and are of the highest class. The plates are executed by various engravers of the foremost rank. Besides his book-plates, Finden produced some celebrated large engravings, among which may be mentioned: *The Village Festival,* after Wilkie; *George IV.,* full-length, seated on a sofa, after Sir Thomas Lawrence; *The Highlander's Return*; *The Naughty Boy*; *Deer-Stalkers*; and others, after Landseer.

FIN DE SIÈCLE, a term which became popular in Paris towards the end of last century, and was also adopted in other countries. It is applied to ideas and objects which are up-to-date. Since the beginning of the twentieth century the term *vingtième siècle* is frequently used instead.

FIND'HORN, a Scottish salmon river which flows through the counties of Inverness, Nairn, and Elgin, and falls into the Moray Firth after a course of 62 miles.

FINDLAY, a city of the United States, in Ohio, midway between Tremont and Lima, 90 miles N.N.W. of Columbus. It possesses petroleum springs and natural gas, and has machine-shops, flour-mills, saw-mills, and potteries. Pop. 19,363.

FIN'DON, or **FINNAN,** a fishing-village, Kincardineshire, Scotland, about 5 miles south of Aberdeen, celebrated for its smoke-cured fish known as Findon or Finnan haddocks. Pop. 200.

FINE, in English law, formerly signified a sum of money paid at the entrance of a tenant into his land and on other occasions, but now generally has the signification of a pecuniary penalty exacted either in punishment of, or in compensation for, an offence, whether committed against an individual, in contravention of the laws of the community, or against the community itself.

FINE ARTS, the arts whose object is the production of pleasure by their immediate impression on the mind, as poetry, music, painting, and sculpture. In modern usage the term is often restricted to the imitative arts which appeal to us through the eye, namely painting, sculpture, engraving, architecture, and is sometimes even restricted to the two first as more essentially imitative and imaginative.

FIN'GAL, a hero of Gaelic romance celebrated as a great warrior and a generous man in many old ballads belonging alike to Ireland and Scotland; but more especially the hero of an epic poem attributed to Fingal's son Ossian, first published by James Macpherson in 1762. *See* OSSIAN.

FINGAL'S CAVE, a famous natural cavern in the Island of Staffa, one of the Western Islands of Scotland. It extends 227 feet from its mouth inward, is composed of lofty basaltic columns, beautifully jointed, and of most symmetrical, though somewhat varied forms. The height from the top of the arched roof to the mean level of the sea is 66 feet; the breadth at the entrance 42 feet, at the end of the cave 22 feet.

FINGER-BOARD, the part of a stringed instrument, as the neck of a violin, guitar, &c., to which the fingers (of the left hand) are applied in playing to stop the strings. The finger-board is a keyed instrument (played with both hands) is commonly called a *keyboard*.

FINGER-PRINTS, as a means of identification, were first called attention to in 1823 by Purkinje, the eminent physiologist of Breslau. The first practical application of the method was made in the Hooghly district of Bengal by Sir William Herschel, who wrote a report recommending its general adoption in India. Sir Francis Galton subsequently took up the subject of finger-prints—or *dactylography*—as a study, and found that the innumerable ridge-patterns and characteristics noticeable on the ball of the thumb and fingers are not alike in any two persons, and persist during the whole period of human life, and that thus an accurate means of identification is afforded by simply inking the under surface of the hand and taking an impression on paper.

A British Home Office committee reported in 1894 in favour of the use of the finger-print system in conjunction with M. Bertillon's anthropometric classification (as is now the practice of many foreign Governments); while identification experiments in Bengal, by means of finger-prints only, proved so successful that in 1897 the Government of India appointed a committee to examine both systems. This committee recommended the adoption of finger-prints on the Bengal plan as being superior to the anthropometric method both in simplicity of working and apparatus, and in the rapidity and certainty of its results. Since 1897 this recommendation has been gradually carried into effect throughout India, where the use of the finger-print system now extends to various branches of public business.

The system is also in use throughout Great Britain, and there is a special department for finger-print records at Scotland Yard. Identification by this means, however, ought to be entrusted to experts or properly trained persons, and not put in the power of unskilled persons.—Cf. Sir W. Herschel, *Origin of Finger-printing*.

FINGERS AND TOES, CLUB-ROOT, or CLUBBING, a disease or malformation in the bulb of the turnip, which, instead of swelling, divides, forms numerous galls or tumours, and becomes hard and useless. It is due to the attack of a parasitic slime-fungus,



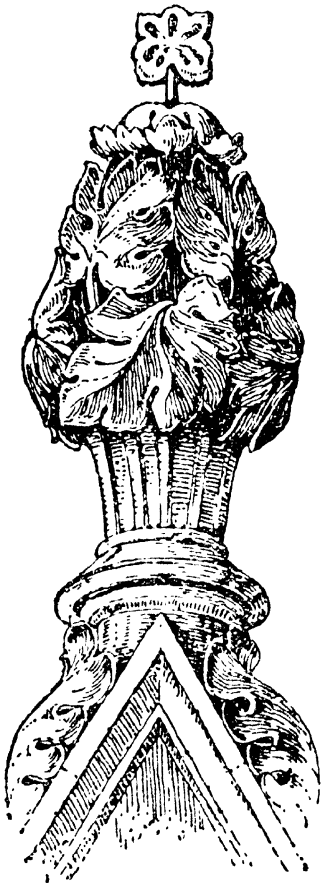
Fingers and Toes

Plasmodiophora Brassicæ. Diseased plants should be burnt, and infected ground should not be planted with cruciferous crops for two or three seasons. Dressing with unslaked or recently slaked lime (3 to 4 tons per acre) is said to be beneficial.

FIN'IAL, in architecture, an ornamental bunch of foliage which terminates pinnacles, canopies, pediments, &c., or any ornament of like kind. By older writers the term is used to denote not only the leafy termination, but the whole pyramidal mass.

FINIGUERRA (fin-i-gwer'rà), **Tommaso, or Maso,** a Florentine goldsmith of the fifteenth century, one of the best workers in *niello*, a form of decorative art then much in vogue in Italy. He was also the inventor of the method of taking impressions from engraved plates

FINING, a substance used to clarify liquors, usually such as are out of condition or are of inferior quality. A solution of isinglass is generally used for beer, and alum, carbonate of soda, or salt of tartar for spirits. Finings



Finial (1277)
Merton College Chapel, Oxford

always destroy some of the real virtue of the liquor.

FINISTÈRE (fi-nis-tār; 'Land's End'), a department of France, so named from occupying its westernmost extremity; area, 2,729 sq. miles. The coast-line is bold and precipitous, composed almost throughout of lofty granite cliffs, in which are numerous deep indentations, the two most important of them forming both the Bay of Douarnenez and the roadstead of Brest. The interior is traversed by hills which extend in all directions. The soil is generally fertile and well cultivated; fishing is extensively carried on; and the minerals are of considerable importance, including iron, zinc, bismuth and lead.

The manufactures consist chiefly of sail-cloth, linen, soap, oil, candles, ropes, leather, paper and tobacco. Shipbuilding also is carried on, and the general trade is extensive. Quimper is the capital; other towns are Brest, Châteaulin, and Morlaix. Pop. (1931), 744,295.

FINISTERRE, CAPE, the most western cape of Spain, on the coast of Galicia.

FINLAND, a European republic situated on the Baltic Sea, and bounded by Russia, the Arctic Ocean, Norway, Sweden, and the Gulfs of Bothnia and Finland. The total area is 132,589 sq. miles, and the population of 3,667,067 is 90 per cent Finns, 9·5 per cent Swedes, and includes a few thousand nomadic Lapps. The coast-line, which is highly indented, is fringed with islands, the Aland group being the most important. The country consists of a great plateau with low coastlands and, in the north, rugged offshoots of the Scandinavian ranges. The south is sandy and marshy and occupied by thousands of lakes which, being connected with each other and with the Gulf of Finland by canals, form an excellent transport system. The rivers are short and broken by rapids, but are much used for floating timber.

The chief towns are Helsinki, Helsingfors (the capital), Åbo, Viborg, Vasa, Uleåborg, and Tammerfors. All of these except Tammerfors are busy ports, though only Helsinki and Åbo are open in winter.

The climate is severe but healthy. Three-fifths of the population are engaged in agriculture, though in 1931 only 5,741,848 acres were in crop. The chief products are rye, barley, oats and potatoes. A great deal of butter is exported. Lumbering is the main industry, and 62,429,000 acres were (1931) forest land (17,570,000 being Government-owned). There were 427 saw-mills. Wood industries, iron goods, textiles and paper occupy about 3,497 large factories employing 129,579 hands.

In 1932 the total value of exports was 4,630,840,000 Finnish marks. This was chiefly composed of timber, pulp and paper, butter, animal foodstuffs, matches and hides. Imports

(tea, coffee, sugar, machinery, &c.) had a total value of 3,437,450,000 Finnish marks. The commerce with Great Britain was larger than that with any other country. The coinage standard is gold, and the unit is the *markka*, normally equal in value to the French franc.

Finland became an autonomous Grand Duchy of Russia in 1809, and was perhaps the most independent part of that empire. By the Constitutional Law of 1906 the House of Representatives consists of one chamber chosen by proportional election, and at the same time the suffrage was extended to women. The independence of Finland was declared in 1917, and the amended Constitution provided for a President and a Council of State (Ministry).

The national religion is Lutheran (3,532,618 adherents), and there are 62,901 Greek Catholics and Raskolnics. Elementary education is free and compulsory, and there are numerous secondary and technical schools, and schools of forestry, agriculture, commerce, navigation, &c. There are three universities, one at Helsinki, founded at Åbo in 1640 and removed in 1827, and two (Swedish and Finnish) at Åbo, founded in 1919 and 1922 respectively.

Army service is universal and compulsory, and there is also a Civic Protective Force. The navy is of little importance, and is mainly for coast patrol and ice-breaking work. The mercantile marine has a total net tonnage of about 510,080. *See* FINNS.—BIBLIOGRAPHY: *The Republic of Finland: an Economic and Financial Survey:* J. Öhqvist, *Finland;* Th. Homen, *East Carelia and Kola Lapmark; Finland* (Foreign Office Peace Handbooks).

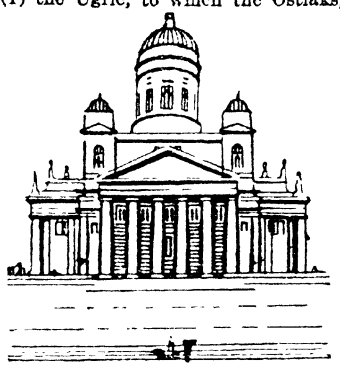
FINLAND, GULF OF, a great arm of the Baltic, 250 to 260 miles long, and from 10 to 70 miles wide, stretching from west to east between Finland on the north and Estonia on the south.

FIN'LAY, George, historian, born of Scottish parents at Faversham, Kent, 1799, died 1875. His chief work, the *History of Greece from its Conquest by the Romans to* 1864, was published in sections under different titles: *Greece under the Romans, History of the Byzantine Empire, History of Greece under the Ottoman and Venetian Domination,* and *History of the Greek Revolution.*

FIN'MARK, a division of Norway, in the extreme north, partly bounded by the Arctic Ocean. It consists of a mountainous and usually sterile tract, stretching 140 miles north-east to south-west, with an average breadth of about 40 miles. The Lofoden Islands belong to a long line of coast where important fisheries are established. Area 18,573 sq. miles; pop. (1930), 53,308.

FINNS, in their own language called *Suomalainen,* are a race of people inhabiting the north-west of European Russia (governments of Archangel and Olonetz), but especially Finland. In a wider sense the term Finns, with its adjective Finnish, is applied to one of the chief branches of the northern or Ural-Altaic division of the Turanian family of peoples and languages.

The Ugro-Finnic family has been divided into four groups or branches: (1) the Ugric, to which the Ostiaks,



Finland—Nicolai Church, Helsingfors

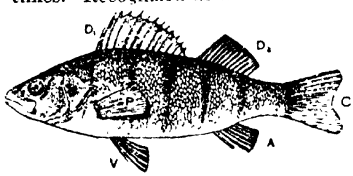
Voguls, and Magyars belong; (2) the Bulgaric or Volgaic, consisting of the Tsheremisses and the Mordvins; (3) the Permic, composed of the Permians, Siriancs, and Votiaks; and (4) the Tchudic or Baltic group. To the last belong, besides the Finns proper, the Esths of Estonia and the Lives or Livonians, the Tchudes, in the governments of Novgorod and Olonetz, and the Lapps in Archangel and the northern parts of Finland, Sweden and Norway. The typical Finns are physically of low stature but of strong build; with round head, forehead low and arched, features flat with prominent cheek-bones and oblique eyes.

FINNISH LANGUAGE AND LITERATURE. The Finnish language belongs to the Ugro-Finnic division of Turanian or Ural-Altaic family of languages, and is most nearly allied to the languages of the Esths, Lapps, Mordvins, Voguls, and Magyars. It is agreeable to the ear, rich in vowels and diphthongs, copious, and uncommonly flexible. The language is remarkably rich in declensional forms, there being as many as fifteen different

cases, expressing such relations as are expressed in English by *near, to, by, on, in, with, without, along*, &c. There is no distinction of gender in nouns. The verb resembles the noun in its capability for expressing shades of meaning by corresponding inflections.

Finnish literature is valuable chiefly for its rich stores of national poetry. These poems, which had been preserved by oral tradition from the times of heathendom, were gradually dying out till 1835, when Lönnrot grouped together in one whole all the fragments he could lay his hands on and published them, under the title of *Kalevala*, as the national epic of the Finnish people. A second edition, increased almost by one-half, was published by him in 1849. He also published a collection of 592 ancient lyric poems and 50 old ballads, and collections of proverbs and riddles.

A great impulse was given to the cultivation of the language in modern times. Recognized as an official lan-



Fins—Perch
D1, First dorsal. D2, Second dorsal. P, Pectoral. V, Ventral. A, Anal. C, Caudal

guage side by side with Swedish, it is becoming more and more the vehicle for imparting instruction. Works on science and history as well as poetry have been written in Finnish in recent years; a great *Finnish-Swedish Dictionary* has been published, and there are now a considerable number of newspapers. The centre of this literary life is Helsingfors.

Among modern writers may be mentioned Johannes Linnankoski (d. 1913) and F. E. Sillanpää, author of numerous stories dealing with peasant life. Manninen, Koskienniemi, L. Onerva and Maria Jotuni are others. Eino Leino was a distinctively national poet who died in 1925. Mme. Aino Kallas has written novels and short stories which have been translated into many languages, including English (*The White Ship*, 1924; *Eros the Slayer*, 1927; and *The Wolf's Bride*, 1930). BIBLIOGRAPHY: Eliot, *Finnish Grammar*; C. J. Billson, *Popular Poetry of the Finns*; Comparetti, *Traditional Poetry of the Finns*.

FINS, the projecting wing-like organs which enable fishes to balance themselves and assist in regulating their movements in the water. The fin consists of a thin elastic membrane supported by rays or little bony or cartilaginous ossicles. The *pectoral* or breast fins are never more than two; they are placed immediately in the rear of the gill-opening on the shoulder. In a state of rest these fins are parallel with the body, and have the apex towards the tail. The *ventrals*, pelvic, or abdominal fins, are placed under the throat or belly, and point downwards and backwards. They are smaller, in general, than the pectorals, and have sometimes long appendages.

Those of the back, or the *dorsal* fins, point upwards and backwards, and vary in number from one to four, to which sometimes are added several finlets or *pinnulæ*—small appendages which are seen in the mackerel. The *anal* fins are situated behind the vent, varying in number from one to three, placed vertically, and, like the dorsal, generally deeper on the anterior margin. The *caudal*, or tail fin, terminates the body, and both propels the fish and serves as the rudder by which it steers itself.

The pectoral and ventral are known as *paired* fins, and represent the fore and hind limbs of other vertebrates; the dorsal, anal, and caudal are *median, vertical*, or *unpaired* fins. The term 'fin' is also used for expansions connected with balancing and swimming in various other animals, e.g. whales, amphibians, cuttle-fishes, sea-snails, &c.

FINSBURY, a parliamentary and municipal borough of England, forming part of London, bounded by the parliamentary boroughs of St. Pancras, Islington, Shoreditch, London City, and Westminster. From 1885 to 1918 it returned three members to Parliament, but now only one. Pop. (1931), 69,388.

FINSEN TREATMENT, a surgical method introduced by a Danish doctor, Niels Ryberg Finsen (1860–1904), which consists in the treatment of certain diseases, especially those of a tubercular nature—such as lupus—by the application of the chemical rays of light in a concentrated form, the light being either that of the sun or the electric light and special apparatus being required.

FINSTER-AARHORN (ār'horn), the highest peak of the Bernese Alps, 14,025 feet above the level of the sea.

FIN'STERWALDE (-väl'de), a town of Germany in the Prussian province of Brandenburg, with manufactures of cotton and woollen cloths. Pop. 13,100.

FION, or **FIONN** (fō'on), a name given in the Ossianic poetry to a semi-mythical class of warriors of superhuman size, strength, speed and

prowess. Generally they are supposed to have been a sort of Irish militia, and to have had their name from *Fion* MacCumhal (the Finn MacCoul of Dunbar, and Fingal of Macpherson), their most distinguished leader. Some scholars, however, believed that the Fion were of the race that inhabited Germany before the Germans, and Scotland and Ireland before the Scots. —Cf. M. Maclean, *The Literature of the Celts*.

FIORD, or FJORD, a geographical term (of Scandinavian origin) applied to long, narrow, and very irregularly shaped inlets of the sea, such as diversify the coast of Norway. Similar inlets of the sea are presented in the sea-lochs of the west coast of Scotland, as also in the fiords on the south-west coast of the South Island of New Zealand, where the scenery is singularly imposing. Fiords often seem to owe their origin to the action of glaciers in remote epochs of the earth's history.

FI'ORIN (*Agrostis alba*), a common British grass found in pastures and waste places. It is not of much agricultural value. A stoloniferous variety, sometimes called *A. stolonifera*, is often a troublesome weed.

FIR, a name sometimes used as co-extensive with the term *pine*, and including the whole genus Pinus; more properly restricted to trees of the genus Abies, which differ from the pines in that their leaves grow directly on the stems. The term fir, thus limited, is applied to the different varieties of the *silver fir* (*Abies pectinata*), the balm of Gilead fir (*A. balsamifera*), and the large-bracted fir (*A. nobilis*). The Scotch fir is a species of pine (*P. sylvestris*).

The firs, even in the widest sense of the term, are almost all remarkable for the regularity of their growth, their tapering form, and the great altitude of their stems. Their timber is often highly valuable, being almost solely used in the construction of houses, and for the spars and masts of vessels of all kinds. Some of them are planted mainly as ornamental trees.

FIRBOLGS, one of the legendary or fabulous tribes of the earliest period of Irish history. Some of the Irish historians begin their account of the Irish monarchy and list of kings with Slainge, the first Firbolg king, who began to reign 1934 B.C. They are said to have been driven out or subjugated by a kindred tribe from Scotland, who in turn were expelled or conquered by the Milesians. The Firbolgs may, it has been thought, correspond to the pre-Aryan inhabitants of Ireland. It has also been suggested that Firbolgs is simply the Irish name for Belgæ.

FIRDU'SI, or FIRDAU'SI, Abul Kasim Mansur, the greatest epic poet of the Persians, was born at Khorassan about A.D. 931, and died there about 1020. At the request of the Sultan Mahmud, of Ghuznee, Firdusi undertook to write an epic on the history of the Persian kings, the Sultan promising him a piece of gold for each verse. Firdusi devoted a large number of years to this work, and produced an historical poem of 60,000 verses, entitled *Shâhnâma* (Book of the Kings), containing the history of the Persian rulers from the beginning of the world to the downfall of the Sassanian dynasty (A.D. 632), and consisting properly of a succession of historical epics. The Sultan, prejudiced against Firdusi by the poet's enemies, gave him only a piece of silver for each verse. In return Firdusi retaliated with one of the bitterest and severest satires ever penned. The resentment of Mahmud compelled the poet to wander from court to court seeking a protection which the sovereigns were afraid to give.

The *Shâhnâma* is one of the finest Asiatic poems. No work in the Persian language can be compared with it. It abounds in rich imagery, contains many passages of splendid poetry, and is of great interest to historians and ethnologists. A French translation of the *Shâhnâma*, by Mohl, with the Persian text, was published by the French Government between 1831 and 1868. There are English translations by J. Atkinson, A. G. Warner, and A. Rogers.—Cf. E. G. Browne, *A Literary History of Persia*.

FIRE AND FIRE-WORSHIP. According to that ancient Indian religious work, the *Mahâ-bhârata*, the sacred fire, called Advuta, "is the ruler and inner soul of all creatures." In other words, it is 'the vital spark.' A Babylonian hymn in which fire is hailed as the "great lord" and "noble son of heaven," declares: "Of all things that can be named, thou dost form the fabric."

The sun and moon were in Ancient Egypt referred to as 'the fire' of the two eyes of the god Ptah. In India, where Agni, the fire-god, had solar attributes, we find the belief that the world will be destroyed by fire from the sun. Brinton has shown that in America many tribes connected fire and the sun. In several South American dialects "the word for sun is derived from that for fire, and the sun is often referred to merely as 'the great fire'." The sun was the giver of life (of the 'vital spark'); it was, as a Zunian myth puts it, "the seed-stuff of the world." The Mexican 'lord of fire' was also 'the ancient god.' Horus, the Egyptian god, was in one of his phases a god of fire and worker

in metals. He was a cripple like the Greek Hephaestos, the Latin Vulcan, and the Scandinavian Loki.

The association of fire with the sun and metals is brought out in ancient Indian texts referring to Agni, who has "golden teeth, a golden beard, a golden form, tawny hair, red horses, and a golden car." The Egyptian Ptah, the Memphis god of artisans, has a beard tipped with gold. There was likewise a 'golden Horus.' In an Indian text a gold diadem has "the complexion of fire," and in another it is stated that "gold was born the offspring of Agni." The 'Golden Hathor' of Egypt was a sky-goddess with solar and lunar attributes like the 'Golden Demeter' of Greece.

Farnell, discussing the practice of women carrying torches over the land, in connection with Demeter worship, says they are "figures of a world-wide agricultural ritual, intended to invoke the fructifying warmth of the earth." Blood was shed on such occasions. Fire-gods were in many lands, as in India, connected with the gods of lightning and thunder who sent rain. Fire was supposed to come from water, and in India the five rivers of the Punjab "are," says the *Mahábhárata*, "said to be the mothers of the fires." The sun, in Egyptian and other mythologies, rises at the beginning from the primeval deep. Babylonian temples had a 'house of light' and a 'house of washing,' and the fire-god was Girru, Gibil, or Nusku. Jastrow has emphasized that the Babylonian incantation ritual revolved round two ideas, 'water and fire.'

In Gaelic lore the butterfly is a form of the fire-god. It is called 'teine-de' (fire of god) and 'dealan-de' ('de' is 'god'). The latter term is applied also to the brightness of the nocturnal heaven, to lightning, to coal, and to a burning stick which is whirled round as it is being carried from a 'new fire' lit at the Beltane or some other festival. In Ancient Britain household fires were extinguished once a year, and 'new fires' were kindled ceremoniously with 'fire sticks.' The 'new fire' was 'fire from heaven' and was regarded as being identical with lightning and the sun. The tree was supposed, like the butterfly (a form sometimes assumed by souls), to contain fire, and was connected with the sky deities. In Gaelic the word for a sacred grove is derived from the same root (nem) as the word for the sky. The ceremony of creating 'new fire' was world-wide.

Old world and new world fire ceremonies were of similar character. Holy fire was kept burning in sacred places by many peoples. In Mexico as in Rome it was watched by vestal virgins. There are also widespread myths of heroes or gods who, like Prometheus, brought fire from heaven. Purification fire ceremonies were widespread. The Persians regarded fire as being particularly sacred. The custom of cremating the dead was connected with the belief that souls were transported by means of fire to Paradise. In India the god Agni conducts souls to Paradise. An *Iliad* reference to cremation is of importance in this connection. Achilles sees in a dream the ghost of his dead friend Patroclus, who declares that he will never return from Hades after he has received his 'due' or 'meed' of fire.

FIRE-ALARM, an apparatus, mechanical, electric, and telegraphic, used for detecting fires, and for giving instantaneous notice of an outbreak. Detectors are often placed in the different apartments of a building; they ring an alarm when the temperature reaches a certain height. In large towns a series of signal-boxes is distributed in different quarters from which an alarm can be immediately telegraphed to the fire-brigade station. In 1930 a fire-alarm of the loud-speaker type was installed in Edinburgh.

FIRE-ARMS ACT, 1920, prohibits any person under 14 years of age, and any other person to whom a police certificate (known as a 'fire-arm certificate') has not been granted, from purchasing, possessing, using, or carrying any fire-arm or ammunition. Persons, however, in the naval, military, or air service, or in the police force, gunsmiths, dealers, carriers, warehousemen, officers of the post office, members of approved rifle-clubs or cadet corps, persons engaged in the humane slaughter of animals for food or other purposes, and persons possessing fire-arms or ammunition as part of the equipment of a ship or carrying such for the use, for sporting purposes, of a certificated person, are exempt from the obligation to hold certificates in respect of fire-arms or ammunition carried, used, or possessed in the course of duty or business.

Persons manufacturing, selling, hiring, repairing, testing, or proving, or lending or transferring fire-arms or ammunition, must be registered as fire-arms dealers. The registration fee is £1. Any constable may demand production of a certificate. The fee payable for a certificate is 5*s.*; it continues in force for three years, and is renewable for the like period from time to time at a cost of 2*s.* 6*d.* Antique fire-arms possessed as curios or ornaments are excluded from the Act, and a certificate may be dispensed with in respect of fire-arms possessed only as trophies of the war. *See* GUN LICENCE

FIRE-BALL, (1) an obsolete kind of offensive weapon, consisting of a ball filled with powder or other combustibles, intended to be thrown among enemies, and to injure by explosion, or to set fire to their works; (2) a name applied to meteors of special brilliancy. These in general differ from others only by being of greater mass and volume. They therefore give out a larger amount of light when heated to incandescence, and are able to penetrate the atmosphere to a greater depth and descend nearer to the earth's surface before becoming disintegrated. Not infrequently the luminous trails formed by the particles brushed off the surface of the meteor continue visible for many minutes after their appearance, and assume twisted forms through the diverse wind currents existing at different heights.

FIRE-BRICKS, bricks used in furnace construction or for other purposes where a high temperature is used. The qualities required in good fire-brick are as follows: "They should not melt or soften in a sensible degree by exposure to intense heat long and uninterruptedly continued. They should resist sudden and great extremes of temperature. They should support considerable pressure at high temperatures without crumbling. They may be required to withstand as far as practicable the corrosive action of slags rich in protoxide of iron or other metallic oxides." (T. Percy, *Fuel*, p. 144.) These qualities are not all shown in the highest degree by any one brick. In selecting a brick, therefore, attention must always be given to the special conditions in which it is to be used, for one which would be good under one set of conditions may prove very bad under another.—Cf. A. H. Sexton and W. P. Davidson, *Fuel and Refractory Materials.*

ANALYSIS OF FIRE-CLAY SPECIMENS

	1	2	3	4	5	6	7	8
Silica	55·61	56·42	58·00	62·35	44·37	65·10	48·01	48·99
Alumina	27·50	26·35	30·85	18·47	38 59	22 22	34 17	32·11
Oxide of Iron	1·91	1·33	1·55	4·77	1·82	1·92	3·05	2·34
Lime	·32	·60	·80	trace	·51	·11	66	·43
Magnesia	·79	·55	—	1·36	·30	·18	·45	·22
Potash	·81	·18	—	2·47	—	·18	1·94	3·31
Soda	—	—	—	—	—	—	—	—
Titanic acid	·33	1·15	—	1·10	—	—	—	—
Organic matter or loss in calcinate	·34	—	—	—	·58	—	—	—
Combined water ..	9 96	10·95	9·70	5·22	11·78	7 10	11·15	9·63
Moisture	2·12	2·80	—	4·15	2·69	2 18	—	2·33

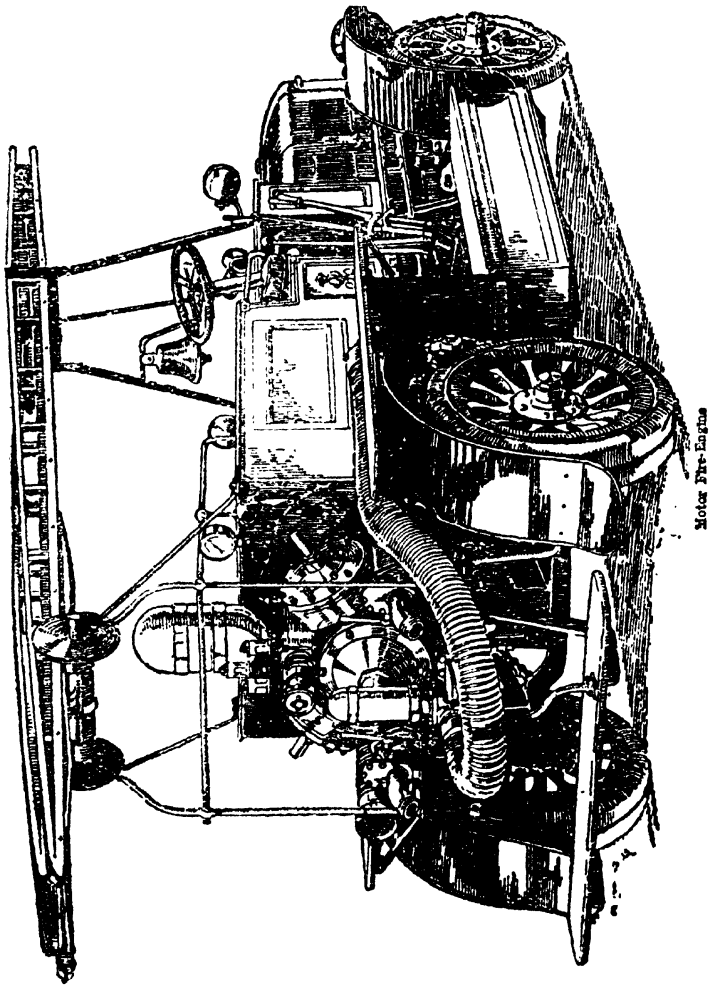
FIRE-BARS, bars of iron fitted into the bottoms of furnaces to support the fire. Their shape and size depend very largely on the nature of the furnace. Fire-bars are not used in the furnaces of large land boilers. The grate consists of hundreds of links which are fastened together to form an endless iron belt about 7 feet wide, which is carried over two rollers, one at the back end of the grate, and one at the forward end. This endless belt of links is kept slowly moving, and carries new fuel into the fire and ejects the spent ash at the back.—BIBLIOGRAPHY: W. Inchley, *Steam Boilers and Accessories*; *Modern Mechanical Engineering* (Gresham Publishing Co.).

FIRE-BOTE, in old law, an allowance of fuel to which a tenant was entitled, from the estate on which he resided.

FIRE-BOX, the structure of a boiler formed to contain the fire. It is usually constructed of steel, lined with refractory brickwork; but in locomotive practice it is generally made of copper, lined with fire-bricks.

FIRE BRIGADE. Body of men equipped and trained to deal with outbreaks of fire. Every town and urban district has its fire brigade. The larger ones consist of paid men always on duty; the smaller ones of volunteers. The equipment consists of powerful motor pumps, hose, ladders, etc. The largest fire brigade, the London Fire Brigade, has a staff of 2,000 men. Its offices are at 94 Southwark Bridge Road, London, S.E.1.

FIRE-CLAY is the name given to the clay used in the manufacture of bricks intended to withstand high temperatures. Fire-clays usually need temperatures exceeding 1500° C. to fuse them, and it is essential that they shall contain no matter which is likely to promote the formation of fusible silicates. Some characteristic analyses of fire-clays are given in the above table. The table for eight specimens is taken from Sexton and Davidson's *Fuel and Refractory Materials.*



Motor Fire-Engine

FIRE-DAMP is the miners' name for methane, CH_4. It is sometimes abundantly evolved in coal-mines, and may be productive of the most dreadful results when it explodes, by causing the death of men at work in the mine. When it constitutes more than $\frac{1}{12}$th of the volume of the atmosphere of mines, the whole—with the fine coal-dust added—becomes highly explosive. The safety-lamp affords the chief protection against this danger. *See* DAMPS.

FIRE-ENGINE, an engine for throwing water to extinguish fires and save buildings. Fire-engines are a species of force-pumps, in which the water is subjected to pressure sufficient to raise it to the required height in the form of a jet. The pump draws its

water through a flexible suction-pipe, which is placed either in a portable cistern kept supplied by buckets or hose, or in a river, canal, or pond, or other source of supply. In large towns the suction-pipe is sometimes connected to one or more street hydrants, the engine thus being used to increase the pressure already existing in the water-main.

For many years the manual fire-engine was the only type in use. Then followed the steam fire-engine, which came into prominence during the latter half of the nineteenth century. The average output of a horse-drawn British steam fire-engine is 300 gallons per minute, but engines of much greater capacity have been made, the largest being one supplied to Liverpool in 1893. It is able to deliver 1,800 gallons a minute.

Modern types of fire-engines are motor propelled. Both steam and petrol motor fire-engines are made, the latter being in more general use. Such engines can start instantly and travel at speeds up to 40 miles an hour. The illustration shows a modern petrol-driven 'Hatfield' motor fire-engine as supplied to H.M. King George V by Merryweather & Sons, of London, who were the pioneers of motor fire-appliances. The fire-pump on this machine is of the treble-barrel reciprocating type, driven by a single crank; several sizes are made, ranging from 150 to 600 gallons capacity per minute, with motors of from 50 to 70 horse-power. The petrol-motor, in addition to propelling the vehicle along the road, drives the pump through silent chain gearing. Accommodation is provided for hose and usual fire-brigade gear, and the chassis is often arranged to carry a detachable fire-escape or light ladders. Frequently a chemical engine for dealing with small fires is fitted also, and in this way a complete fire-extinguishing and fire-escape equipment is provided on one vehicle.

FIRE-ESCAPE, a contrivance for enabling persons to escape from the upper part of a building on fire. There are several kinds, the most popular form for private use being the 'chute,' which consists of a tube of canvas fastened to an iron frame in the window opening. The end of the escape is thrown out of the window and held at the bottom, when persons can make their escape very rapidly by sliding down the interior of the chute.

The escapes used by fire-brigades usually consist of an arrangement of long ladders worked on the telescopic principle and extended by means of winding gear. They are mounted on wheels for easier transport from place to place, and, unlike earlier types, modern hand-drawn escapes are designed to travel with the ladders in the horizontal position. Various sizes are made, the usual heights of extension ranging from 30 feet to 60 feet, though escapes to extend even to 100 feet have been constructed.

A modern development in fire-escape construction is found in the Merryweather motor turn-table ladders. In these machines the power of the motor which propels the vehicle is ingeniously utilized to operate the telescopic ladders, which are permanently mounted on a motor chassis, and which, by means of patented mechanism, can be raised from the horizontal to the upright position, and also extended to their full height of 90 feet with no effort on the part of the driver, who merely touches a small lever.

FIREFLY, a name popularly given to any winged insect which gives out light. Except the lantern-fly, the fireflies are all beetles, and are members of two nearly allied families, the Elateridæ or skipjacks, and Lampyridæ, to which the glow-worm belongs. The British glow-worm has too little luminosity to entitle it to the name of firefly, but the *Lampyris italica* and *L. corusca* of Canada are allied to it.

True fireflies are found only in the warmer regions of the earth. The *Elater* or *Pyrophorus noctilucus* of South America and the West Indies is one of the most brilliant, giving out its light from two eye-like tubercles on the thorax. Their light is so powerful that small print may be read by it, and in Hayti they are used to give light for domestic purposes, eight or ten confined in a phial emitting sufficient light to enable a person to write.

FIRE INSURANCE. Insurance against loss by fire is one of the oldest and most important branches of insurance. It is undertaken by all large offices and practically every building in the civilized world is insured against fire, as well as furniture and other household possessions. In Great Britain the premium on an ordinary house or shop is very low, but it is higher on factories, especially those where any inflammable material is used. The premium is reduced in cases where fire extinguishing apparatus is installed.

FIRELOCK, a musket or other gun, with a lock furnished with a flint and steel, by means of which fire was produced in order to discharge it; distinguished from the older matchlock, which was fired with a match.

FIRE OF LONDON, THE GREAT, broke out in a house near London Bridge, 2nd Sept., 1666, and raged for

several days. Two-thirds of London was destroyed—89 churches and more than 13,000 dwelling-houses. The monument erected by Wren at Fish Street Hill commemorates the Great Fire, and at one time bore an inscription attributing the fire to the Popish faction.

FIRE-PLACES. Fire-places are usually constructed in the walls of a room, and where possible should be placed in an inside wall, so as to economize the heat which passes through the back of the fire-place. For ordinary register stoves the depth of the opening should be 1 foot 2 inches. For dog grates 1 foot 6 inches is better. The height of the opening for ordinary stoves is 3 feet, and it is usually finished with an arch turned on an iron bar or bars if the breast projects more than 4½ inches from the face of the wall, and the jamb on either side is of less width than 17½ inches; the bars must be turned up and down at the ends, and be built in the jambs for at least 8½ inches.

The back of a fire-place set in a party or internal wall must be 8½ to 12 inches thick above the mantelpiece. When the wall is external, the thickness may be 4½ inches. The breast of every chimney and the brickwork surrounding every flue should be 4½ inches thick. Fire-places for kitchen ranges require a depth of 1 foot 10 inches at least, and a height of 5 feet. The hearthstone should be 6 inches longer than the opening on each side, and 18 inches wide in front of the breast of the fire-place.

On every floor except the lowest the hearthstone must be laid on brick trimmer arch or other incombustible material, and be solid for a depth of at least 6 inches. On the lowest story the hearthstone may be bedded on concrete covering the site, or on solid material placed on the concrete. The centering on which trimmer arches are turned is often left in order that the ceiling laths may be nailed to it. Unless this possibility is borne in mind, less than 6 inches clear depth may be left for the hearth-stone. This difficulty does not occur when the trimmer arches are turned on cast-iron centres. Fire-places are allowed to be built on corbels of brick, stone, or other incombustible material if the work so corbelled out does not project from the wall more than the thickness of the wall measured immediately below the corbels, but all other fire-places must be built on solid foundations and with footings similar to the wall against which they are built.

Under the Chimney Sweepers Act the statutory size of flues to fire-places was 14 by 9 inches, but this is not now enforced. In order to economize in cost and space when gas-fires are to be installed small flues made of terra-cotta can be built in the thickness of a 4-inch partition without projecting beyond the face. It is usual to have one fire-place with a 9-inch by 9-inch flue for cooking, &c., when these flues are used. In hospital wards fire-places are placed in the centre of the wards with descending flues carried in the floors to the outside walls.

FIRE-PROOFING, the rendering of materials or structures non-inflammable and heat-resisting. Fire-proofing is carried out in a great variety of ways. Buildings are rendered fire-proof largely by the use of the maximum amount of steel, brick and concrete, and the minimum amount of wood and inflammable material. Wood can be rendered less inflammable than it naturally is by painting it with fire-proof paint, which is paint mixed with asbestos. Ordinary safes and strong-rooms are made heat-resisting by having very thick sides and doors which are filled with salts containing water, e.g. borax.

FIRE-RAISING, in Scots law, is the same as arson in English law. In Scotland it is a capital crime in some cases, but capital punishment is not now inflicted. *See* ARSON.

FIRE-SHIPS, in naval warfare, vessels filled with combustibles, and fitted with grappling-irons, to hook enemies' ships and set them on fire. This ancient device once was frequently used in warfare, but since the introduction of iron instead of wood in shipbuilding, and the enormously increased range of naval guns, a fire-ship is as obsolete as a cross-bow or a javelin is in land-fighting.

FIRE TACTICS, the Field-Service Regulations of the British army definitely state that "the foundation of infantry tactics is the combination of fire and movement," while the accepted definition of the word tactics is "the art of manœuvring troops in the presence of the enemy." The expression 'fire tactics' may therefore be taken to mean "the art of applying fire to a selected target in the manner and volume most conducive to assisting the movement of other troops."

The days are long past when movement and fire were two separate parts of a soldier's training: when fire could only be delivered at point-blank ranges, and then merely as an item in a battle; when troops could be enjoined to "wait until you see the whites of their eyes" before firing; and when they could manœuvre in perfect safety, as far as damage from fire was concerned, in full view of an opposing force. In modern days the

position is entirely different. The excellence of the present-day guns and small-arms makes battle-field manœuvring impossible, and increases immensely the area in which a modern battle takes place. Then fire was used *after* troops had got to close quarters; now it is used to enable the same troops to reach that position. Then a battalion might move and fire by the executive command of its leader; now the commander explains his scheme, gives his orders, and the work is carried out by subordinates who control a system of small and easily handled fire-units working in close co-operation with other similar units, and able to move, either in advance or retirement, under any available cover, and with the support of the fire of other units or arms.

This word 'support' is the guiding principle in modern fire tactics. Against modern arms, be they guns, machine-guns, or rifles, no unit, however small or however efficient, can hope to succeed by its own unaided efforts, when these efforts take the form of a direct and unsupported advance of the entire unit. To take an extreme example. Six men in a small trench are being attacked by a similar number across broken ground. However expert in the use of the rifle the attackers may be, they will surely fail in their attack if all the six fire together and then immediately advance in the same manner. This will be equivalent to using the power of fire and movement separately, and the time occupied in advancing will afford the defenders in their trench an opportunity of firing in safety and with comparative accuracy at the advancing men. Should the attackers, on the other hand, arrange for certain of their number to keep up an aimed fire on the enemy trench while the remainder make ground, they will be using fire to assist movement, and will be affording the enemy no opportunity of returning the fire in safety.

This example illustrates in a very elementary way the essential principle of co-operation and covering-fire. In the modern organization of battalions arrangements exist which provide the means of applying this necessary covering-fire to a much greater extent than was formerly thought necessary or possible. Thus a platoon has in its own organization, as a means of providing its own covering-fire, two sections provided with Lewis guns, the functions of these sections being very largely to throw a stream of bullets on to the point of the enemy's line which for the moment is of the most tactical importance, thus enabling the rifle sections to make ground without undue casualties.

FIRE-WORKS may be divided into three kinds, the classification depending chiefly on the method of setting them off or firing them. Some are fired whilst held in the hand, or set off on the ground; others, such as rockets, are projected by the aid of a small explosive carried within themselves, and explode in the air. Others, heavier and more showy, such as shells, are projected from a small grenade or mortar, similar to a trench mortar. Lastly there are what is known as 'set-pieces' or fire-work pictures, which comprise fire-works representing water-falls, portraits, mottoes, crests, aeroplanes, or any special design desired.

Amongst fire-works of the first kind may be mentioned rockets, wheels or whirligigs, and Bengal lights. Rockets are charged on what is known as the spindle system, a long steel needle penetrating the paper tube that holds the charge. After the tube has been filled, and the spindle withdrawn, a cavity remains, which after the explosion becomes filled with the expanded air, causing the ascent of the rocket. The composition contained in the upper part of the paper tube is so arranged as to make it burst at the proper altitude, and scatter the stars with which it is filled.

Shells are made of a kind of *papier mâché* consisting of layers of paper and calico compressed into the shape of a bowl until they are as hard as iron. Two of these bowls are filled with large stars and joined together, then covered with canvas. They are fired from a small mortar, and the expelling explosion ignites a fuse connected with a time-fuse inside the shell, causing the shell to burst and ignite the stars.

The following are some of the ingredients used: oxalate of soda, regulus antimony, nitrate of lead, picrate of ammonia, subchloride of copper, and carbonate of strontia. Methylated spirits are frequently used in mixing colours. Iron filings make wonderful coruscations, and are used to represent falls and cascades. Steel filings are also used with even better effect.

With set-pieces any design can be produced in outline. The subject is first set out on squared paper, and scaled, and it is then transferred to a frame, which is divided into small squares. The design is traced with small bamboo canes which bend easily, and can be made to follow the design. Small fire-works on the rocket principle are fastened to the frame-work; these are called lances and gerbs. A lance is a small paper tube filled with a composition and priming on top; this is used for small devices, such as crests, mottoes, &c. A gerb is much larger, and filled in certain proportions with a

composition of sulphur, saltpetre, and charcoal, a colouring mixture being added. This is used for large productions. Part of the manufacture of gerbs is called coning. Cones are attached to them containing salts of various metals, sodium giving a yellow light, calcium a red, strontium a crimson, and barium a green, and these produce the colour effect on the set-piece. The lances and gerbs are glued perpendicularly to the canes which trace the outline desired. They are then attached to a fuse, which is a piece of cotton soaked in a liquid composition, dried, and enclosed in a paper tube. When a port-fire is applied to the end of this fuse or quick-match, the ignition is instantaneous over the whole set-piece.

Magnesium powder and lycopodium are used for giving lightning effects in stage pieces. Life-saving rockets carry a line from the shore to a wrecked ship, or from ship to shore. Fire-works are much used for signalling purposes. Rockets and ground-flares played a big part in the European War, and were used as signals everywhere. The S.O.S. was usually a combination of coloured rockets, commonly known as Very lights, which were fired from a specially made pistol.

FIRKIN, a British measure of capacity, now legally abolished, the fourth part of a barrel or half of a kilderkin. The measure varied with the material. For beer it was equivalent to 9 imperial gallons.

FIRM, a partnership or association of two or more persons for carrying on a business; a commercial house; or the name or title under which a company transacts business.

LONG FIRM, a term given to that class of swindlers who obtain goods by pretending to be in business in a certain place, and ordering goods to be sent to them, generally from persons at a distance, without any intention of payment. When they have obtained all they can in this way, they decamp, to reappear elsewhere under a different name. A person practising this system is said to be a member of the Long Firm.

FIR'MAMENT, the vault of heaven, originally conceived as a solid canopy. The Hebrew word *raki'a*, which is so rendered in Scripture, conveys the idea of expansion and solidity, since the root signification of the word is that which is expanded by beating out. The English *firmament* is adopted from the Latin *firmamentum*, which in the *Vulgate* is the equivalent of the Greek *stereōma* (*stercos*, firm, solid), by which the writers of the *Septuagint* rendered *raki'a*.

FIR'MAN (Pers. *fermân*), a decree, order, or grant of an Oriental sovereign, as of Turkey, issued for various special purposes, for instance to ensure a traveller protection and assistance. It differs from a *Hatti Sherif* in so far as it may be signed by any minister, whereas the *Hatti Sherif* is approved by the Sultan himself with his special mark, and is therefore supposed to be irrevocable.

FIROZÁBÁD', a town and municipality in Agra district, in the United Provinces of India, head-quarters of a tahsil of the same name, 24 miles E. of Agra. It contains numerous ruins of handsome buildings, and is a station on the E. Indian Railway, 817 miles from Calcutta. Pop. 16,000. Pop. of tahsil or revenue district, 108,521.

FIROZPUR' or **FEROZEPORE**, a commercial town, Punjab, India, capital of a district of the same name. The arsenal is the largest in the Punjab. Pop., including the military cantonments, 2 miles S. of the city, 54,351. The district forms the south-western portion of the Jalandhar division. Area, 4302 sq. miles; pop. 965,000.—**Firozpur** is also the name of a town in Gurgaon district, Punjab. Pop. 6920.

FIROZSHAH', a battlefield in Firozpur district, Punjab; the scene of the defeat of the strongly entrenched Sikh army by the British forces under Sir Hugh Gough and Sir Henry Hardinge, 21st Dec., 1845.

FIRST-AID TO THE SICK AND INJURED, the term First-aid is the expression used to denote the temporary treatment of persons suffering from sudden illness or the effects of accident, pending their being placed under medical care.

Its objects are two-fold; first, as far as possible to alleviate suffering; second, to prevent the aggravation of the injury or illness by injudicious handling. When a person is seen to fall or to be knocked down in the streets, the first impulse of well-disposed but ignorant onlookers usually is to raise the patient and even to endeavour to place him on his feet. Such a procedure may be attended with very serious consequences to the sufferer. It may be necessary at times, as in the case of a street accident, to remove the injured person out of the way of traffic, but this should be done with the greatest care, as any rough or careless handling may seriously aggravate the injury. As a general rule the person with a knowledge of first-aid will endeavour to ascertain the nature of the injury or illness and to apply the necessary treatment before moving the patient. The treatment, if intelligently applied, will, in the case of

many injuries, do much to lessen the suffering of the injured person.

It has been said by a great surgical authority that the first twenty minutes after an accident are the most important. That is to say, given the skilful application of first-aid within a brief period of the occurrence of an accident, the chances of untoward complications are appreciably diminished and, in serious cases, the prospects of complete recovery materially enhanced. Cases not infrequently happen in which the lapse of a much less period than twenty minutes before the application of first-aid would entail fatal consequences. The most common of these are hæmorrhage or bleeding, poisoning, and suspended animation caused by immersion in water, exposure to noxious gases, or electrical shock. Many instances could be given in which life has been saved by the prompt application of first-aid in such cases and, conversely, many could be quoted in which life has been unnecessarily sacrificed while untrained onlookers have, perforce, allowed the vital moments to pass.

Much has been done by legislative enactment and other means to provide safeguards against the risk of accidents, but no legislation can put a stop to human carelessness or human recklessness, and it is safe to say that in every industrial country the yearly casualties attendant on civil life, resulting in death or more or less serious injury, are approximate to the losses entailed by a considerable war.

Accidents being inevitable, it is the intention of this article to show, as briefly as may be, the steps, apart from surgical or medical treatment, that have been taken in this country to mitigate their consequences by bringing within the reach of all the opportunity of acquiring a knowledge of first-aid.

St. John and St. Andrew's Ambulance Associations. The course of training in first-aid as laid down by the St. John and the St. Andrew's Ambulance Associations, and followed by the bodies which have in more recent times taken up this branch of education, embraces instruction in elementary anatomy and physiology, the symptoms and practical treatment of cases of sudden illness such as fits, fainting, and apoplexy, and of all cases of accident embracing fractures, wounds, and hæmorrhage, burns and scalds, choking, shock, and minor injuries, as well as the symptoms of and antidotes to poisons accidentally or deliberately administered, and, lastly, the methods to be adopted for the transport of the injured. It will thus be seen that the knowledge to be acquired is of a useful character, quite apart from its practical application, for everyone is the better of having at least an elementary acquaintance with that wonderful thing, the structure of the body.

It must be here emphasized that first-aid must necessarily be merely a temporary and palliative measure. If it were generally to be supposed that first-aid treatment were more than a temporary safeguard pending the earliest possible surgical or medical attention, it would be better never to teach it. It is true that there are cases of minor illness or accident which scarcely necessitate medical attention, but in ninety-nine cases out of a hundred the first-aider must remember that his duty, first-aid having been performed, is to get his patient to hospital or under the care of a doctor with all the speed he may.

Systematic instruction in the theory and practice of first-aid was established in England by the St. John Ambulance Association in the year 1877, and was extended to Scotland in the year 1879. Scotsmen, however, have a liking for national institutions, and, chiefly on the initiative of medical men and employers of labour in Scotland, the St. Andrew's Ambulance Association was formed in 1882. At that time St. John did not see its way to withdraw from work in Scotland, while it is on record that St. Andrew's made sporadic incursions into the northern parts of England. No doubt this friendly rivalry in a good cause had a stimulating effect in the earlier stages of the movement, but its usefulness diminished, and the danger of overlapping increased, with the firm establishment of the ambulance cause. In the year 1908, therefore, both bodies agreed that, for the future, the border between England and Scotland should, so far as Great Britain was concerned, form the demarcation line of their respective spheres of work.

The classes of instruction promoted by both associations at once received enthusiastic support, chiefly, it must be said, on the part of workmen engaged in occupations attended with danger. Railwaymen, miners, shipyard and factory workers were eager to be taught and found a ready help from the members of the medical profession, who cheerfully devoted as many hours as they could spare to the work of instruction. A remarkable feature of this movement is that it does not grow stale. Year by year many thousands are instructed, yet year by year thousands more come forward for instruction.

Ambulance Corps. No review of the ambulance movement would be complete which omitted to refer to

the St. John Ambulance Brigade and the St. Andrew's Ambulance Corps. These organizations are disciplined bodies formed for the double purpose of enabling holders of first-aid certificates to perfect themselves by continued practice, and of providing organized assistance for public functions at which accidents are likely to occur. For this purpose they are divided into units of convenient size formed primarily for civilian purposes. These organizations played no small part in the provision of personnel both in the South African War and in the European War of 1914–8.

British Red Cross Society. Within recent years the work of instruction in first-aid has been undertaken by several organizations other than those already named. Although it scarcely falls within the sphere of civilian ambulance, mention must be made of the British Red Cross Society, incorporated by Royal Charter, which was formed in 1905. Its operations are carried out throughout the whole country with much success. Its principal object is to train and maintain a body for the purpose of acting as an auxiliary to the medical services of the navy and army in time of war, and the usefulness of its work was shown during the European War of 1914–8. It is in connection with this society that the organization popularly known as the V.A.D.'s was raised and maintained.

The St. Patrick Ambulance Association was instituted in Ireland in 1912 with head-quarters in Dublin. This association carries on work in Ireland on lines similar to those of the sister associations in England and Scotland.

Educational authorities and organizations such as the Boys' Brigade, Boy Scouts, Girls' Guildry, and Girl Guides promote classes of instruction in first-aid, but these, as a rule, do so in conjunction with either the St. John or St. Andrew's Ambulance Association.

In all other parts of the world there are numerous associations carrying on teaching and training in first-aid.

First-aid has also received the approval of the Government. The Marine Department of the Board of Trade requires candidates for the certificate of master or mate to hold a recognized first-aid qualification. Mine managers are also required to have a similar qualification. Regulations have also been laid down whereby mines rescue stations, with ambulance personnel, have been established. Other regulations make compulsory the provision of ambulance rooms in certain classes of factories. It is but due, however, to employers of labour to say that such provision had, in many cases, been made long before the introduction of Government regulations.

The staffs in the railways, fire brigades, tramways, police forces, &c., throughout the kingdom, although not compelled to undergo a first-aid training, voluntarily and willingly take up this work and are without a doubt amongst the most efficient first-aiders in the country. Railwaymen, who were the first to support the first-aid movement, have maintained their position in the forefront, and there is no body of workmen in the course of whose calling a knowledge of first-aid is so much required. The expense of the training of the employees in most of these companies or corporations is borne by the company or corporation by which they are employed.

Ambulance Wagon. A passing reference must be made to the ambulance wagon, that necessary link between the patient and the doctor. In England the ambulance wagon service is usually run by the municipal or county authority. In Scotland the St. Andrew's Ambulance Association maintains motor ambulance wagon services ready at all times to deal with cases of accident or sudden illness, and in the principal towns these wagons are manned by permanent ambulance attendants fully qualified to render first-aid. The original horse-wagons of last century have long since disappeared. Motor traction for ambulance purposes was tried by the association by way of experiment in the year 1906, and at the present time the association has a fleet of nearly one hundred motor ambulance wagons covering the whole of Scotland. That country is particularly well provided for in this respect, for, in addition to the association's vehicles, wagons have been provided by a few of the municipalities and numbers of the coal-mines are in possession of this necessary means of transport. It is but due to the Scottish branch of the British Red Cross Society to say that the coal-mine wagons and a very large augmentation of the fleet of the St. Andrew's Ambulance Association formed its generous gift to civilian ambulance at the close of the European War.

FIRST-FRUITS, in the Church of England, the income of every spiritual benefice for the first year, paid originally to the Crown, but now to a board, which applies the money so obtained to the supplementing of the incomes of small benefices. *See* ANNATES.

FIRST OFFENDERS. At common law magistrates had power, in lieu of passing sentence upon first offenders, to bind them over in good behaviour

for a period, but the infrequent use of the power led to the legislature giving it a statutory sanction in all courts of criminal jurisdiction by the passing of the First Offenders Act, 1887, while in 1907 the Probation of Offenders Act extended the power to all offenders whether first offenders or not. The latter Act repeals the former. It empowers the court, in view of the character, antecedents, age, health, or mental condition of an accused person, or of the triviality of the offence, or of the extenuating circumstances under which the offence was committed, and of the inexpediency of inflicting punishment, (*a*) in the case of an offence chargeable before a court of summary jurisdiction, not to proceed to conviction, but either to dismiss the charge or to discharge the accused on his being bound over to be of good behaviour and to appear for conviction and sentence if called upon within such time (not exceeding three years) as the court may appoint; and (*b*) in the case of a conviction on indictment of an offence punishable with imprisonment, not to proceed to sentence, but to bind the accused to be of good behaviour and to appear for sentence if called upon within such period (not exceeding three years) as the court may specify.

The court may in its discretion lay down further conditions providing for supervision over (*a*) the associates and haunts of the offender; (*b*) where the offence is drunkenness or one committed under the influence of drink, the power of the offender to procure intoxicating liquor; and (*c*) the employment of the offender. For the period specified the offender may be placed under the supervision of a 'probation officer,' who is named in the order by the court, and whose duties, subject to the direction of the court, are (*a*) to visit the offender at intervals and to report; (*b*) to see to the observance of the conditions laid down by the court; (*c*) to advise, assist, and befriend the offender; and (*d*) if necessary to find him suitable employment. Provision is made for dealing with offenders who fail to observe the conditions of their release.

By the Children Act, 1908, restraints are placed upon the punishment of children and young persons. A child (i.e. under 14 years) may not be sentenced to imprisonment or penal servitude; a young person (i.e. between 14 and 16 years) may not be sentenced to penal servitude, nor even to imprisonment unless too unruly or too depraved to be sent to a place of detention. No person under 16 years of age may suffer the death penalty. In addition to the methods of dealing with offenders under the Probation of Offenders Act, a youthful offender may be (*a*) committed to the care of a relative or other fit person (*b*) sent to an industrial or reformatory school; (*c*) whipped; (*d*) ordered to pay a fine; or (*e*) committed to a place of detention, or his guardian may be fined or ordered to give security for his good behaviour.

FIRTH or **FRITH**, an estuary, a term applied in Scotland to arms of the sea, such as the Firth of Clyde, of Tay, and of Forth, &c. It is the same word as the Norwegian *fjord*.

FISCHART (fish'art), **Johann**, German satirist, born between 1545 and 1550, died in 1589. His writings are mostly satirical, partly in prose, partly in verse, partly of both mixed together, and have the most whimsical titles. As a satirist he is the most unrestrained of his age, the Papal dignity, and the lives of the priesthood and Jesuits, astrological superstition, scholastic pedantry, &c., being among his favourite subjects of attack. His most celebrated works are a rifaccimento of the *Gargantua* of Rabelais, *Das glückhafft Schiff von Zurich* (The Lucky Ship of Zurich, 1576), and about fifty others.

FISCHER, Ernst Kuno Berthold, German philosopher, born at Sandewalde, Silesia, 23rd July, 1824, died in 1907. Educated at the Universities of Leipzig and Halle, where he studied philosophy, philology, and theology, he was tutor at Heidelberg University, but was compelled to discontinue his lectures on account of his advanced views. He was then professor of philosophy at Jena from 1856 to 1872, when he succeeded Zeller at Heidelberg.

Fischer belonged to the modified Hegelian school, and greatly popularized Kant's philosophy. His works include: *Diotima: the Idea of the Beautiful* (1849); *Logic and Metaphysic, or the Doctrine of Science* (1852); *Francis Bacon and his Successors* (1856); *The Life and Character of Benedict Spinoza* (1865); *Anti-Trendelenburg* (1870); *Goethe-Schriften* (1895–1904). His most important work, however, is his *History of Modern Philosophy* (1852–94; new edition, 1897–1903). This monumental work is written in the form of monographs on Descartes, Leibnitz, Kant, and other great philosophers down to Schopenhauer.

FISHER, Andrew, Australian statesman. Born near Kilmarnock, 29th Aug., 1862, he worked for some time as a coalminer, and in 1885 went to Queensland, where he was elected to the state legislature in 1893. In 1900 he became a member of the Commonwealth parliament. He was

minister of trade and customs in 1904, leader of the Labour party in 1907, and prime minister 1908–9 and 1910–13. He became High Commissioner in England in 1915, resigning in 1921. He died 22nd Oct., 1928.

FISHER, Rt. Hon. Herbert Albert Laurens, British historian and politician, born in London in 1865. Educated at Winchester and New College, Oxford, Paris, and Göttingen, he became tutor and lecturer in history at Oxford. In 1912 he was appointed vice-chancellor of the University of Sheffield, retaining his post until 1916, when he became President of the Board of Education. He held this post until 1922, and in 1925 was appointed Warden of New College, Oxford. As Minister of Education Fisher was responsible for the Education Act of 1918. He was elected a fellow of the British Academy in 1907, and delivered the Lowell lectures at Boston in 1909. His works include: *The Mediæval Empire* (1898), *Napoleon* (1913), and *Studies in History and Politics.*

FISHER, John, Bishop of Rochester, was born in 1459 at Beverley, in Yorkshire, and graduated M.A. at Cambridge in 1491. In 1501 he received the degree of D.D., and was made chancellor of the university. He was largely responsible for the foundation of Christ's College (1505), and St. John's College (1511) at Cambridge, the necessary money being found by Lady Margaret Beaufort, mother of Henry VII. In 1504 he was promoted to the see of Rochester. He opposed Henry VIII's divorce; listened to the pretended prophecies of Elizabeth Barton, the Maid of Kent; opposed the royal supremacy, and was imprisoned in 1534 and attainted. His appointment as cardinal by Pope Paul III led to his execution after trial by a special commission, 1535. He was beatified by Pope Leo XIII in 1886.

FISHER, John Arbuthnot Fisher, first Baron, Admiral of the Fleet, G.C.B., G.C.V.O., O.M., born 25th Jan., 1841, died 10th July, 1920. At the age of fourteen he entered the navy, and served in the Baltic during the Crimean War. In the Chinese War, from 1859 to 1860, he took part in the capture of Canton and Pelho. Captain of the *Inflexible* in 1882, he was present at the bombardment of Alexandria. He was Director of Naval Ordnance from 1886 to 1891, and a Lord of the Admiralty from 1892 to 1897. Delegate to the Peace Conference at the Hague in 1899, commander-in-chief of the Mediterranean Fleet from 1899 to 1902, he was Second Sea Lord from 1903 to 1904, and First Sea Lord from 1904 to 1910.

He introduced the *Dreadnought* policy and the plan of scrapping old ships instead of keeping them on the Navy List. He resigned his post on account of the severe criticism of Lord Charles Beresford, who put his charges before the Government. An inquiry was held, but the report was favourable to the First Sea Lord, who was raised to the peerage as Baron Fisher of Kilverstone. In 1912 Lord Fisher acted as chairman of a Royal Commission on oil-fuel. Reappointed First Sea Lord in 1914, he resigned on 14th May, 1915, in consequence of a disagreement with Mr. Winston Churchill, then First Lord of the Admiralty. He was chairman of the Inventions Board since 1915, a Grand Cordon of the Legion of Honour, and had received the Order of Merit in 1905.

FISHERIES. The fishing industries are concerned with the capture and disposal of fish and a great variety of other inhabitants of seas, lakes, and rivers. For the most part the booty is used for food; but aquatic animals yield many useful and ornamental products, in addition to what is edible. For example, sponges, corals, pearls, mother-of-pearl, sealskins, whalebone, and several kinds of oil, for which we are indebted to fishermen, might be mentioned as important commercially. Even the refuse from our common food-fishes is now worked up to yield valuable manures and foods for domestic animals.

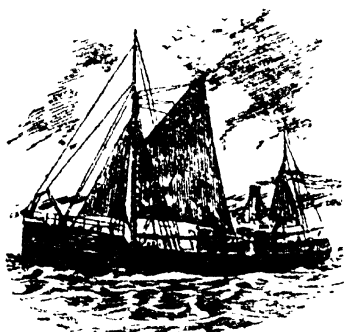
The chief fisheries of the world are those of Britain, the United States, Canada, and Newfoundland; but most of the countries that bound the North Sea, the Baltic, and the Mediterranean have a considerable interest in the produce of the waters. France, in addition to developing her home fisheries, has encouraged, protected, and subsidized her fishermen who work in the distant waters of Newfoundland, Iceland, and the North Sea. In the east, Japan has been conspicuous as a great fishery nation, a fact that has much to do with the rapid growth of her naval power.

The products of our fisheries form an important part of the food-supply of the British Isles. In 1928 over 1,000,000 tons of fish, valued at £18,000,000 were landed in the Ports of England and Scotland, not including either shell fish or salmon caught in the rivers. About 14,000 boats were employed and nearly 60,000 people were engaged in manning them. Nearly half of the catch (400,000 tons) consisted of herrings. Cod and Haddock were next in importance. Whale and seal fisheries being distinct branches, are not counted in the total National Fisheries. Before the European War it was estimated that

the home fish-supply equalled in weight one-third of the total meat supply of England and Wales; and the annual value of the take in 1913, exclusive of shell-fish, was put down as above £10,000,000. In Scotland the take, again excluding shell-fish, was valued at close on £4,000,000.

During the European War there was of course a great fall-off in the captures; but whereas the average value per hundredweight of 'wet fish' in 1914 is given at 15*s.* 6*d.*, it had risen by 1918 to 53 0*s.* 5*d.*, so that the value of the English sea-fisheries had gone up to fully £14,000,000, and the Scottish catch for the same year was valued at £6,000,000.

Since the conclusion of peace there has not been the success in the fishing industries that many expected. Indeed there seems reason to believe that they are in a critical condition. A period of apparent prosperity in the great trawling fisheries has been followed by a serious decline, largely owing to increased wages, and more especially to the expenses of transport and distribution. The herring fisheries have fared even worse than the others, for their success has always depended on a large export trade, especially to Russia and Germany; and since the European War this traffic has almost ceased. For a time our Government guaranteed a price to the fishermen, and took over their herrings, but early in 1921 it was announced that the guarantee would be withdrawn, and

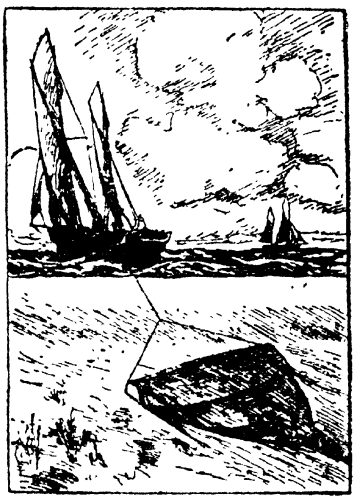


A Steam Trawler

the herring fishermen were faced with an almost hopeless situation.

The shell-fisheries too, have come to a period of trial and depression, largely owing to the fact that the public have waked up to realize that enteric fever may be due to the eating of oysters, mussels, cockles, or other shell-fish taken from sewage-polluted waters.

Fresh-Water Fisheries. In the United Kingdom the only fresh-water fish of much importance commercially are the salmon and the eel; and these are both only part-time dwellers in fresh water. The salmon



Fishing with Trawl Net

spawns in the upper reaches of many of our rivers, and the young lives in fresh water as a tiny 'parr,' generally for two or three years, before putting on silvery dress, and passing down to the sea as a 'smolt.' In the sea this grows rapidly, and it may return to fresh water as a 'grilse' a few months later, weighing as many pounds as it weighed ounces when descending. After spawning it again visits the sea to feed and grow; and this periodic change continues throughout the life of the fish. Salmon are chiefly caught when making for, or actually ascending rivers with a view to spawning. They are taken by various forms of net or by artificial flies or other lures.

The story of the eel is the converse of that of the salmon. The eel leaves the fresh water when about to spawn; it migrates far from our shores; and the young eels are hatched out, in a form quite unlike the adult, often many hundred miles from the home of their parents. They drift in the Gulf Stream towards the British coasts; and on reaching our shores, they swarm up our rivers on the quest for good feeding-grounds. After four or five years the spawning instinct develops, and the mature eel starts on

its great migration, from which it probably does not return. Eels are usually caught when starting on this spawning migration. They are captured in traps and nets as well as by hooks. A station for the capture and distribution of young 'elvers' was established at Epney-on-Severn in connection with the German Fisheries Union. It dealt with as many as 4,000,000 young eels in a year. Since the War it has been taken over by the Board of Agriculture and Fisheries.

Sea Fisheries. The sea-fisheries of the United Kingdom have developed greatly in recent years. Till well on in the nineteenth century nearly all fishing boats were small and open, and poorly equipped. Now comparatively large, decked vessels are commonly employed, and the use of steam- and motor-engines, with the development of the beam-trawl and the otter-trawl, has added enormously to the effectiveness of the gear.

Line-fishing with baited hooks is carried on as of old, but the 'steam-liners' are able to visit distant waters, and the captured fish are preserved fresh for the market by means of ice. Drift-nets are still used for herring fishing, but the 'steam-drifter' and the motor-driven boat are under control in a quite different way from the old sailing smack. Steam-carrying vessels are frequently made use of to convey to market the catch of a fleet of smacks that continue for many weeks on the fishing-grounds. Even for work in home waters experiment has shown the enormous benefit of the motor-engine. One experimental boat, working from Beer in Devonshire, between 29th July, 1915, and 29th Jan., 1916, was able to earn 210 per cent more than the average Beer sailing-boat working the same grounds.

Since vessels driven by steam-power came into competition with smaller craft, there has been steady deterioration of the 'inshore' fisheries; but little groups of fishermen have fought stubbornly to maintain themselves in the fishing villages in face of adverse conditions. In the European War these men rendered enormous service to the country, and now their value is being appreciated, and various plans are being revived or initiated for helping them, and improving their chances of holding their own.

In Scotland a scheme of loans for the provision of new boats, the purchase and repair of existing boats, and the purchase of gear was tried for a time, and was given up in 1891, on account of difficulties in collecting the interest. In Ireland the Congested Districts Board and the Department of Agriculture offered loans, and did good service by demonstrating new methods of fishing, and by helping to find new markets. In certain districts of England, too, advances were made for the installation of motors, and an important feature of the funds for this purpose was that the fishermen were associated with their administration, and made collectively responsible for their proper application and repayment. In 1913 a Committee appointed by the President of the Board of Trade favoured an extension of the motor-loan scheme, and emphasized the necessity for the immediate formation of a Fisheries Organization Society, to promote co-operation amongst fishermen. In Sept., 1914, the Development Commissioners submitted to the Treasury a scheme for the formation of such a society—not trading for profit—and an initial grant of £2,000 was made for the purpose. The society is now firmly established and doing admirable work.

Since the European War the Development Commissioners have made advances of money to the Board of Agriculture and Fisheries, to the Fishery Board for Scotland, and to the Congested Districts Board for Ireland for the building of boats, for provision of motors, and other assistance to the struggling inshore fishermen.

But the inshore fisheries are not the only ones that have shown a tendency to decline, and, to quote the words of the Tenth Report of the Development Commissioners (1920), "every maritime country has by now discovered that the depredations of man have their effect—which is very marked in the case of some fish—on the population of the sea." Accordingly there has been general recourse to scientific study of fish, their environment, their habits, and the habits of the organisms on which they feed or which feed upon them.

Before the European War an International Council for the Exploration of the Sea had been formed with a view to securing co-operative scientific research among the nations which fish the seas of Western Europe. Nine Powers were represented on this Council, and though its activities were greatly curtailed during the War years, the Council met again in 1920, and took up the threads that were dropped in 1914. It is only by strenuous national and international study of the great fishery problems that salvation for the fisheries can be achieved.

Among the many fishery subjects that have been illuminated by scientific research, the spawn and spawning habits of fish may be mentioned. It was not till 1864 that the great fact was discovered by Sars that our ordinary food-fish have floating eggs.

Even at a much later date one often met with absurd arguments against trawling based on the assumption that the eggs of our food-fish were laid on the bottom of the inshore waters. Now it is well established that the vast majority of our edible fish produce pelagic or floating eggs far from the shore. The drift of these eggs has been carefully studied by experiments with floating bottles and otherwise; and it is now known that fishery interests are not local, but that one area may be seriously affected by what is done in neighbouring or even in remote areas.

The growth and movements of young fish have also been fruitful subjects of study. It is now possible in many cases to determine with fair exactness the age of fish by examination either of their scales or of their ear-stones (otoliths). In this way rate of growth in different areas may be ascertained. Experiments in the transplantation of plaice from inshore waters to the Dogger Bank have demonstrated that growth can be greatly accelerated by liberating the fish on rich feeding-grounds. Fish averaging 8¼ inches in size, and which if left on the inshore grounds would have added about 2 inches in a year, grew on the average 5¼ inches in that period on the Dogger Bank, and increased 382 per cent in weight, as against a probable 100 per cent in the inshore waters.

The question whether the protection of immature fish would lead to a great increase in the number of mature adults has been debated. On the one hand it is urged that the wholesale destruction of the young must lead to a fall-off in number of breeding adults. On the other side it is argued that the taking of many of the full-grown fish will inevitably leave more space and food for the young, and so will reduce the normal 'infant mortality,' and permit of a good deal of destructiveness by man without damage to the fishery. It is now likely that the settling of this most important controversy will be possible as the diminution of fishing in the North Sea during the European War has provided the necessary conditions for testing the facts.

The feeding habits, the migrations, and the spawning seasons of fish have all been investigated with good results. Even the study of the lower animals and plants on which our food-fish ultimately depend has been profitable. Some fish, such as the herring, obtain their nourishment directly from the minute organisms that drift about in the waters, others are indirectly dependent on these, so knowledge of the conditions that determine the paucity or abundance of such drifting forms comes to be of great value for the fishery expert. Already we have investigations published by the Board of Agriculture and Fisheries, aiming at showing how the fluctuations in catches of such fish as pilchards, herring, and mackerel can be referred to changes in the physical and chemical nature of our seas.

In conclusion it may be pointed out that one great result of real insight into the ways of our fish should be that fishery legislation should more and more do what it is meant to do, namely, discourage wasteful methods and encourage all that makes for the prosperity of the species which we wish to abound. By-laws that are not based upon sound knowledge are as likely to hurt as to benefit.

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FISHGUARD (W. 'Abergwaen'), a market town and seaport in North Pembrokeshire, Wales, at the mouth of the River Gwaen and the head of Fishguard Bay, which affords a good sheltered anchorage. An entirely new port and connected works were constructed here in 1906 by the Great Western Railway in connection with the opening of a route to Southern Ireland (by Rosslare). Fishguard is also a general port of call for Cunard and Booth liners from New York and South America. Pop. (1931), 2,963.

FISH-HAWK, a name given in America to the osprey or fishing-eagle (*Pandion haliactus*).

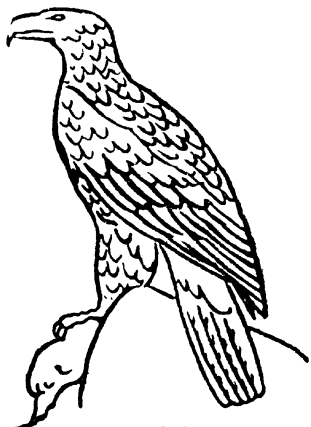
FISH-HOOK, a curved, barbed, and pointed steel wire used for catching fish. Redditch in Worcestershire and Limerick are the chief British seats of the fish-hook manufacture. The Limerick hook, which has the greatest reputation, has a barb that is forged solid, and then filed into the proper shape, while ordinary hooks have a barb that is raised by cutting into the wire. Hook-making machines are now common, especially in the United States, where the wire is run into the machine, and on the other side the hook drops out completed, only needing to be tempered and coloured.

FISH-JOINT, in railway engineering a splice or joint where two rails end to end are fastened together by flat pieces of iron (*fish-plates*) placed one on each side of the rails, and fastened by screw-nuts and bolts. It is essential

that the fish-plate should be a tight fit against the top and bottom flanges of the rail. The holes for the bolts are drilled so as to admit of a certain amount of longitudinal movement.

FISH-LOUSE, or **SEA-LOUSE**, a name for several crustaceans of the ord. Copepoda, parasitic on fishes. Some are common on many of the British sea-fishes. *Argulus foliaceus* is found on fresh-water fishes, and even on tadpoles. Sickly fishes often become the victims of multitudes of these creatures, or the sickness is induced by the numbers which attack them.

FISK UNIVERSITY, American educational institution founded in 1866 by



Fish Hawk

Clinton B. Fisk at Nashville, Tennessee, for the education of coloured people.

FISSION (from Lat. *findere*, to split), in biology, reproduction by division of one organism of low type into two, each of these, again, dividing into two others, and so on. The products of the division of the body of the primitive organism may either remain connected, when they will give rise to a composite structure (as in many corals), or they may be thrown off and lead an independent existence (as in some of the Hydrozoa).

FISSIROSTRES (-ros'trēz), a tribe of the Insessores or perching birds, distinguished by having a very wide gape, extending beneath the eyes. It comprehends the night-jars or goat-suckers, whip-poor-will, swallows, swifts, martins, &c. But in modern classification this division is often disregarded.

FISSUREL'LIDÆ, the keyhole limpets, a family of sea-snails resembling the limpets in appearance and habits, but differing considerably in structure. In the typical genus Fissurella there is a hole at the top of the conical shell, communicating with the gill-chamber, which contains a pair of gills. The species are widely distributed; some are British and many fossil.

FIS'TULA, in surgery, an abnormal channel, usually caused by the bursting of an abscess, which connects some hollow organ with the surface, such as an anal fistula (a passage from the lower bowel to the skin near the anus), or establishes a communication between two hollow organs, such as the bladder and bowel. It occurs most frequently near some outlet of the body, as the urinary passages and anus.

FISTULA'RIA, a genus of teleostean fishes related to the sticklebacks, and characterized by the elongation of the facial bones into a long fistula or tube, at the extremity of which the mouth opens. A notable species is the tobacco-pipe fish, which may attain the length of 6 feet.

FISTULI'NA, a genus of Fungi, allied to *Boletus*, found on old oak, walnut, and chestnut trees, as also on ash and beech; it is much esteemed in some parts of Europe as an article of food. When grilled, it is scarcely to be distinguished from broiled meat.

FITCHBURG, an American city, Worcester County, Massachusetts, 40 miles N.W. of Boston; it has manufactures of paper, machinery, and woollen goods. Pop. 40,692.

FITCHET, or **FITCH**, the fur of the polecat. It has a yellow ground, with long, soft, black shining hairs on its surface, which are exclusively used for artists' brushes. The fur is not in great request, as it emits an unpleasant odour which is difficult to dissipate.

FITTONIA, a genus of plants, ord. Acanthaceæ, natives of Peru. *F. Verschaffeltii* is cultivated for its ornamental leaves; these bear on the upper side peculiar lens-shaped hairs, which are said to be light-perceiving organs. It is a fact that the leaves place themselves very exactly at right angles to the brightest available light.

FITZ (Lat. *filius*), the old French word for *fils*, son; used as a prefix like the Scotch *Mac*, and the Irish *O'*, in certain surnames, as *Fitz*gerald, *Fitz*herbert, *Fitz*maurice, *Fitz*william, especially in the surnames of the illegitimate sons of kings or princes of the blood; as *Fitz*roy, *Fitz*clarence.

FITZGERALD (fits-jer'ald), **Edward**, poet and translator, born

1809, died 1883. He studied at Trinity College, Cambridge, and was a friend of Tennyson, Thackeray, and Carlyle. He spent a retired life in Suffolk, occupied with books and boating. His chief work is a translation of *The Rubáiyát* of Omar Khayyám, the Persian poet (1859). His *Letters and Literary Remains* were published in three volumes in 1889 by his friend and literary executor, W. Aldis Wright.

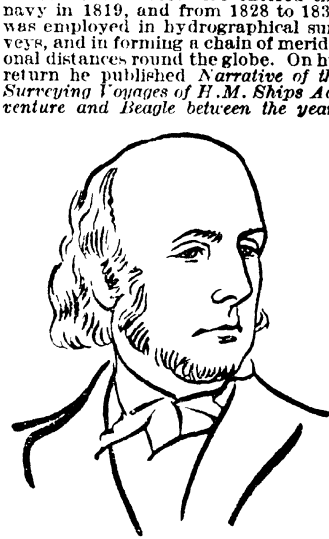
FITZGERALD, Lord Edward, born near Dublin 1763, died 1798. He was a younger son of the Duke of Leinster, and married Pamela, the reputed daughter of the Duke of Orleans, (Philippe Égalité) and Mme de Genlis. In 1796 he joined the United Irishmen, and plotted for a French invasion of Ireland; was betrayed by a spy, and arrested. He stabbed two of the officers sent to take him, but was disabled by a pistol-shot, which caused his death before he could be brought to trial.

FITZGERALD, Percy Hetherington, novelist and miscellaneous writer, born in Ireland in 1834. Educated at Stonyhurst College, Lancashire, and at Trinity College, Dublin, he was called to the Irish Bar in 1855, and was afterwards appointed a Crown Prosecutor on the North-Eastern Circuit. Besides novels, he wrote many biographical and other works, of which the most important are: *Charles Lamb: his Friends, his Haunts, and his Books* (1865); *Life of David Garrick* (1868); *The Kembles* (1871); an edition of Boswell's *Johnson* (1874); *The Royal Dukes and Princesses of the Family of George III* (1882); *A New History of the English Stage* (1882); *Life and Times of William IV* (1884); *Henry Irving: Twenty Years at the Lyceum* (1893); *Fifty Years of Catholic Life and Social Progress* (1901); and *Memories of Charles Dickens* (1914). He was also a sculptor of ability, his statue of Dr. Johnson standing in the London churchyard of St. Clement Danes. He died in 1925.

FITZGERALD, Lord Thomas, known as 'silken Thomas,' born about 1513, died 1537. He was vice-deputy for his father, the ninth Earl of Kildare, on whose arrest by Henry VIII Lord Thomas raised a formidable revolt in Ireland, which was ultimately put down by Skeffington, and Lord Thomas and his five uncles were hanged at Tyburn.

FITZROY, Edward Augustus, English politician. A member of the Duke of Grafton's family, he was born 24th July, 1869. Having passed through Eton and Sandhurst, he joined the 1st Life Guards. In 1900 he entered the House of Commons as M.P. for S. Northamptonshire and retained his seat until 1906, being again M.P. 1910–18. In 1918 he was elected for the Daventry division, as he was at all later elections to 1929. From 1922–28 Captain Fitzroy was Chairman of Committees in the House of Commons; in 1928 he was elected Speaker.

FITZROY, Robert, English admiral and meteorologist, born 1805, died by his own hand 1865. He entered the navy in 1819, and from 1828 to 1836 was employed in hydrographical surveys, and in forming a chain of meridional distances round the globe. On his return he published *Narrative of the Surveying Voyages of H.M. Ships Adventure and Beagle between the years*



Edward Fitzgerald

1826 and 1836, describing their Examination of the southern shores of South America, and the Beagle's Circumnavigation of the Globe. In 1854 he became superintendent of the meteorological department of the Board of Trade. In 1857 he was promoted to the rank of rear-admiral, and in 1863 to that of vice-admiral. He acquired great popularity with the public for the system of storm-warnings which he established.

FIUME (*Tersattica Vitopolis* of the Romans, *Fanum St. Viti ad Flumen* of the Middle Ages), a seaport, formerly a free town of Hungary, from 1920–1924 an independent state, and since 1924 in Italy. Area of state 390 sq. miles; pop. (1931). 106,775.

The town is situated on the Gulf of Quarnero, in the north-eastern extremity of the Adriatic. It has some good streets and buildings, and its industries embrace paper, tobacco, machinery, chemicals, petroleum,

metal goods and liqueurs. Fiume came into prominence when the Budapest-Agram- (Zaghreb) Fiume Railway was built. The Hungarian Government had spent large sums on the improvement of the harbour, and it became a place of large trade, all the shipping trade of Hungary passing through its port.

People, &c.—The population of the town is mixed, and consists of Italians and Yugo-Slavs. Out of the 49,800 inhabitants (1910) 24,800 were Italians, 13,000 Croats, 2,500 Slovenes, and 6,500 Magyars. Pop. (1931), 52,928. In spite of its mixed population, the industrial development of the town, especially since the creation of the port, was considerable, and it is interesting to note that before the European War the great concerns were mostly Italian and Magyar, whilst the smaller ones were in the hands of the Slavs.

History. Fiume, under the name of *Vinodol*, is mentioned for the first time in 1260, and the town was a fief of the Patriarch of Aquileia. In 1366 Hugo de Duino received it as a fief from Duke Albert of Austria, but Frederick III of Hapsburg bought it in 1467. In 1723 Charles VI created it a free port, and in 1776 Maria Theresa united it to Croatia. It was joined to Hungary as a *corpus separatum* in 1779, annexed by Napoleon as part of Illyria in 1809, occupied by the British in 1813, restored to Austria in 1814, and again to Hungary in 1822. It was reunited to Croatia in 1849, but again annexed to Hungary as a *corpus separatum* in 1869.

It was natural that during the European War Fiume, like so many districts with a mixed population, should become a point of discussion. The Italian Irredentists did not perhaps intend to claim the town at first, and the Treaty of London (April, 1915) did not assign it to Italy. But the Committee *Pro Fiuma Italiana* was not idle, and Fiume was at last claimed as Italian; whilst the Yugo-Slavs maintained that it was inhabited by Yugo-Slavs, and both ethnically and historically part of Croatia. President Wilson, when the discussion was raised before the Supreme Council, was against the Italian claim, whilst France and England endeavoured to effect a compromise. Whilst the Supreme Council was still considering the question, a *coup de théâtre* was suddenly effected.

In Sept., 1919, the poet Gabriele d'Annunzio, who had distinguished himself on the outbreak of the war by his eloquent patriotic and imperialistic speeches, and served in the army, seized the city and set up a provisional government. At the head of an expedition composed of mutineers from the army, he went down the short strip of coast which divided the Italian lines from the port, entered the city, and proclaimed its annexation to the Kingdom of Italy. It was a defiance of the Peace Conference, and the Italian Government did not openly recognize the poet's action, although the majority of the Italian public were in sympathy with d'Annunzio. Ordered to evacuate the city, he refused to obey, and even the declaration of a blockade did not move him.

In the meantime the Treaty of Rapallo was signed by the representatives of Yugo-Slavia and Italy on 12th Nov., 1920, and the independent state of Fiume was established. D'Annunzio, however, and the insurgents denounced the treaty and declared a state of war with Italy. A blockade was declared by the Italian Government, and in Jan., 1921, d'Annunzio and the insurgents evacuated the town. In 1924 an agreement was signed by which Yugo-Slavia agreed that Fiume should become Italian.

FIVE FORKS, a locality in Dinwiddie County, Virginia; the scene of an important battle fought 1st April, 1865.

FIVE MILE ACT, an act of Charles II (1665) forbidding nonconformist clergymen who refused to take the oath of non-resistance and swear to attempt no alteration of the constitution in Church or State, to come within 5 miles of any corporate town where they had preached since the Act of Oblivion. They were also prevented from keeping schools. The Act was repealed in 1688.

FIVES, a ball game of considerable antiquity. The name is almost certainly derived from an essential feature, the use of the five fingers, 'fives' being a slang expression for the hand, a much more probable derivation than such suggestions as that five players originally took part in a game, or that five points have to be scored by the winners.

Reduced to fundamentals, the game consists in hitting with the palm and fingers, which are protected by a padded leather glove, a small hard ball. The ball must be struck before it has bounced more than once, and it must strike a wall above a certain line. An 'open court' comprises merely a level piece of ground and a smooth wall in front; a 'closed court'—the more usual kind of court—has two walls at right angles to the front one, and a back wall to complete a square or rectangle, so that any or all of the four walls may be struck by the ball during its passage.

The ball has an india-rubber core;

it is bound with fine twine, and covered with white leather.

There are two forms of the game of fives, known as the Eton and the Rugby game. The main features are identical in both, viz. the serving of the ball to the opposing striker, and the necessity of hitting it before the second bounce and of ensuring its striking the front wall above the base line. One difference, however, is that although in the Rugby game singles or doubles may be played, in the Eton game a contest between two individuals only is impracticable and rarely undertaken.

The Eton Game. The original Eton game was played against the chapel wall, with the buttresses constituting side walls, the balustrade of the chapel steps projected into the court. These conditions are represented in a modern 'Eton court' by a paved floor, the front of which is raised 5 inches above the back, forming a step. This type of court has no back wall. Along the left lateral wall at its middle point a projection is erected to act as an obstacle; it is colloquially known as 'the pepper-box,' and is a special feature of the game, in which the object is to serve the ball into the 'pepper-box' so that it strikes it and emerges at an angle, making it difficult for one of the opponents to reach it and return it. The striker loses a point if the ball passes too high over 'the pepper-box.'

A game is fifteen points, a point being scored when the ball is struck outside the reach of an opponent. The right to serve is lost if the ball is struck below the prescribed line, or, as has already been explained, if it passes too high over the projecting 'pepper-box'. It is obvious that a very lengthy game may ensue if the opposing sides keep on alternately gaining the right to serve, no point being scored. On the other hand, a superior side may win the whole fifteen points without their opponents ever finding an opportunity to score. The balls are 1¾ inches in diameter, and weigh 1¼ ounces.

The Rugby Game. The size of court varies considerably. The game is much simplified by the absence of the 'pepper-box'; there is usually, but not invariably, a back wall. The balls are rather smaller than those employed in the Eton game. Scoring is identical in both games.

Whilst some primitive and elementary representation of the game is fairly universal, fives is more particularly played at the British public schools. At several, both varieties of court exist and both varieties of the game are played, but on the whole every school remains faithful to one or other variety. The Eton game is particularly favoured at Eton, Harrow, Westminster, Charterhouse, Repton, Shrewsbury, and Wellington. The Rugby game is preferred at Rugby, Winchester, Marlborough, St. Paul's, Bedford, Oundle, and Clifton.—Cf. A. Tait, *Fives* (All England Series).

FIXED STARS, a name applied to the stars proper, as distinguished from the planets. The term is appropriate, because the stars for long periods of time preserve practically the same apparent positions with reference to each other. Their light is intrinsic, and not borrowed, and our sun itself is but one of the fixed stars. *See* STARS.

FIXTURES (Lat. *figere*, to fasten), in law, are accessories annexed to houses or lands which by the fact of their being so annexed become a part of the real property and pass to the reversioner, not being moveable at will by the tenant or occupier of the property. The old rule of the common law generally was that whatever had been affixed to the premises or put into the land by a tenant during his occupancy could not be removed without the landlord's consent, for such things belong to the owner of the land. Large exceptions are made to this rule in favour of the tenant, covering generally fixtures for trade, for agricultural purposes, and for ornament or conveniences, but the removal must not damage the land or buildings of the landlord. 'Tenants' fixtures' have come to mean chattels fixed to the soil which may be removed by the tenant. Landlord's fixtures are chattels which pass to the owner of the land.

FIZEAU, A. H. L. (1819-96), a French physicist who made important experiments on light. He was the first to determine the velocity of light by a terrestrial experiment. A ray of light was sent so as to be reflected back to the starting-point by a distant mirror. A toothed wheel was interposed in the path of the ray, and was rotated at such a speed that the outward ray passed between one pair of teeth, and the reflected ray between the adjacent pair. The speed of light was then found by a simple arithmetical calculation.

Another experiment of Fizeau's is often referred to at the present day in discussions of the vexed question of the relative velocity of ether and matter. This experiment proved the correctness of the formula given by Fresnel for the velocity of light in a material medium moving relative to the earth. *See* ETHER; LIGHT.

FLAG, a popular name for many monocotyledonous plants with sword-

shaped leaves, mostly growing in moist situations; but sometimes particularly appropriated to *Iris pseudacōrus*, nat. ord. Iridaceæ, also termed *Flower de lis* or *Flower de luce*. It has sword-shaped leaves and yellow flowers, and grows in marshy places.

FLAGELLANTS (flaj'el-ants; Lat. *flagellare*, to lash or scourge), the name of a sect in the thirteenth century who maintained that flagellation was of equal virtue with baptism and other sacraments. They walked in procession with shoulders bare, and whipped themselves till the blood ran down their bodies, to obtain the mercy of God and appease his wrath against the vices of the age.

Rainer, a hermit of Perugia, is said to have been their founder in 1260. He soon found followers in nearly all parts of Italy. Their number soon amounted to 10,000, who went about, led by priests bearing banners and crosses. They went in thousands from country to country, begging alms; and for centuries they formed a sort of intermittent order of fanatics, frequently reappearing here and there in times of extraordinary declension or distress. Their doctrines were condemned by the Council of Constance (1414–8), and they gradually disappeared after the middle of the fifteenth century.—Cf. W. M. Cooper, *Flagellation and the Flagellants*.

FLAGEOLET (flaj-e-let), a sort of small flute or whistle played by means of a mouthpiece. The tone produced is similar to that of the *piccolo*, but is softer in quality, and the range is two octaves. The double flageolet consists of two instruments united by one mouthpiece, and producing double notes. The name *flageolet tones* is given to those harmonic tones on the violin, violoncello, and other stringed instruments, produced by the finger lightly touching the string on the exact part which generates the harmony, and not by pressing the string down to the finger-board. The flageolet was employed by Mozart.

FLAG-OFFICER, in the British navy, a general distinguishing title for an admiral, vice-admiral, and rear-admiral, who have the right to carry flags indicating their rank at the mast head.

FLAG OF THE PROPHET, the *Sanjak-sherif*, or sacred flag of the Mohammedans. It was originally composed of the turbans of the Koreish captured by Mohammed; but the black curtain that hung in front of the door of Ayesha, one of Mohammed's wives, was afterwards substituted. It is preserved in the seraglio at Constantinople. The carefully-guarded banner unfolded at the commencement of a war is not the real sacred flag, though it is commonly believed to be so.

FLAG OF TRUCE, properly speaking, this means the white flag which is carried as a distinguishing mark by an envoy deputed to carry a message from one belligerent in the field to his opponent. By general custom it is applied to all the persons collectively forming the mission.

The laws and customs of war recognize the possibility of occasional necessary intercourse between belligerents, and provision is made for the proper conduct of all such negotiations (Hague Convention, Chapter III). A commander wishing to communicate on any matter with the commander of an opposing force deputes an officer to represent him. This officer, known as the parlementaire, must be provided with a written authority signed by the commander, and on his mission may be accompanied by not more than three other persons, viz. a trumpeter, a flag-bearer, and an interpreter.

All the persons composing a 'flag of truce' are entitled to inviolability as far as the natural chances of war admit, i.e. the enemy may not take any hostile action against them personally, provided the 'flag of truce' makes no attempt to engage in espionage (q.v.). Should a 'flag of truce' see or hear anything in a quite open way, he may legally report it to his own commander, and this is not espionage; but it follows that the enemy commander to whom the 'flag of truce' surrenders himself must take every precaution to prevent such a thing happening, and this invariably takes the form of blindfolding every member of the flag of truce. A commander is not obliged to receive a flag of truce, in which case it must return directly to its own lines.

FLAGS, NATIONAL, flags were in use in very early times, being displayed in war by the Egyptians and the Saracens. The Romans marched to battle under the eagle, while the Greek emblem was Athena's owl. In the Bayeux tapestries may be seen numerous flags carried by the Norman invaders of Britain. One of the earliest records of an English battle standard is in 1138, when, at the battle of Northallerton, triple flags—those of St. Peter, St. John of Beverley, and St. Wilfrid of Ripon—were displayed from a mast which was surmounted by a silver pyx and borne on a wheeled car. In 1244 Henry III caused to be made a standard of crimson silk representing a dragon, richly adorned with gold and having eyes of precious stones.

UNION JACK, the red cross of St. George on a white field, and the white cross of St. Andrew (saltire) on a blue

field, were the national flags of England and Scotland respectively at a time prior to the reduction of heraldry to a science. In 1606 these two flags were, by order of James I, combined in one; the St. George's Cross being placed over the white saltire, and given a narrow white border in order to avoid the heraldic solecism of placing colour upon colour. On the admission of Ireland into the Union in 1801 the Cross of St. Patrick, a red saltire on a white ground, was added, being placed side by side with that of Scotland. This flag is still carried by warships on a 'jack' or jack-staff at the point of the bowsprit; hence the common name of 'Union Jack', mistakenly supposed by some to be an allusion to King James, and by others to the English soldier's former *jacque* or surcoat, which often bore a red cross.

Royal Standard. The *Royal Standard* of the United Kingdom displays in two of its quarters the royal lions of England, the remaining ones being occupied respectively by the Scottish lion and the Irish harp. This flag is personal to the sovereign, being hoisted upon any place in which he is in residence, on certain home and foreign stations, and during state ceremonies.

The three *ensigns, red, white,* and *blue,* are a survival from the period prior to 1864, when the British fleet consisted of three divisions so named. The *white ensign,* which differs from the other two in having a St. George's Cross upon its field in addition to the Union flag in the upper quarter next the staff, is flown by the Royal Navy and the Royal Yacht Squadron; the *red ensign,* with the Union flag in the corner, by merchant ships in general; and the *blue ensign,* differing from the *red* only in the colour of the field, by the Royal Naval Reserve and certain privileged yacht clubs.

United States. To the 'stars and stripes' of the United States has been long attached the doubtfully authentic legend which would derive its design from the *bars* and *mullets* of the Washington coat-of-arms. During colonial days the flag was of horizontal stripes, the Union device of Great Britain appearing in the upper corner. Shortly after the Declaration of Independence this flag gave place to one having thirteen stripes, of red and white alternately, as representing the thirteen original states of the Union; with thirteen stars in place of the British emblem; all being on a blue field. In 1908 the stars—but not the stripes—were increased to twenty in number, seven new states having been incorporated in the Union. A star was added for each new state subsequently admitted, the number now being forty-eight. In the flag of the United States navy the devices are separated, the admiral's flag bearing the stripes only, while the stars are shown upon a 'jack'.

Denmark. The national flag of *Denmark,* particularly interesting as dating from the thirteenth century, and thus being probably the oldest in existence, is (for the navy) swallow-tailed in form, a white cross on a red field. The standard is similar in shape, but with the royal arms added at the centre of the cross; the merchant flag is rectangular.

France. The early royal standard of *France* was the blue hood of St. Martin, to which succeeded the red oriflamme that formed the standard of the abbey of St. Denis. In the fifteenth century this was replaced by a blue standard covered with fleurs-de-lis, these being later reduced in number to three, as in the royal arms. The white standard came into use under Henri IV. In 1794 appeared the tricolor with its three vertical divisions of blue, white, and red. Napoleon retained this unchanged until his elevation to imperial power, when the standard was powdered with golden bees, a device revived under the second empire. At the Bourbon restoration the white flag had once more come into use, retaining its place until it yielded to the tricolor in 1830.

Germany. The flag of the *German* merchant service remains unchanged by the European War, being three horizontal stripes—black, white, and red; but the iron cross, black eagles, and imperial crown which formerly adorned the standard have now disappeared in favour of three horizontal stripes—black, red, and gold.

Holland. The flag of the *Dutch* mercantile marine is of three horizontal bars—red, white, and blue; that of *Belgium,* vertical bars, black, yellow, and red, while the standard bears the royal achievement on the middle stripe.

Spain. The *Spanish* naval flag is of three horizontal stripes, the broader middle stripe being yellow, and the others red; the merchant flag is yellow, crossed by two horizontal bars of red.

Italy. The flag of the *Italian* mercantile marine displays three vertical stripes, respectively green, white, and red.

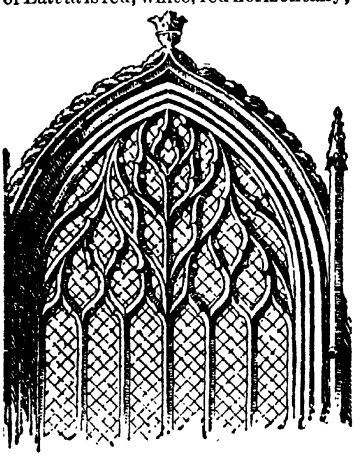
Russia. The flag of *Russia's* merchant fleet is red, with the Soviet device of a sickle and hammer, and some lettering in yellow in the top left corner.

Sweden; Norway. The *Swedish* navy has a yellow cross on a blue field; that of *Norway* has a blue, white-bordered cross on red.

Greece. The *Greek* naval flag shows nine horizontal stripes, alternately blue and white, the upper quarter next the staff having a white cross on a blue field.

Japan. *Japan's* naval flag is a red rising sun, emitting rays of alternating red and white. Several new flags came into existence as a result of the European War.

Other flags. The flag of *Estonia* has blue, black, and white in horizontal stripes, whilst that of *Finland* has a blue cross on a white ground, and that of *Poland* is white and red in horizontal bands with an eagle on a red shield in the white band. The flag of *Latvia* is red, white, red horizontally,



Flamboyant Tracery, St. Mary's, Dinan, fifteenth century

whilst the new flag of *Yugoslavia* is blue, white, red horizontally. The new flag of Austria has red, white, red in horizontal stripes of equal width. The flag of *Czechoslovakia* is white and red in horizontal bands, with a triangle of blue on the edge nearest the mast. —BIBLIOGRAPHY: E. Hulme, *Flags of the World: their History, Blazonry, and Associations*; A. MacGeorge, *Flags*.

FLAHAUT DE LA BILLARDERIE (flä-ō dė lä bē-yär-drē), **Auguste Charles Joseph, Comte de,** French general and diplomatist, born 1785, died 1870. He had a brilliant career under Napoleon I, but on the return of the Bourbons he left France and lived in exile from 1815 to 1830. He married in England Admiral Lord Keith's daughter, who became Baroness Keith in 1823. He returned to France in 1830, and was Ambassador successively at Berlin, Vienna, and London.

FLAMBARD, Rannulph or **Ralph,** a Norman of humble origin who became the chief minister of William Rufus. He was early connected with the Conqueror's court, and, being handsome, clever, and unscrupulous, he gained great influence with the king, and rose to still greater favour with Rufus, whom he encouraged in his tyrannical and rapacious courses. His flagrant extortions earned the hatred of the people, and his character is painted in the blackest characters by the chroniclers.

In 1099 he was made Bishop of Durham; but on the death of William he was committed to the Tower by Henry I. He managed to escape, however, by a rope conveyed to him in a vessel of wine, and instigated Robert Duke of Normandy, to invade England. He was subsequently forgiven by Henry and restored to Durham, where he afterwards lived peaceably, much engaged in architectural works connected with the city and the cathedral, till his death in 1128.

FLAMBOROUGH HEAD, a headland on the east coast of England in Yorkshire. It consists of a lofty range of chalk cliffs about 6 miles long and from 300 to 450 feet high. On the extreme point of the promontory, at a height of 214 feet above sea-level, is a lighthouse 87 feet high, with a revolving light visible from a distance of 25 miles.

FLAMBOY'ANT, or **GOLD-MOHUR TREE** (*Poinciana regia*), a leguminous tree, a native of Madagascar, but cultivated all over the tropics for the sake of its magnificent crimson and white flowers. It is a feature of the renowned sea-front of Rio de Janeiro.

FLAMBOY'ANT, a term designating a style of Gothic architecture in use in France about the same period with the Perpendicular style in England, that is, from the fourteenth to the sixteenth century, having prevailed during the whole of the fifteenth century. It was distinguished by the waving and somewhat flamelike tracery of the windows, panels, &c. (hence the name), and is usually regarded as a decadent variety of the decorated Gothic.

The mouldings in this style are often ill combined, some of the members being disproportionately large or small. The pillars are cylindrical, either plain or with a few of the more prominent mouldings of the arches continued down them, without any capital or impost intervening. This is so common that it may be regarded as a characteristic of the style. Mouldings also sometimes meet and interpene-

trate each other. The arches are usually two-centred, sometimes semicircular, and, in later examples, elliptical. The foliage enrichments are usually well carved, but the effect is often lost from the minuteness and intricacy of the parts.

FLAME, a blaze rising from a burning body, or any inflammable gas in a state of visible combustion. Flame is attended with great heat, and sometimes with the evolution of much light; but the temperature may be intense when the light is feeble, as is the case with the flame of burning hydrogen gas.

The flame of a candle may be divided into three zones: an inner zone containing chiefly unburned gas, another zone containing partially-burned gas, and an outer zone where the gas is completely consumed by combination with the oxygen of the air.

The luminosity of flame depends upon the presence of extremely small particles of solid matter (usually carbon) or of dense gaseous products of combustion. When the pressure of the gas producing the flame is so great that it is all but flaring, it is found that certain sounds will cause the flame to alter its shape, thus producing the phenomenon of *sensitive flames*.

FLAMEN, among the ancient Romans the name given to any priest devoted to the service of one particular deity. Originally there were three priests so called; the *Flamen Diālis*, consecrated to Jupiter; *Flamen Martiālis*, sacred to Mars; and *Flamen Quirinālis*, who superintended the rites of Quirinus or Romulus. The number was ultimately increased to fifteen, the original three, however, retaining priority in point of rank, being styled *Majōres*, and elected from among the patricians, while the other twelve, called *Minōres*, were elected from the plebeians. The wife of the *Flamen Diālis* was called *flaminica*, and was a priestess of Juno. —Cf. Sir J. G. Frazer, *The Golden Bough*.

FLAME THROWERS. Fire and war have always been associated ideas, and incendiary devices have been employed in battle from prehistoric times. Samson's exploit with the foxes is an early instance, while the mixtures from which the Chinese developed gun-powder were invented for incendiary purposes. The celebrated 'Greek Fire' by means of which Constantinople was defended from the barbarians during the decay of the Eastern Empire is the most memorable example in history, and the composition of this substance was a jealously-guarded secret. In the museum of the Tower of London is the iron lattice frame-work of a mediæval incendiary bomb intended to be thrown from a catapult. Such bombs were made as large as 2 feet in diameter, and red-hot shot for setting on fire hostile ships were much used in naval actions in later days when the use of fire in land-warfare had come to be considered barbarous.

The German use of *Flammenwerfer* in conjunction with poison-gas (q.v.) in 1915 forced the Allied armies to adopt retaliatory measures, because although the actual results achieved by the German flammenwerfer were surprisingly small, the moral effect of an unknown and terrifying weapon is always considerable until its possibilities and limitations can be demonstrated to troops. On its first employment most exaggerated reports of the range and effectiveness of the German flammenwerfer were widespread, and these were not dissipated until specimens had been captured by British troops and examined and tested in the Army Central Laboratory.

The small German flammenwerfer consisted of a tank so shaped and fitted that a man could carry it on his back. This formed the reservoir and was filled about two-thirds full with an easily ignited liquid consisting of a mixture of creosote, wood alcohol, and other wood distillates. To provide means to expel this liquid, nitrogen was forced into the space above the liquid from a cylinder until the pressure was about 200 lb. per square inch. The nitrogen cylinder was then disconnected; a gauge enabled the operator to ascertain whether the pressure was correct. The liquid was discharged through a valve controlled by the operator. This valve was connected by a flexible tube to a length of rigid tube about 4 feet long provided with a nozzle. Ignition was by means of an inflammable ring, which was itself lighted by a percussion cap which was fired by impact of the jet of liquid when the valve was opened. The diameter of the nozzle was about ¼ inch, and the weight of the complete apparatus about 80 lb. The total time of discharge (which could be continuous or in short bursts at intervals) was about 7 seconds, and the maximum range only 28 yards.

When investigation had demonstrated the limitations and more obvious disadvantages of the small German flammenwerfer, the British General Staff wisely decided that apparatus so vulnerable would be useless for offensive purposes, and would prove a source of danger rather than assistance to our troops unless a range

greater than that for bombing (40 yards) could be obtained.

The Germans had a larger device for stationary use in trenches, which weighed about 4 cwt. and had a range of 50 yards. This could have been employed only for defence, because the opposing trenches were always more distant than 60 yards (apart from isolated look-out, listening, bombing, and sentry posts).

The only large apparatus which was employed in offensive operations was the Livens Large Flammenwerfer, a British invention (the work of Captain W. H. Livens, D.S.O., M.C., and Mr. F. H. Livens, M.I.C.E.). This embodied new principles and was designed to operate not from trenches but from the underground mine galleries or Russian saps which were driven out to the enemy trenches along the greater part of the British front. The Livens apparatus had a range of 100 yards, and as the jet could be brought as close to the enemy as was required, and could be swung through a large arc, enemy works on a front of 150 yards could be subjected to fire by each flammenwerfer to a depth of 80 yards.

The apparatus consisted of a long steel barrel built up in sections clamped together; it was 9 inches internal diameter, and could be extended to any required length and oil capacity (it was 30 feet long on occasion). The tube, or barrel, had a floating piston in it and was filled with oil. At the moment of firing, compressed gas was admitted behind the piston, and the piston forced out the liquid through the jet. The jet remained underground until the moment of firing, and was provided with a steel hood, and this hood had a cutting blade, so that the ground above the jet remained unbroken until the signal came to fire, when the jet was forced up under oil pressure, and the steel hood broke through the last few inches of soil. After firing, the jet sank back and nothing, save a small hole indistinguishable among grass and shell-holes, remained to betray the presence of the apparatus. If necessary a system of supply tanks enabled the apparatus to be fired three times consecutively at intervals of a few seconds, and over a ton of oil could be discharged.

This apparatus was used with great success at the commencement of the Somme battle in July, 1916, and also in the taking of High Wood and other difficult positions. The incendiary material used consisted of a mixture of petroleum distillates, the propellent nitrogen or deoxygenated air, the pressure used being about 850 lb. per square inch.

Consideration will make it clear that the only advantage of a flammenwerfer over incendiary bombs and shells is the large area swept by flame, and against this advantage must be set the short range, the necessarily elaborate, vulnerable, and heavy nature of the apparatus, and the large amount of labour involved in installation. With nozzles of known types the distance the liquid is thrown depends upon the diameter of the nozzle as well as upon the application of suitable pressure and the nature of the liquid, and such very large quantities of oil are required to supply large nozzles that 1¼ inches is the maximum size of nozzle that is practicable, and the maximum ranges possible are between 100 and 120 yards when conditions are favourable, and are greatly lessened by cross or head winds.

Flammenwerfer were therefore superseded before the end of the War in the Allied armies by the Livens Projectors. These were created principally for use in gas warfare, and were 8-inch calibre mortars, capable of throwing 65-lb. bombs 2,000 yards. These were fired electrically in salvoes of up to 6,000 mortars at a time, and by means of them woods could be deluged with fire, or lakes of fire several acres in extent could be created over enemy positions, fortifications, and villages.

The Livens Drum (or bomb) consisted of a very light steel sausage-shaped casing, stayed internally by a steel tube containing the fuse parts and bursting charge, and filled for incendiary purposes with cotton-waste balls and a mixture of Mexican fuel oil two-thirds and crude petrol one-third, or thermite, or a spontaneously inflammable liquid containing phosphorus, or a solidified oil mixture. The bursting charge consisted of ophorite (an explosive invented by Professor J. F. Thorpe, C.B.E., F.R.S., which gives an intense flame) or black powder. Incendiary bombs were largely used by aeroplanes and incendiary shells from guns.

Those who wish for information at greater length on this subject will find it in two admirable articles on *Incendiaries in Modern Warfare* by Captain Arthur B. Ray, late C.W.S., in the *American Chemical Society's Journal of Industrial and Engineering Chemistry* (July and Aug. numbers 1921).

FLAMIN'GO, a bird of the genus Phœnicopterus, constituting a family Phœnicopteridæ, coming half-way between storks and geese. Its body is rather smaller than that of the stork, but owing to the great length of the neck and legs it stands from 5 to 6 feet high. The beak is naked, lamellate at the edges, and bent downwards as if broken; the feet are palmated and

four-toed. The common flamingo (*P. roseus*) ranges from Central Europe through Africa, and into Asia as far as Lake Baikal, India, and Ceylon. It is entirely scarlet, except the quill-feathers, which are jet-black. The tongue is fleshy, and one of the extravagances of the Romans during the later period of the empire was to have dishes composed solely of flamingoes' tongues.

The flamingoes live and migrate in large flocks, frequenting desert seacoasts and salt-marshes. They are extremely shy and watchful. While feeding they keep together, drawn up artificially in lines, which at a distance resemble those of an army; and, like many other gregarious birds, they employ some to act as sentinels, for the security of the rest. Their food appear to be mollusca, spawn, crustaceans, &c., which they fish up by means of their long neck, turning their head in such a manner as to take advantage of the crook in their beak. They breed in companies in inundated marshes, raising the nest to a certain height by heaping up the mud with their feet into a small hillock, which is concave at the top. In this the female lays her eggs, and it was formerly believed that she sat on them with her legs hanging down, like those of a man on horseback. But the nests are not so high as to allow of this, and the birds really sit with their legs doubled up under them. An American species of flamingo is *P. ruber*, which ranges from Florida to South America, and there are three species peculiar to the latter.

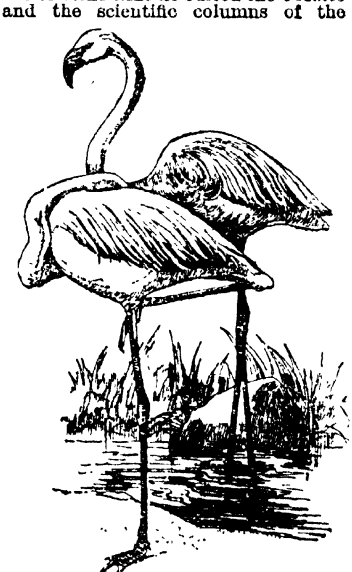
FLAMINIAN WAY (*Via Flaminia*), the principal northern road which led from ancient Rome. It was constructed by C. Flaminius the elder in 220 B.C. during his censorship, and led from Rome to Ariminum (Rimini) on the Adriatic, 222 miles. Remains of it are yet extant in various places.

FLAMINI'NUS, Titus Quinctius, Roman general, born about 230 B.C., died about 174. He was quæstor in 199, consul in 198, terminated the Macedonian War by the defeat of Philip at Cynoscephalæ 197, and proclaimed at the Isthmian games in 196 the independence of Greece.

FLAMIN'IUS, Gaius, Roman general, was tribune in 232 B.C., prætor in 227, consul in 223, censor in 220, and again consul in 217. He had a triumph for defeating the Insubrian Gauls; and during his censorship (220 B.C.) he constructed the Flaminian Way and built a circus. In 217 he was sent against Hannibal into Etruria, and was defeated and killed

FLAMMARION, Camille, French astronomer, born at Montigny-le-Roi (Haute-Marne) on 26th Feb., 1842. He first studied theology at Langres, which perhaps accounts for the mysticism pervading some of his works. In 1858 he came to Paris, entered the Observatory as a student, and was transferred in 1862 to the Bureau des Longitudes. He made several balloon ascents for the purpose of studying the upper regions of the atmosphere.

For some time he edited the *Cosmos* and the scientific columns of the



Flamingoes
(Phœnicopterus roseus)

Siècle, and in 1882 he founded the monthly magazine *L'Astronomie*. Flammarion also started the French Astronomical Society in 1887, and several other societies both in France and in the United States. He is one of the most imaginative and popular writers on astronomy. His works include: *Les Mondes imaginaires et les mondes réels* (1864), *La Pluralité des mondes habités* (1862), *Dieu dans la nature* (1866), *Les Merveilles Célestes* (1865), *Voyages Aériens* (1868), *Histoire du ciel* (1872), *L'Atmosphère* (1872), *Les Terres du ciel* (1884), *Le Monde avant la création de l'homme* (1886), *Uranie* (1892), *La Fin du monde* (1893), *L'Inconnu et les prob-*

FLAMMENWERFER. *See* FLAME THROWERS.

FLAMSTEED, John, the first Astronomer Royal of England, was born 1646, died 1719. He graduated at Cambridge in 1674, took orders in the Church, but devoted himself chiefly to mathematical and astronomical pursuits. He was appointed by Charles II astronomical observator to the king, and carried on his observations at the Queen's House at Greenwich, until the observatory was built for him in 1676. Here he passed his life, formed the first trustworthy catalogue of fixed stars, and supplied the lunar observations by means of which Newton verified his lunar theory. His great work *Historia Cœlestis Britannica* was finished in 1723. In 1832 the discovery of a collection of his letters disclosed a protracted quarrel between him and Newton.

FLANDERS, a region of Europe now included in Holland, Belgium, and France, stretching along the North Sea. The erection of the territory into a county took place in the ninth century, and was made by Philip the Bold, King of France, in favour of his son-in-law, Baldwin. It afterwards passed to the united Houses of Spain and Austria, and ultimately to the latter, but underwent considerable curtailment by the conquests of the French in the west, when part of it became French Flanders, and by the conquests of the Dutch in the north. The remainder still retains its ancient name, and forms the modern provinces of East and West Flanders, in Belgium.

East Flanders, the Belgian province of *East Flanders* (Fr. *Flandre Orientale*) has an area of 1,147 sq. miles. The surface forms an extensive plain, sloping gently eastwards. It wholly belongs to the basin of the Scheldt. Its soil, partly of a sandy and partly of a clayey nature, is so industriously and skilfully cultivated that it has the appearance of a vast garden. The principal crops are wheat and flax. Linen, laces, and damask are among the important manufactures. Gand or Ghent is the capital. Pop. (1931), 1,157,386.

West Flanders (Fr. *Flandre Occidentale*) has an area of 1,249 sq. miles. The surface is generally flat; the soil naturally sandy and poor, but well cultivated and fertilized, though not so productive as that of East Flanders. The most important branch of industry is linen. Great quantities of lace also are made. Bruges is the capital.

Flanders has always been 'the cock-pit of Europe,' and during the European War (q.v.) it was the scene of some of the fiercest and most prolonged battles. Ypres especially, as being the key to the Channel Ports, was the chief storm-centre of the fighting of the British and Imperial armies. The three Battles of Ypres, each including many subsidiary battles, took place in 1914, 1915, and 1917. Pop. (1931), 911,760.

FLANGE, a rib or rim which is given to an object for the purpose of strengthening it or limiting its position or motion, for example, the top and bottom flanges of an 'I' girder, the flange of a railway wheel, the flanges on the end of a pipe by which one pipe is attached to the next by means of screw-nuts and bolts.

FLANK, in fortification, that part of a work which affords a lateral defence to another. In military tactics flank signifies the outer extremity of the wing of an army, or of any division of an army, as of a brigade, regiment, or battalion.

FLANNAN ISLANDS, or **SEVEN HUNTERS,** a group of uninhabited rocky islands in Scotland, in the Outer Hebrides, county of Ross and Cromarty, 21 miles W.N.W. of Lewis. They contain some ancient monuments supposed to be religious.

FLANNEL, an all-wool fabric, woven plain, and at one time largely used for all kinds of underwear. Its only defect was the natural property of shrinking brought about by the milling or fulling action due to absorption of perspiration and to repeated washings. The wool may now be treated to minimize this defect, but within the last two decades such cloth has been largely supplanted by various kinds of hosiery fabrics, and somewhat similar open-work woven fabrics for next-to-skin wear.

Flannel cloth is still largely used for children's underwear, sports suits, shirts, and the like, either in whites, greys, fawns, or decorated with coloured stripes. The cloth is made in all the countries of the United Kingdom, but principally in West Yorkshire, East Lancashire, West of England, and Wales. Union flannel (so-called) shirtings are often striped with cotton threads for cheapness and to minimize shrinkage.

FLANNELETTE, an all-cotton fabric, made to imitate flannel as much as possible in appearance by raising mechanically the soft thick cotton weft to form a nap or fluffy surface on both sides of the fabric. It is woven either plain or twill, almost invariably contains attractive coloured stripes, and is used extensively and almost exclusively for sleeping garments and underclothing. On account of the exuberance of projecting fibres, the fabric is easily set on fire, and hence

caution should be exercised when wearing flannelette clothing. Newly manufactured flannelette is often treated to resist combustion.

FLASH BOILER, a small tubular boiler into which a spray of water is injected which almost instantly vaporizes into steam. These boilers are used on steam-driven motor-buses, and work at a high pressure, some 500 to 600 lb. per square inch.

FLASH POINT. *See* PETROLEUM.

FLAT, a character or sign in music, used to lower or depress, by the degree of a semitone, any note in the natural scale. It is marked thus ♭. An *accidental flat* is one which does not occur in the signature, and which affects only the bar in which it is placed.

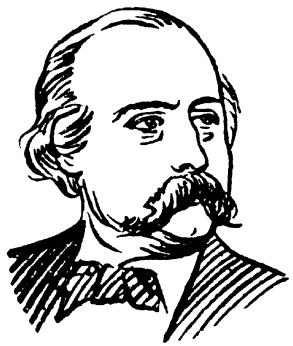
FLAT-FISH, a fish which has its body of a flattened form, and swims on one side. The side facing downwards is pale in colour, while that facing upwards is dark and bears both the eyes. In turbot and brill the eyes are on the *left* side, but they are on the *right* side in plaice, flounder, dab, halibut, and sole. The sense is sometimes extended to other fishes which have the body much compressed from above downwards, as the skate and other members of the ray family.

FLATHEAD INDIANS, a name applied to several different American tribes that flatten the skull of the infant by pressure. The practice is now nearly extinct. In the United States the Catawa and Choctaw in the south-east were known as Flatheads, but nearly all the Muskhogean, Natchez, and Tonika tribes were addicted to the practice of artificial deformation of the head. On the north-west coast most of the Salish of Puget Sound and British Columbia, the Chinook of Columbia River, and many of the Indians of Vancouver Island were known collectively as Flatheads. But the Salish proper, now known in official reports as Flatheads, never flattened the head. Cranial deformation is a widespread practice in parts of Europe, Asia, Oceania, and America, and is one of the most striking illustrations of the spread of culture in ancient times.

FLAUBERT (flō-bār), **Gustave,** French novelist, was born in 1821 at Rouen, died in 1880. He received his preliminary education in his native town, afterwards going to Paris to study law; but he soon gave this up and devoted himself to literature. He first became famous in 1857 as the author of *Madame Bovary*, a realistic study of contemporary life.

In 1858 he travelled in Tunisia, and four years later published the historical romance *Salammbô*, depicting the life and manners of ancient Carthage. *L'Education sentimentale* (1869) was a return to the style of *Madame Bovary*. The phantasmagoria *La Tentation de Saint Antoine*, and his play *Le Candidat*, appeared in 1874. In 1877 he produced *Trois Contes*, a set of three stories, one of which was *Un Cœur simple*, and was engaged upon another novel, *Bouvard et Pécuchet*, at his death. His posthumous works include: *Lettres à George Sand* (1884), *Par les champs et par les grèves* (reminiscences of a tour in Brittany in 1847), &c.—BIBLIOGRAPHY: E. Faguet, *Flaubert*; M. du Camp, *Souvenirs Littéraires*.

FLA'VEL, John, nonconformist divine, born in Worcestershire 1627, died at Exeter 1691. He was curate at



Flaubert

Deptford and Dartmouth, but was ejected under the Act of Uniformity, when he continued to preach privately. After the fall of the Stuarts he returned to Dartmouth. His works, among which is *Husbandry Spiritualized*, were long immensely popular.

FLAVIN (Lat. *flavus*, yellow), a yellow dye, with colouring matter of which is quercitrin. It is contained in quercitron bark, and is extracted from the bark by treating first with alkali and then with acid. Flavin has much greater tinctorial power than quercitron bark and yields with aluminium and tin mordants very brilliant colours.

FLAX, the common name of the plants of the genus Linum, nat. ord. Linaceæ. It is supposed that there are nearly a hundred of the species, but the one which is cultivated specially, either for the production of linseed or for flax fibre, is that known as *Linum Usitatissimum*. This plant grows in most of the temperate regions as well as in warm ones, rises to a height of about 3 feet, has lanceolate leaves, and

bears small flowers—usually of a pale blue colour, but occasionally white. When the plants are required for fibre-producing purposes, the seeds are sown rank, but if linseed and oil are the products desired, a smaller quantity of seed per acre is sown. The seeds obtained from plants which have been grown specially for fibre are not so good as those where the plants are less rank in the field, and which have been grown solely for seed.

When the flowers begin to droop, and the leaves turn yellowish, the harvesting of the plants is commenced. All flax plants for fibre are pulled up by the roots, tied together in small bundles, and arranged neatly in large crates. These crates, with their charge, are then submerged in specially prepared ponds or else in slowly running streams; in the latter case the crates are moored to the bank for safety. Fermentation commences almost immediately, and, after a few days—the time depending upon several conditions—the bast layer, which contains the fibres, is found to be capable of being stripped easily from the stalk. This operation of steeping is technically termed *retting*.

When the stalks reach the above condition, they are removed from the crates and placed in the field in stooks to dry. Subsequently, the stalks are *rippled*, that is, the upper ends drawn between the teeth of a coarse comb, which results in the seed-bolls being separated from the stalks or stems. At other times the stalks are passed between a pair of rotating rollers so set that they break the seed-bolls without damaging the seed.

From this point the two products pass to different industries. The seed may be used in this state after it has been cleaned and polished, or it may be crushed in order to extract the oil, in which case the residue, called linseed-cake, is used as food for cattle. The stalks are taken to the breaking and scutching department. The breaker consists of a number of pairs of fluted rollers, and, as its name implies, breaks the woody part of the stalk without damaging the fibrous layer. The latter is then taken to the scutching-mill, which consists of a number of blades fixed radially to a rotating centre. A fixed board is used in conjunction with the rotating boards or blades, and about one-half of the fibrous layer at a time is passed through a slot in this fixed board and hangs between it and the rotating blades; the remaining woody or barky matter left in after breaking is literally scraped from the fibrous layer by the scutcher, so that this layer may be as clean as possible before it undergoes the first operation in a so-called spinning-mill.

The flax fibre, according to quality, may then be made into *line* or *tow*; the former is the best, and is a result *inter alia* of a hackling process, while the tow is less valuable than line, and is due to a carding process. Both types are ultimately made into *sliver* form (a thin ribbon-shaped and continuous collection of fibres), and these slivers are doubled, i.e. two or more are joined, drawn, roved, and spun, by elaborate types of machines, into yarns of various thicknesses and qualities. These yarns are subsequently used in the single state as warp and weft in the manufacture of various kinds of linen goods, e.g. sailcloth, tent duck, table, bed, and household linen generally and for many kinds of ornamented fabrics. Two or more of the above single yarns may be compounded (twisted together) to form more valuable substances for cloth-making, or they may be similarly twisted for use as threads, twine, fishing-lines, or the like, or knitted into garments or nets.

The finest grades of flax, which may be used in the manufacture of lace, cambric, lawn, and similar delicate and light structures, can be drawn and spun to very fine yarns, so fine that it may require more than 100,000 yards in length to make one pound in weight.

In normal times Russia is by far the greatest flax-producing country, but large quantities of superior fibre are grown in other continental countries and in Ireland, while recently increased amounts have been grown in England and Scotland.—*Cf.* H. R. Carter, *Flax and its Products*.

FLAXMAN, John, one of the most distinguished English sculptors, born at York 1755, died in London 1826. His earliest ideas on art were derived from casts in the shop of his father, who sold plaster figures, from many of which young Flaxman made drawings and models in clay. In 1770 he was admitted a student of the Royal Academy, and for some time earned a living by producing designs and models for Wedgwood the potter. He also began the series of sepulchral monuments which were ultimately his chief source of livelihood.

In 1787 he went to Italy, where he remained seven years, producing some important sculpture, and winning fame by his designs in outline to illustrate Homer, Dante, Æschylus, and later (1817) Hesiod. In 1794 he returned to England, where he was diligently occupied with his professional pursuits until his death. He had been elected an associate of the Royal Academy in 1797, royal academician in 1800, and in 1810 was appointed professor of sculpture to that institution.

Works. His works are very numerous, and are to be found all over the country, a considerable number being in St. Paul's Cathedral and Westminster Abbey, a notable example being the monument of Lord Mansfield. They include public monuments in the round, memorials for churches, and classical and ideal pieces. His best works are his simple monuments in relief. A large collection of casts from the original models is preserved in University College, London.—Cf. A. Cunningham, *Lives of the most eminent British Painters, Sculptors, and Architects.*

FLAX, NEW ZEALAND, a fibre obtained from a plant belonging to the ord. Liliaceæ, the *Phormium tenax.* It is indigenous in New Zealand and Norfolk Island, and grows in great tufts with sword-shaped leaves sometimes 6 feet long. The long spike, bearing a large number of yellow flowers, rises from the centre of the leaves. The thick leathery leaves contain a large quantity of good strong fibre, which is used by the natives of New Zealand for making cloth, nets, &c. Considerable quantities of this flax (or hemp) are imported into Britain, being used for ropes, twine, &c. Cloth has also been made of it. The plant has been introduced into European culture.

FLEA, a name for blood-sucking insects regarded by entomologists as constituting a sub-order of the two-winged flies (Diptera), termed Aphaniptera because the wings are inconspicuous scales. All the species more or less resemble the common flea (*Pulex irritans*). The body is laterally compressed, and the mouth-parts are modified into piercing stylets and a suctorial proboscis. The flea is remarkable for its agility, leaping to a surprising distance, and its bite is very troublesome. Eleven species of flea are known to spread the germs of plague, especially one (*Xenopsylla cheopis*) that is parasitic on rats. The sand-flea (*Sarcopsylla penetrans*), chigoe, or jigger of tropical America, is a serious pest, for its eggs are deposited in the feet of human beings, causing painful swellings.

FLEABANE, a name popularly given to several composite plants from their supposed power of destroying or driving away fleas, as the species of the genus Conyza, which were believed to have this power when suspended in a room. The common fleabane is *Pulicaria dysenterica,* found in moist sandy places in the south of England. Its smoke was supposed to expel fleas. The blue fleabane is *Erigeron acre,* common on dry banks.

FLEA-BEETLE, the name given to different species of small springing beetles which are destructive to plants. The turnip-flea (*Haltica nemorum*), whose larvæ are sometimes so destructive to young turnips, furnishes an example. It is popularly, but erroneously, called the turnip-'fly.' An allied species (*H. concinna*) is very destructive to hops.

FLÈCHE (flāsh), **LA,** a town in France, department of Sarthe, on the right bank of the Loir, 25 miles south-west of Le Mans. It contains a military college, occupying part of the extensive buildings of a former college belonging to the Jesuits. Pop. 10,830.

FLECKER, James Elroy, English poet and dramatist. He was born at Lewisham, 5th Nov., 1884, and was out East in the consular service from 1910–13. He died of consumption at Davos Platz on 3rd Jan., 1915. A poet of great individuality and high quality, his brilliant play, *Hassan,* was published posthumously and produced in 1923.

FLECKNOE (flek'nō), **Richard,** an English poet and dramatic writer, said to have been a Roman Catholic priest, contemporary with Dryden, and chiefly memorable for having had his name gibbeted by that satirist in the title of his satire against Shadwell (*Mac Flecknoe*). He died in 1678.

FLEECE, coat of the living sheep removed at one shearing. The interlocking of adjacent hairs renders the shorn clip fairly coherent. Fleece wools are distinguished from dead wools, which are not derived from the living animal. The fleece, after the shearing with hand or power implements, is roughly trimmed and bundled together ready for baling. After reaching the market or factory it is opened, examined and classified, cased fleeces being those of approximately similar quality. *See* GOLDEN FLEECE.

FLEET, river of London, now merely an underground stream. It rose at Hampstead and fell into the Thames at Blackfriars. Its northern part was called the Holbourne and the rest the Fleet Ditch. In the 18th century it was covered in and became a sewer. Its lower course was roughly along Farringdon Rd., Farringdon St., and New Bridge St.

The Fleet gives its name to Fleet St., noted as the centre of the newspaper life of the country. This runs parallel with the River Thames, from the Strand to Ludgate Circus.

FLEET MARRIAGES, irregular marriages performed without licence by needy clergymen in the Fleet Prison, London, from about 1616 till they were suppressed by the Marriage

Act of 1754. These clergymen were ready to marry any couples that came before them for a fee proportioned in amount to the circumstances of those who were married. Sometimes a dram of gin was thought sufficient; at other times the fee was rather exorbitant. Registers of these marriages were kept by the officiating parties, and a collection of these books, purchased by Government in 1821, amounted to between 200 and 300 large registers, and upwards of 1,000 smaller books. These books were inadmissible as evidence in a court of justice.—Cf. J. Ashton, *The Fleet: its River, Prison, and Marriages.*



The Yard of Fleet Prison

FLEET PRISON, once a celebrated prison in London till it was pulled down in 1845. It stood on the east side of Farringdon Street, and on this site a prison was in existence as early as the twelfth century, which took its name from the creek or stream of the Fleet, on the bank of which it was erected. Used as a prison for religious martyrs during the reigns of Mary and Elizabeth, and for political offenders in the reign of Charles I, it became in 1641 a place of confinement for debtors, and served as such down to the period of its abolition. It was burned by Wat Tyler in 1381, at the Great Fire in 1666, and by the Gordon rioters in 1780. It was the scene of many disgraceful abuses, and was called by Pope the 'Haunt of the Muses,' from the number of poets who were confined in it.

FLEET, urban district of Hampshire. It is 36¾ miles from London, on the S. Rly. Fleet Pond, covering nearly 100 acres, is one of the largest sheets of water in the S. of England. At Church Crookham, 2 miles away, tobacco is grown. Pop. (1931), 4,528.

FLEETWOOD, a seaport and watering-place in England, in the county of Lancashire, on the Wyre, near its entrance into Lancaster Bay, 22½ miles north-west of Preston. The harbour is safe and commodious, and there is a large coasting trade. Passenger steamers sail daily from Fleetwood to Belfast. Rossall School is situated close at hand. Pop. (1931), 22,983.

FLEMING, Marjorie, Scottish child immortalized by Sir Walter Scott. She only lived for eight years, 1803 to 1811, but during that time she showed remarkable precocity. She read a good deal and wrote poems, and diaries. Sir Walter Scott saw her at the house of his aunt, Mrs. Keith of Ravelston, and took a great interest in her. Dr. John Brown in *Horae Subsecivae* wrote about her, and her life was written by H. B. Farnie. It is called *Pet Marjorie.*

FLEMING, Sir Sandford, Canadian engineer. He was born at Kirkcaldy, Fifeshire, on 7th Jan 1827, and went

to Canada as a youth. He took an important part in the preliminary survey for a Canadian transcontinental railway, and later, in the establishment of a cable between Canada and Australia. He was largely responsible for the introduction of unified time reckoning, or standard time (q.v.), throughout the world. Died 22nd July, 1915.

FLEMINGS, name used for the inhabitants of Flanders (q.v.). Many of them settled in England at various times, especially in the eastern counties. They brought with them the weaving industry, and there are evidences of their activities at Dedham and elsewhere in Essex, and the adjacent counties. In the 12th century Henry I settled some of them in Pembrokeshire and that neighbourhood, but they were disliked and often attacked by the Welsh.

To-day Belgium is inhabited by Flemings, who speak Dutch and inhabit Flanders and other parts in the north-west of the country, and Walloons who speak French and live in the south-east.

FLEMISH LANGUAGE AND LITERATURE, the Flemish or Vlaemisch language is a form of Low German, differing only slightly in pronunciation and orthography from the Dutch. It is spoken by a considerable number of the inhabitants of Belgium, especially in the provinces of East Flanders, West Flanders, Antwerp, Limburg, and Brabant. A fragment of a prose translation of the *Psalms* upwards of a thousand years old is the oldest extant specimen of the Flemish.

The 'father of Flemish poetry,' Jakob van Maerlant, wrote several romances dealing with Merlin and the Holy Grail, *The Mirror of History*, and other works, in the thirteenth century; and a version of *Reynard the Fox* belongs to the same period. The fourteenth century was remarkable for the number of wandering poets, authors of knightly romances. The translation of the Bible, which is considered the standard for the construction and orthography of the language, was finished in 1618.

The eighteenth century produced several good writers on philology, but was barren in poetic genius. The French almost annihilated the native literature, and it did not revive till the revolution of 1830, since which time it has been very vigorous. The leaders in this revival were Willems, Blommaert, Van Ryswyck, Hendrik Conscience, Van Duyse, Snellaert, Snieders, De Laet, Dedecker, David, and Bormans. Among modern Flemish writers are: Guido Gezelle, Hilda Ram, Cyrill Buysse, Baekelmans, Max Rooses, Pol de Mont, and Frans de Potter.—

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FLEMISH SCHOOL OF PAINTING. *See* PAINTING.

FLENSBURG, formerly **FLENSBORG**, a seaport of Germany in the Prussian province of Schleswig-Holstein, at the west end of the fiord of same name, 19 miles N.N.E. of the town of Schleswig. It is now the most important town in Schleswig. There were disturbances in the town in Sept., 1919, during the Schleswig-Holstein plebiscite, taken in accordance with the terms of the Treaty of Versailles. Pop. 63,139.

FLERS (flăr), a town in France, department of Orne, 37 miles north-west of Alençon. It contains the remains of a fine old castle, and has manufactures of linen and bleachworks. Pop. 13,810.

FLESH, a compound substance forming a large part of an animal, consisting mainly of the muscles, with connective tissue, and the blood-vessels and nerves supplying them. It consists chiefly of fibrin, with albumen, gelatin, hæmatosin, fat, phosphate of sodium, phosphate of potassium, phosphate and carbonate of calcium, sulphate of potassium, and chloride of sodium. The solid part is, besides, permeated by an alkaline fluid, called flesh-juice. It has a red colour, and contains dissolved a number both of organic and inorganic substances. The organic matter consists of albumen, casein, creatine, and creatinine, inosic and several other acids; the inorganic, of alkaline sulphates, chlorides, and phosphates, with lime, iron, and magnesia.

FLESQUIERES, a village of France, department Nord. Heavy fighting took place here during the European War. The village, taken by the British on 21st Nov., 1917, and evacuated in March, 1918, was retaken in Sep., 1918.

FLETA, a Latin commentary upon English law, said to have been written in the Fleet Prison in the reign of Edward I. It has been attributed to William de Brampton, and also to Thomas de Weyland, J. de Lovetot, and Adam de Strutton. It is impossible to determine the author, unless further evidence is discovered. Sir W. S. Gilbert gave the name Fleta to one of the fairies in his opera *Iolanthe: or the Peer and the Peri.*

FLETCHER, word meaning a maker of arrows. One of the London livery companies is called the Fletchers. This was united with that of the bowyers or makers of bows. The offices are at 4 Broad Street Place, London, E.C.2.

FLETCHER, Andrew, a Scottish political writer, the son of Sir Robert Fletcher of Saltoun, born in 1653, died in London 1716. He opposed the court in the Scottish Parliament, and had to retire to Holland. In 1685 he joined the enterprise of the Duke of Monmouth. He afterwards took refuge in Spain and in Hungary, and returned to England at the Revolution. He brought forward measures to secure the religion and liberties of the nation on the death of the queen (Anne), and carried various limitations of the prerogative, forming part of the Act of Security, rendered nugatory by the Scottish union, which he vehemently opposed.

FLETCHER, Giles, brother of Phineas Fletcher and cousin to the dramatist John Fletcher, an English poet and clergyman, born 1580, died 1623. He published *Christ's Victory and Triumph over Death* in 1620.

FLETCHER, John. *See* BEAUMONT AND FLETCHER.



Fleur-de-lis
1, Early form. 2, Middle Ages. 3, Renaissance. 4, Louis XIV

FLETCHER, Phineas, brother of Giles, born 1584, died 1650. He entered Cambridge in 1600, and was rector of Hilgay, Norfolk. Among his works are: *The Locusts, or Apollyonists,* a satire against the Jesuits; *Sicelides,* a dramatic piece; *The Purple Island*; and *Piscatory Eclogues.*

FLETTON, district of Northamptonshire and Huntingdonshire. Some part of it is within the city of Peterborough, but another form is the urban district of Old Fletton. Pop. (1931), 7,480. The district is famed for its enormous brickfields from which the popular Fletton brick is obtained.

FLEUR-DE-LIS (*fleur-dê-lē'*; Fr., 'flower of the lily'), in heraldry, a bearing as to the origin of which there is much dispute, some authorities maintaining that it represents the lily, others that it represents the head of a lance or some such warlike weapon. The fleur-de-lis was for long the distinctive bearing of the Kings of France.

FLEURUS (*fleu-rüs*), a town of Belgium, province of Hainaut, 7 miles north-east of Charleroi. In the vicinity, in 1690, the French under Marshal Luxembourg defeated the Germans under Prince Waldeck; and in 1794 the French republican forces under Marshal Jourdan defeated the Austrian army. Pop. 6,600.

FLEURY (*fleu-rê*), **Andre Hercule de,** cardinal and Prime Minister of Louis XV, was born in 1653, died in 1743. In 1698 Louis XIV gave him the bishopric of Fréjus, and shortly before his death appointed him instructor to Louis XV. After the death of the regent in 1723 he proposed the Duc de Bourbon as first minister, but in 1726 he overturned the Government which he had himself set up, and from that date kept the direction of affairs in his own hands. In the same year he was made a cardinal. The internal affairs of France prospered under his administration, but his foreign policy was unfortunate.

FLEURY, Claude, French writer, born 1640, died 1723. He was educated in the Jesuit College at Clermont, and after beginning to practise as a lawyer resolved to take orders. In 1672 he became the tutor of the young Princes of Conti, and afterwards associated with Fénelon in the education of the young Dukes of Burgundy, Anjou, and Berri. In 1716 he became confessor to Louis XV. He had procured admission into the Academy in 1696 by several important works, among which the best known are his *Histoire du droit français, Mœurs des Israélites, Mœurs des Chrétiens, Institution au droit ecclésiastique, Histoire Ecclésiastique.*

FLIEDNER (*flēd'nĕr*), **Theodore,** D.D., German clergyman and philanthropist, born 1800, died 1864. He became pastor of Kaiserswerth in 1822, but found his life-work in prison reform; the institution of a Protestant order of deaconesses for the relief of the sick, the poor, and the fallen; and the establishment of schools and training-colleges.

FLIGHT, navigation of the air. Human flight, the study of which is termed aeronautics, is a development of modern times. The solution of the many problems of flight are dependent upon meteorology for knowledge of atmospheric conditions, engineering experience, the study of physics, and the effect of air upon fuel combustion. With Langley's early studies of the flight of flat surfaces and Lilienthal's experiments with curved surfaces, gliders came into being, and the development of the internal combustion engine made possible the aeroplane and airship. *See* AERONAUTICS; GLIDER.

FLIGHT LIEUTENANT, officer of the Royal Air Force. He ranks above a flying officer or observer and below a squadron leader. The equivalent rank in the navy is lieutenant, and in the army captain.

FLINDERS, Matthew, English navigator, celebrated for his Australian discoveries, born in Lincolnshire 1774, died 1814. He went to Australia in 1795, and discovered Bass Strait in 1798. In 1801 he obtained from the British Government the command of an expedition to explore the Australian coasts, in which he spent two years. Returning home, he was taken prisoner by the French at Mauritius, and detained till 1810, after which he published his *Voyage to Terra Australis*. *Flinders Island* (off the north-east coast of Tasmania) was named after him, also Flinders River in Queensland.

FLINT, Robert, Scottish theologian and philosopher, born near Dumfries in 1838, died in 1910. Educated at Glasgow University, he became minister at Aberdeen in 1859 and of Kilconquhar in 1862. In 1864 he was appointed to the chair of moral philosophy at St. Andrews University, and in 1876 to that of divinity at Edinburgh University. He was Stone lecturer at Princeton University in 1880, and Croall lecturer at Edinburgh in 1887–8. His works include: *Christ's Kingdom upon Earth* (1865); *Philosophy of History in Europe* (1874); *Theism and Anti-theistic Theories* (1877); and *On Theological, Biblical, and other Subjects* (1905).

FLINT, or FLINTSHIRE, a maritime county in North Wales, consisting of two separate portions, a larger and smaller, the latter being distant 6 miles S.E. from the main portion, and separated from it by Denbighshire; total area, 163,707 acres, of which three-fourths is under crops or in pasture. A range of hills of moderate elevation intersects the county lengthways south-west to north-east. There are numerous well-watered and fertile valleys, including a portion of the celebrated Vale of Clwyd. The county is rich in minerals, particularly lead, the mines of which are productive. Coal also abounds, and copper is obtained in considerable quantities. Flint returns one member to Parliament. Pop, (1931), 112,849.

Flint. Formerly county town, a municipal borough and seaport on the estuary of the Dee, 13 miles S.W. of Liverpool. In the vicinity are extensive alkali-works and several lead- and coal-mines. There are also large copper-works. The shipping trade of the port is small. A little north-east of the town, on the shore of the estuary, stands the ancient castle of Flint, commenced by Henry II and completed by Edward I. It was the prison of Richard II, and has remained in ruins since 1667. Formerly a parliamentary borough, Flint was disfranchised in 1918. Pop. (1931), 7,635.

FLINT, minutely crystalline silica of a bluish-grey or greyish-black colour, weathering white or yellowish-brown. It usually occurs in nodules or rounded lumps as a chemical replacement of limestone. Its surface is generally uneven, and covered with a whitish rind or crust, the result of weathering or of the action of water percolating through the rocks. It is very hard, strikes fire with steel, and is used as an ingredient in glass and in all fine pottery ware. The fracture of flint is perfectly conchoidal; though very hard, it breaks easily in every direction, and affords very sharp-edged splintery fragments, formerly made into arrow-heads, &c. *See* FLINT IMPLEMENTS.

In England, flint is most typically seen in the Upper Cretaceous chalk, in which it is formed as a series of concretions arranged in zones parallel with the stratification. The silica in sponges and in other marine animals which lived on the sea-floor while the chalk was being deposited no doubt furnished the silica thus concentrated along certain zones.

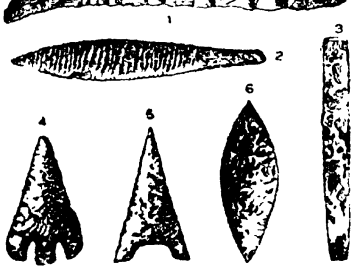
FLINT-GLASS, a species of glass, so called because pulverized flints were originally employed in its manufacture. It is extensively used for domestic purposes. Its dispersive power in regard to light renders it invaluable in the manufacture of the object-glasses of telescopes and microscopes, as by combining a concave lens of flint-glass with one or two convex lenses of crown-glass, which possesses a much lower dispersive power, a compound lens is formed in which the prismatic colours arising from simple refraction are destroyed, and the lens rendered achromatic. Quartz and fine sand are now substituted for flint in the manufacture of this glass. *See* GLASS.

FLINT IMPLEMENTS AND WEAPONS. According to those who believe that Eoliths were shaped by man, flint working dates back to the Second Interglacial epoch, or an even earlier period. The Lower Palæolithic Age flints have been classified as Chellean, Acheulian, and Mousterian, and were worked by Neanderthal man. A new technique was introduced into Europe from North Africa by Cro-Magnon man (about 20,000 B.C.) at the beginning of the Upper Palæolithic period, which has been divided into the three cultural stages, Aurignacian, Solutrean, and Magdalenian.

The Solutrean technique was extremely fine, distinctive forms being the leaf-shaped flint lances and delicately worked flint gimlets. In ancient Egypt the Solutrean technique reached a high pitch of development. No finer flint artifacts than Solutrean were

ever produced in ancient times. The Magdalenian flints are of poorer quality and workmanship than even the Earlier Aurignacian. During this cultural stage in Europe bone and horn implements and weapons were more in use than those of flint.

The transition period between the Palæolithic and Neolithic Ages is divided into Azilian, Tardenoisian, and Maglemosian —contemporary cultures. Tardenoisian flints were chiefly microliths, or 'pigmy flints' of geometric forms. They are widely distributed, being found on the North African coast, in Central and Western Europe and the British Isles, and as far eastward in Asia as India. Azilian is Iberian, and Maglemosian is Nordic.



Neolithic Flint Implements and Weapons
1, Knife. 2, Knife or dagger. 3, Chisel. 4, 5, and 6, Arrow-heads
From specimens in the British Museum and the Museum of Practical Geology

The Neolithic technique was begun by giving an edge to flaked flint axes by polishing on a grinding-stone. Sir John Lubbock (afterwards Lord Avebury) was the first to apply to the cultural Ages the terms Palæolithic (Old Stone), during which flint was flaked, and Neolithic (New Stone), during which it was polished. Flint chipping, however, continued through out the Neolithic Age.

Some backward peoples are still producing flint artifacts. Flint knives are used for ceremonial purposes by other peoples, including the Jews, who circumcise with a Solutrean blade. The earliest use of flint for religious purposes has been traced back to Solutrean times, when leaf-shaped lances, too delicate for use, were stained red and deposited, possibly as votive offerings, in quantities. One of the earliest representations of Hathor, the Egyptian cow-goddess, is in flint—a flint cow. The original thunder-bolts or hammers of gods like Zeus (Jupiter), Thor, and Indra were of flint.

In the Far East, as in Europe, flint artifacts are supposed to be thunder-bolts, rings, axes, or arrows flung by gods or fairies and elves. Flint arrow-heads, &c., were worn as charms after the introduction of metal working. Weapons were supposed to be inhabited by spirits and were worshipped. In ancient Egypt the axe (*neter*) was a symbol of divinity. The sacred axe of Crete was an important religious symbol. It was no doubt because weapons were anciently sacred that so much lore gathered round flint arrow-heads, stone axes, &c., after these went out of use.—BIBLIOGRAPHY: Lord Avebury, *Prehistoric Times*; Osborn, *Men of the Old Stone Age*; W. J. Sollas, *Ancient Hunters*; J. Reid Moir, *Pre-Palæolithic Man*.

FLINT-LOCK, a musket-lock in which fire is produced by a flint striking on the steel pan. Since the invention of the percussion lock by Rev. Alexander Forsyth (adopted about 1836) flint-locks have become obsolete.

FLOATING BATTERIES, batteries erected either on simple rafts or on hulls of ships, for the defence of a coast or for the bombardment of an enemy's ports. They were used notably at the siege of Gibraltar (1779–83) and during the Crimean War (1854).

FLOATING DEBT, name given to that part of the national debt which is not funded or converted into consols, war loan, etc. It consists of exchequer bonds, treasury bonds, savings certificates, etc.

FLOATING ISLAND, an island formed in a lake or other inland water, consisting generally of a mass of earth held together by interlacing roots. Sometimes such islands are large enough to serve as pasture grounds. Such islands are found in many lakes of England, France, and Prussia, and are common in the White Nile. Artificial floating islands have been formed by placing lake mud on rafts of wicker-work covered with reeds.

FLOATSTONE, a porous variety of opal of a spongy texture, whitish-grey in colour, so light as to float in water. It frequently contains a nucleus of common flint.

FLOBECQ (flō'bek), a town of Belgium, province of Hainaut, 20 miles N.E. of Tournai. Pop. 4,070.

FLOCCULATION, the process by which extremely fine particles of mineral matter, &c., aggregate into large lumps. The tendency of material of the nature of mud (that is, materials in which the particles average less than one-hundredth of a millimetre in diameter) to flocculate is of considerable importance in flotation methods of concentrating minerals.

FLOCKS, originally a term given to the accumulated fibres which become detached from woollen fabrics during the milling process, and which during the continued operation are rolled into irregularly shaped small groups. When the operation of fulling or milling is completed, the soap solution and the flocks are caused to enter a rectangular vessel with a perforated bottom, so that the flocks may be arrested while the soap solution passes through. The flocks are then removed from the vessel and dried, while the solution is collected and the oil and other substances separated. Flocks are used extensively as a substitute for hair in upholstery.

FLODDEN, a village of England, in Northumberland, about 5 miles S.E. of Coldstream. Near it was fought the celebrated battle in which James IV of Scotland was defeated by the Earl of Surrey (9th Sept., 1513). The loss of the Scots was from 8,000 to 10,000 men, including the king, the Archbishop of St. Andrews, and a large number of the nobles; that of the English from 6,000 to 7,000. At the beginning of the battle the armies mustered respectively 30,000 and 32,000 men. The English victory was so near a defeat that Surrey was unable to prosecute the war with any vigour. *See* Sir Walter Scott's poem *Marmion*.

FLOGGING, the infliction of stripes or blows with a rod, whip, lash, or scourge, especially as a judicial punishment. In Britain it long existed as a punishment in the army and navy; but it was totally abolished in the former in 1881 and in the latter, although not formally abolished, is not inflicted.

Whipping of adult males is authorized by statute (1) in the case of incorrigible rogues, (2) for firing at the sovereign, (3) for robbery with violence, or robbery or assault when armed, (4) for trying to choke, (5) for certain offences by males against morality under the Criminal Law Amendment Act, 1912. The punishment of the knout in Russia before the Revolution of 1917 and of the bastinado in the East are severe forms of this punishment. Females may not be whipped. *See* FIRST OFFENDERS; WHIPPING.

FLOOD, Henry, Irish orator and politician, born near Kilkenny 1732, died 1791. He entered the Irish Parliament in 1759, was Privy Councillor for Great Britain as well as for Ireland in 1775, and Vice-Treasurer for Ireland from 1775 to 1781. In 1783 he had a personal dispute in the House with Grattan, when a remarkable display of the power of invective was made on both sides. He afterwards became a member of the British Parliament. His speeches and some poetical pieces were published in 1787.

FLOOD LIGHTING, lighting of the exterior of a building, generally by powerful, concealed electric lights. It was first introduced in New York, where many large buildings were illuminated at night in this way. In 1931 experiments in flood lighting were tried in England, notably on the Houses of Parliament and other buildings in London and the castle at Rochester. In Sept., 1931, there was a great display of flood lighting on London buildings in connection with the meeting of the International Illumination Congress.

FLOOR-CLOTH, a term which is usually applied to soft woollen fabrics used for washing floors and the like. It is essentially a fabric which is capable of absorbing a comparatively large amount of water, and is made from thick soft-spun woollen yarns in a coarse *sett*. The term floor-cloth was formerly applied to different kinds of fabrics, other than carpets and rugs, which were used for covering kitchen floors and other places where there is much traffic. A considerable quantity has been made for years from coir fibre yarns (coco-nut fibre) and similar material, and used for the aisles of churches, kitchen, office, and similar floors. Its open nature had obvious defects in regard to methods of cleaning, and this led to the introduction of fabrics coated with impervious substances, which not only fulfilled the function of an attractive floor covering, but were also easily washed, mopped, or otherwise cleaned. The fabric was, indeed, very similar to, but heavier than, oil-cloth or American cloth, which is used for covering tables; the foundation was made from hemp and flax-tow yarns, and the surface appeared in solid colours, but was often decorated by designs in various colours.

Floor covering has also been made from a mixture of different kinds of oils with substances which, when combined, set hard so as to yield the well-known linoleum-like article. The floor-cloth known as *kamptulicon* is made from ground cork, india-rubber, and other substances, rolled into sheets between heavy steam-heated calender rollers, or else prepared and laid on a fibrous foundation. This method of manufacture probably led to the extensive linoleum trade which now supplies in the various grades the bulk of modern hard floor coverings.

FLOORS AND FLOOR-SPACE. Floors are constructed with wooden joists, rolled-steel joists, solid reinforced concrete, or hollow bricks

with rolled-steel joists. For the purpose of calculating the loads on foundations, and other constructions carrying loads in buildings, the superimposed loads are taken as equivalent to the following dead load.

	Pounds per square foot of floor area.
Domestic purposes	70
Hospitals	84
Counting-houses and offices	100
Public concert-rooms, retail shops, and workshops ..	112
Ballrooms and similar floors subject to vibration ..	150
Book-stores in libraries and floors of warehouses ..	224

Trimmer joists should be 1 inch thicker than ordinary joists. In floors of wide span, if there is a ceiling beneath, the deflection should not exceed $\frac{1}{36}$ inch per foot of span. Hoop iron 2 inch by $\frac{1}{8}$ inch tarred and sanded is a good substitute for joists to be notched over in lieu of a fir wall plate, which is liable to decay. The ends of timbers built in walls should have an air-space round them, and the floor should also be ventilated. Floor joists of long span can be stiffened by herring-bone strutting 2 inches by 2 inches, about 5 feet apart the full depth of the joists, or solid bridging 1½ inches thick with a ⅝-inch round iron tie through the neutral axis of the joists close to the solid bridging. Solid floors of reinforced concrete should not be made of coke breeze on account of its liability to expand. As a general rule the span for rolled-steel joists carrying a distributed load should not exceed 24 times the depth of the joist. Reinforced hollow block floors can be made with a depth of 5 inches and a span of 10 feet to carry 112 lb. per foot super.

The best floor-boards come from the White Sea ports, the second quality from Canada and the Baltic. For hard wear maple flooring is the best; it is generally prepared grooved and tongued and holed for nails throughout the tongues. Pitch pine, oak, and teak are used for floor-boards. In hospitals antiseptic floors are made of teak and terrazzo. Solid floors are finished with wood blocks which are fixed in mastic, and sometimes dowelled. Linoleum and rubber are used in sheets fixed with cold glue as a finish to concrete floors. Jointless floors are made of a mixture of sawdust and cement. Many of them contain also magnesite, which destroys any iron it comes in contact with, and special precautions should be taken to protect the metal.

Floor-space. *Hospitals*, from 90 feet to 160 feet super per patient; *surgical wards*, 150 feet to 200 feet super; *workhouse infirmaries*, 70 feet super per inmate, special wards 166 feet super; *elementary schools*, classrooms 10 feet super, assembly hall 6 feet super; *secondary schools*, 15 feet to 18 feet super. Lodging-houses and factories are regulated by cubic capacity on account of the varying height of the stories. Offices, if they are not considered to be workshops, come under the sections of the Public Health Act which deal with overcrowding, and are reckoned by cubic capacity and not floor-space.

TABLE OF WOOD GIRDERS, BINDERS, AND JOISTS IN BALTIC FIR

Length of bearing in feet.	Girders 10 feet apart.		Binders 4 feet to 6 feet apart.		Joists 1 foot apart.		Ceiling joists 1 foot apart.	
	Depth in inches.	Breadth in inches.	Depth in inches.	Breadth in inches.	Depth in inches.	Breadth in inches.	Depth in inches.	Breadth in inches.
6			6	4	6	2	4	2
8			7	4½	7	2½	4	2
10	9	6	8	5	7½	2½	5	2
12	10	8	9	6	8	2½	6	2½
14	11	9	9	6	9	3		
16	12	10	11	6½	11	3		
18	12	11	12	7	12	3½		

FLOQUET, Charles Thomas, French statesman. Born 2nd Oct., 1828. He was deputy for the Seine in the National Assembly of 1871, and in the same year was imprisoned for his Communistic sympathies. In 1876, as a radical republican, he entered the Chamber of Deputies and was President of the Chamber from 1885 to 1888. In 1888–89 he was Premier, during which time he fought a duel with Boulanger. In 1892, being involved in the Panama scandal, he resigned. He died 18th Jan., 1896.

FLORA, the Roman goddess of flowers and spring, whose worship was established at Rome in the earliest times. Her festival, the Floralia, was

celebrated from 28th April to 3rd May with much licentiousness.

FLORA, in botany, signifies the plants of a region collectively, as *fauna* signifies the animals.

FLORÉAL (flō-rā-ál; month of flowers), the eighth month in the calendar of the French Revolution. It began 20th April, and ended 19th May

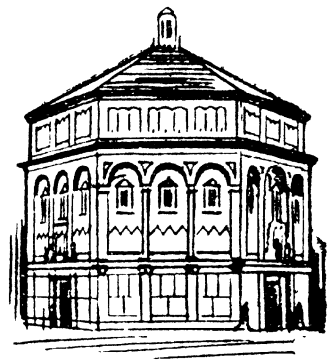
FLORENCE (It. *Firenze*; in O.It. and in poetry, *Fiorenza*; ancient *Florentia Tuscorum*), a celebrated city of Italy, capital of a province of the same name, 143 miles N.W. of Rome, and 50 miles E.N.E. of Leghorn. The city is surrounded by hills, and is beautifully situated on both banks of the Arno, the greater part, however, lying on the right bank. The river is spanned by four stone and two iron bridges: the Ponte alle Grazie, constructed 1235, restored 1835; the Ponte Vecchio (the 'Old' Bridge), said to date from the Roman period, reconstructed in 1362, and still retaining its old form, with its three arches supporting a roadway with goldsmiths' shops on either side, and above, a covered passage connecting the Pitti Palace and the Uffizi; the Ponte Santa Trinità, erected soon after 1567, adorned with statues, and remarkable for the symmetry of its arches; the Ponte alla Carraja, 1218, restored 1337, and again in 1559; and two iron suspension bridges at either



Flora, after Titian

end of the city. On either side of the Arno is a spacious quay called the Lung' Arno, a favourite promenade.

Buildings. The private dwellings are mostly handsome, and the palaces, of which there are many, are noble and impressive structures. The city contains numerous piazzas or squares, the most important being the Piazza della Signoria, surrounded by important buildings, and adorned with a marble fountain, and a bronze equestrian statue of Cosmo I. In this piazza is situated the Palazzo Vecchio, originally the seat of the Government of the



Baptistery at Florence by Giotto

republic, and subsequently the residence of Cosmo I; also the Loggia dei Lanzi, a fine open arcade containing numerous well-known groups of statuary.

The most remarkable building in Florence is the Duomo, or cathedral of Sta Maria del Fiore, erected between 1298 and 1474, but its façade not completed till 1887, and the porches, which are adorned with statues and reliefs, only in 1903. One great feature is Brunelleschi's magnificent dome which served Michael Angelo as a model for St. Peter's at Rome. The cathedral is situated in a spacious square, nearly in the centre of the city. Close by are the Campanile or bell-tower designed by Giotto, and the Baptistery of San Giovanni, the latter having three bronze gates with figures in relief, one of them by Andrea Pisano, and the other two by Ghiberti, celebrated as among the most beautiful works of the kind extant. The church of S. Croce contains the tombs of many eminent Tuscans, among them Michael Angelo, Galileo, Machiavelli, and Alfieri, besides much fine sculpture and fresco-work; while in the Piazza outside stands the Dante memorial by Pazzi.

Art Collections. The chief art collection is the Galleria degli Uffizi, which contains specimens of painting and statuary by the greatest masters. In statuary, among numerous antiques may be specified the *Venus de' Medici*, the *Apollino*, the *Knife-grinder*, the *Dancing Faun*, the *Wrestlers*, and the group of *Niobe and her Children*

while in painting there are works by Leonardo da Vinci, Botticelli, Ghirlandajo, Michael Angelo, Raphael, Titian, Fra Angelico, Fra Bartolomeo, Andrea del Sarto, Correggio, Guido, &c. Other important art collections are preserved in the churches and palaces, one of the principal being the paintings in the Pitti Palace. The building formerly known as the *Bargello*, erected about 1250 for the chief magistrate of the republic (the Podestà), and subsequently used as a prison, has been restored, and is now a national museum, illustrative of the history of Italian culture and art in mediæval and modern times. The Laurentian or Medicean Library contains upwards of 9,000 ancient MSS. The Magliabecchian Library, now united with that from the Pitti Palace to form the National Library, is the great repository of printed books.

The charitable institutions are numerous and important. Schools and kindred institutions are also numerous. The manufactures embrace woollens, silks, straw-hats, porcelain, mosaics, and numerous objects in the fine arts.

History. Florence was probably founded by the Romans in the second century B.C., and early attained considerable prosperity. During the Dark Ages it was frequently devastated, but it revived about the beginning of the eleventh century, at which time the Florentines became extensive European traders. Their silk and woollen fabrics excelled, and their skill as workers in gold and jewels was unsurpassed. About this time Florence took an active part in the feud which broke out between the Guelphs and Ghibellines, the town generally supporting the former against the Imperial party. In 1283 a species of republic was constituted; but about the year 1300 the party struggles again burst forth between the same rival families under the new names of the *Whites* and the *Blacks*, in which the Blacks (the Guelphs) were eventually victorious, and the Whites, among whom was the poet Dante, banished.

In the course of these troubles a family of merchants named the Medicis rose to great influence in Florentine politics. One of them, Cosmo, born 1389, was the founder of the political greatness of his house. His grandson, Lorenzo, surnamed *Il Magnifico*, as a statesman, scholar, and patron of art and literature, attained the highest celebrity. Under him Florence, which, though calling itself a republic, was in reality ruled by him, rose to a great pitch of opulence and power, and notwithstanding the hostility of the Pope he exercised a great influence throughout Italy.

On the fall of the republic in the sixteenth century a member of a lateral branch of the Medici, the line of Cosmo having become extinct, was created Duke of Florence by Charles V. The ducal dynasty of Medici continued to rule till the year 1737, when, becoming extinct, they were succeeded by Francis of Lorraine, afterwards Emperor of Germany. From this period the history of Florence merges into that of Tuscany until its amalgamation with the Kingdom of Italy. From 1865 till 1871 it held the dignity of capital of the new Kingdom of Italy, the seat of the Government being transferred to it from Turin.

Amongst the illustrious men it has produced are Dante, Petrarch, Boccaccio, Guicciardini, Lorenzo de' Medici, Galileo, Michael Angelo, Leonardo da Vinci, Benvenuto Cellini, Andrea del Sarto, Amerigo Vespucci, Macchiavelli, and others. Pop. (including suburbs), (1931), 316,286.

The province has an area of 1,497 English sq. miles. The surface is diversified by mountains, valleys, and plains. The climate is generally mild and healthy, and the soil very fertile. Pop (1931), 840,287.—BIBLIOGRAPHY C. Yriarte, *Florence*; Ruskin, *Mornings in Florence*; E. Hutton, *Literary Landmarks of Florence*; F. T. Perrens, *Histoire de Florence* (9 vols.); E. V. Lucas, *A Wanderer in Florence*; J. W. Brown, *Florence, Past and Present.*

FLORENCE, COUNCIL OF, along with that of Ferrara, a continuation of the Council of Basel. At Florence its sessions continued at intervals from 1439 to 1442. Its object was a reunion of the Eastern and Western Churches; but the seeming agreement come to was soon after repudiated by a council at Constantinople.

FLORENTINE WORK, a kind of mosaic work, consisting of precious stones and pieces of white and coloured marble, which has long been produced in Florence. It is applied to jewellery, and used for table tops.

FLOREN'TIUM, another name for the rare element more usually called illinium.

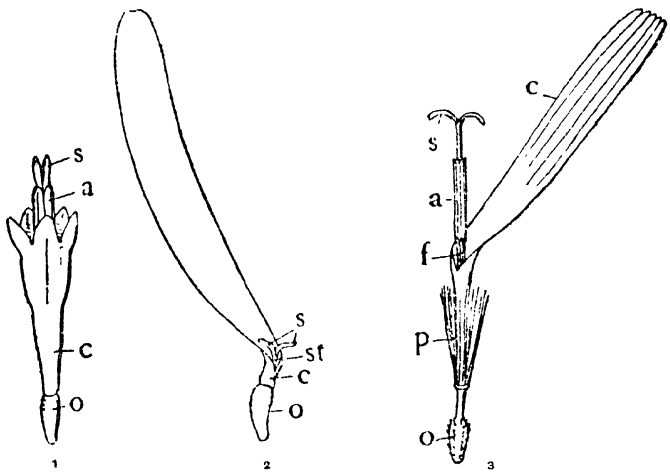
FLO'RES, or **FLORIS,** an island of the Indian Archipelago, in the Sunda group which extends east from Java. It is 224 miles long and from 15 to 37 miles wide, and has a mountainous surface, with several volcanic peaks. The natives are tall and robust frizzly-haired savages, belonging to the dark Papuan race. The island is under Dutch supremacy. Sandalwood, bees'-wax, and horses are exported. The passage between the east end of the island and those of Solor and Adenara is called Flores Strait; and the part of the Pacific north of the Flores chain

and south of Celebes is called the Flores Sea. Area, 8,870 sq. miles; pop. 250,000.

FLO'RES, the most westerly island of the Azores, about 30 miles long by 9 miles broad, with a hilly surface. The chief products are wheat, pulse, and poultry, and great numbers of small cattle are reared. Flores was the station of the English fleet before the fight between Sir Richard Grenville in the *Revenge* and fifty-three Spanish vessels in 1591. Pop. about 10,850.

FLOR'ET, a single small flower in a compact inflorescence, as in the Compositæ, Dipsaceæ, and grasses.

FLORIAN, Jean Pierre Claris de, French writer, born 1755, died 1794.



Florets

1, Disc Floret of Daisy. 2, Ray Floret of Daisy. 3, Floret of Dandelion; o, ovary; p, pappus; c, corolla; a, another tube; st, style; s, stigma; f, filaments

He was patronized by Voltaire, and gained fame as a writer of fables, pastorals, romances and comedies. He was imprisoned during the Revolution, but the fall of Robespierre saved him from the guillotine. His romances *Galatée, Estelle, Gonzalve de Cordoue, Numa Pompilius,* his fables and translation of *DonQuixote* are his best works.

FLORIAN, ST., the patron saint of Poland, born about A.D. 190, died by drowning during the Diocletian persecution, 230. He is represented as pouring out flames from a vessel, and his protection is sought against fire.

FLORIANOP'OLIS. *See* DESTERRO.

FLOR'IDA, one of the United States, forming the south-eastern extremity of the country, and having the Gulf of Mexico on the south and west, and the Atlantic on the east.

Area and Surface. It consists partly of a peninsula stretching south for about 400 miles, partly of a long, narrow strip of land running along the Gulf of Mexico to a distance of 350 miles from the Atlantic coast-line. The peninsula is about 90 miles in width, and contains about four-fifths of the total area, which is 58,666 sq. miles. The surface is in general level, rising little above the sea, especially in the southern parts, where it is almost a continuous swamp or marsh. The northern portion is more broken and elevated, but the whole coast is flat.

Rivers and Lakes, etc. The principal river is the St. John's, flowing northwards through peninsular Florida to the Atlantic. Its tributary, the Ocklawaha, has its course so flat that for a long distance it spreads out into the forest for half a mile or more on either side, so that nothing is seen but trees and water. The Appalachicola and Suwance flow into the Gulf of Mexico. There are many lakes throughout the peninsula, the largest being Okeechobee (area 1,250 sq. miles). Numerous islands are scattered along the south and west coasts, the most remarkable of which is a group, or rather a long chain, called the Florida Keys at the southern extremity of Florida. The most important of these is Key West, containing the city and naval station of same name.

Products. The state produces tropi-

cal plants and fruits in great perfection, especially oranges, lemons, limes, shaddock, &c. The planting of orange groves is being carried on extensively, and oranges are now a speciality of Florida. Tobacco, cotton, sugar, maize, potatoes, rice and oats are among the other productions. The forests form an important source of wealth. The minerals are unimportant.

Animals, Birds, etc. The wild animals comprise panthers, cougars, wolves, bears, foxes, raccoons, opossums, deer, &c. Birds are extremely numerous and various. The coasts, rivers and lakes swarm with fish; tortoises and turtles also abound. The swamps and other inland waters are infested with alligators. Snakes are numerous, but most of them are harmless.

Climate. The climate in general is excellent, and the state is much frequented as a winter health resort for invalids, many large and modern hotels having been built for the accommodation of visitors.

Towns. Florida, long in a backward condition, has made great advances in prosperity, being now well supplied with means of communication, and towns and villages rapidly springing up. Tallahassee is the capital and seat of government, but the largest towns are Jacksonville (pop. 129,549), Miami (110,637), Tampa (pop. 101,161), St. Petersburg (40,425), Pensacola (pop. 31,579), Orlando (27,330), and West Palm Beach (26,610). St. Augustine is the oldest town in the United States.

History. Florida was first explored in 1512 and 1516 by Ponce de Leon, a Spanish adventurer. It was ceded to Great Britain by Spain in 1763 in exchange for Cuba; reacquired by the Spaniards in 1781, and confirmed to them at the peace of 1783. It was ceded to the United States in 1821, and organized as a territory in 1822. A long series of conflicts with the Seminole Indians retarded its prosperity. In 1845 it was admitted into the Union. In 1861 it seceded from the Union, to which it was not readmitted till 1868. Pop. in 1910, 752,619; pop. by 1930 census, 1,468,211.—BIBLIOGRAPHY: S. Lanier, *Florida: its Scenery, Climate, and History*; W. W. Davis, *The Civil War and Reconstruction in Florida*.

FLORID'EÆ. *See* RED ALGÆ.

FLORID GOTHIC, that highly enriched variety of Gothic architecture which prevailed in England in the fifteenth and at the beginning of the sixteenth century; often called the *Tudor style*, as it flourished chiefly during the Tudor era.

FLORIN, a name given to different coins of gold or silver of different values, and to moneys of account, in different countries. The coin was first struck in Florence in the thirteenth century. The English florin is 2*s.* or one-tenth of a pound sterling; the Austrian *gulden* or florin and the *guilder* or florin of Holland are each 1*s.* 8*d.* A gold florin, value 6*s.*, was used in England in the reign of Edward III.

FLORINA, a town of Macedonia, in Greece, formerly belonging to Turkey. It was acquired by Greece as a result of the Balkan Wars 1912–3. During the European War it was captured by the French in April, 1916, and again in Sept., 1916.

FLORINIANS, a sect of Gnostics of the second century, so called from *Florinus*, a Roman priest who was excommunicated by Pope Eleutherius in A.D. 176.

FLORIO, John, lexicographer and translator, born in London of Italian parents in 1553, died 1625. He taught French and Italian in Oxford University. He was appointed by James I teacher of languages to the queen and Prince Henry. His chief works are his *Italian and English Dictionary, The World of Words*, and his translation of Montaigne. Shakespeare is said by Warburton to have ridiculed him in the character of Holofernes in *Love's Labour's Lost*, but this is probably not true.

FLORIS, Frans, a Flemish painter, whose family name was De Vriendt, born at Antwerp in 1520, died there 1570. After a visit to Italy, he moulded his style on the antique and on the Italian Renaissance masters, and acquired the title of the 'Flemish Raphael.' At Antwerp he established a school for painters, which produced many eminent artists. His chief works are: *The Fall of the Rebel Angels*, in the Louvre; *The Last Judgment*, in the church of Notre Dame, Brussels; and *The Assumption*, in Antwerp Cathedral. Other works are to be met with in Flanders, Holland, Spain, Paris, Vienna and Dresden.

FLORUS, Annæus, a Roman historian, was probably a native of Spain or Gaul. He is variously styled in the MSS.: in some *L. Annæus Florus*, in others *L. Julius Florus*, in others, *L. Annæus Seneca*, and in one simply *L. Annæus*. He lived in the beginning of the second century after Christ, and wrote an epitome of Roman history from the foundation of the city to the first time of closing the temple of Janus, in the reign of Augustus (*Epitome de T. Livio Bellorum omnium annorum DCC Libri duo*).

FLOSS-SILK, the portions of raveled

silk broken off in reeling the silk from the cocoons, carded and spun into a soft coarse yarn, and used for common fabrics or embroidery.

FLOTATION OF MINERALS, a process of mineral concentration in which the valuable portion of the ore is caused to float and thus separate from the worthless mineral portion or gangue. The method involved is thus exactly opposite to that commonly used in water concentration, in which advantage is taken of differences in specific gravities, the heavier portions sinking, and the lighter portions being washed away.

The principles on which the various flotation processes are based are very complex, the most important being surface tension, wettability, adhesion, adsorption, viscosity, and flocculation, although colloidal conditions and electrostatic forces may play a part of minor importance. Surface tension is the contractile force at the surface of a liquid, whereby resistance is offered to rupture. This is due to the fact that the molecules at the surface of a liquid have a greater coherence than the molecules within the liquid, and therefore the surface acts as if it were an elastic film. In flotation processes, this phenomenon is closely associated with the wettability of a solid by a liquid, and particles which are not easily wetted tend to float, whilst particles which are easily wetted tend to sink. As an example, it may be mentioned that if a small needle be carefully placed on the surface of water it will float, whereas a piece of glass of the same size, though lighter, will sink. A thin film of oil will assist the needle to float, and may cause the glass also to float, by reducing the ease with which it is wetted with water. If the needle be above a certain size, it will not float because the force of gravity overcomes the force of surface tension.

In mineral separation, it is found that sulphides of the metals, for example, copper pyrites, galena, zinc blende, &c., are not easily wetted and thus tend to float, whereas the gangue minerals such as silica, barytes, oxide of iron, &c., are easily wetted and tend to sink.

A second action which has to be taken into account is connected with the behaviour of oil. On being mixed with water, oil rises to the surface owing to its lower specific gravity and insolubility in water; it also shows a preference for certain classes of mineral sulphides such as those mentioned above, so that it attaches itself readily to them, while passing the particles of gangue, which are quickly wetted by water, and sink.

This property of oil was the basis of a patent, taken out in 1898, for a process in which the ore was pulverized and mixed with water, to which oil was afterwards added. The oil, rising to the surface, carried the valuable sulphide particles with it, leaving the gangue minerals behind in the water. It was found in actual practice that the oil carried up more than its theoretical load of sulphides, and the reason for this was afterwards realized to be the effect of air which was present in the ore pulp and water. In the early methods, 3 tons of oil were used for 1 ton of ore, but in the recent modifications less than 1 lb. of oil is used per ton of ore treated. In carrying out the processes, it is essential that the material be in a very fine state of division, and they are particularly suitable for the treatment of slimed material.

In the modification known as film flotation, the correct quantity of oil, such as pine oil, is added to the slime, thus making a mixture of sulphide minerals, siliceous and earthy minerals, oil, and water, which is brought gently to the surface of still water, in a direction forming an acute angle with the surface of the water. The gangue, which has a greater adhesive preference for the water than for the oil, sinks, whilst the valuable sulphides have a greater adhesive preference for the oil, and float.

In froth flotation processes, an acid or alkali is added to the slime together with the oil, and gas bubbles are caused to form by agitation or some other suitable means; a froth is thus formed which carries the valuable mineral particles to the surface, where they can be separated. By suitable adjustment of conditions the bubbles are found to persist long enough to carry the mineral to the surface for efficient separation.

Very large quantities of ores, &c., amounting to millions of tons per annum, are treated by these methods for the recovery of copper, lead, zinc and other minerals, including certain quantities of the precious metals.

FLOTIL'LA, name, meaning little fleet, given to a group of destroyers or submarines under a single command. Other small warships are also organized in flotillas. Destroyers in the British Navy are now grouped in flotillas of eight and the one which carries the captain, or commander, is called the flotilla leader.

FLOTOW (flō'tō), **Friedrich Adolphus von,** German musical composer, born 1812, died 1883. He studied music in Paris, but his earlier operas did not find favour with the Parisian opera-house directors, so he had to content himself with performances in

the aristocratic private theatres. At length the *Naufrage de la Méduse* was successfully produced at the Renaissance Theatre in 1839. This was followed by *L' Esclave de Camoëns* (1843), and *L' Ame en Peine* (1846), performed in London as *Lcoline*. *Alessandro Stradella* was first performed at Hamburg in 1844, and his most successful work, *Martha*, at Vienna in 1847. Among his other works are: *Indra* (1853), *La Veuve Grapin* (1859), *L'Ombre* (1869), and *L'Enchanteresse* (1878). He was director of the court theatre at Schwerin from 1855 to 1863; the last years of his life were chiefly spent at Vienna.

FLOTSAM, JETSAM, AND LIGAN, in law. *Flotsam*, or *floatsam*, is derelict or shipwrecked goods floating on the sea; *jetsam*, goods thrown overboard which sink and remain under water; and *ligan*, goods sunk with a wreck, or attached to a buoy as a mark of ownership. When found, such goods



Common Flounders

may be returned to the owner if he appear; if not, they are the property of the Crown.

FLOUNDER, one of the flat-fishes, family Pleuronectidæ, genus Pleuronectes, the common flounder being the *Pleuronectes flesus*. It is one of the most common of the flat-fishes, and is found in the sea and estuaries all round the British coast. Flounders, indeed, have been successfully transferred to freshwater ponds. They feed upon crustacea, worms and small fishes, and are much used as food. An allied species is native to the Mediterranean.

FLOUR, the edible part of wheat, or any other grain, reduced to powder, and separated from the bran and the other coarser parts by some process of sifting. The use of hand-mills for grinding the grain dates back to the earliest times, and was still common in some parts of this country even in the nineteenth century (*see* QUERN), though grinding by means of large mill-stones driven by water-power or otherwise had long been in use.

The modern flour-mill is a very elaborate structure. Chilled-iron or steel rollers have taken the place of the old mill-stones, and all the processes connected with the cleaning, grinding, separating, sifting, &c., are accomplished automatically, so that the grain is not touched by hand from the time it enters the receiving-bin till it finally emerges as the finished flour. Briefly, the process is as follows: The wheat is received into a bin, and then passes into a 'separator,' where by means of vibrating screens and a current of air the light rubbish is separated and carried away. The grain is further cleaned and polished by means of brushes and a revolving cylinder, after which it is ready for the process of separating the 'berry' from the husk or bran. This is effected by passing the wheat through grooved rollers, the grooves being cut at an angle, which strip off the bran but only lightly crush the flour. This unfinished product is known as 'semolina' or 'middlings.' The same operation is repeated several times until all the bran is stripped and sifted away, and the 'middlings' are then subjected to several processes of alternate crushing and sifting, until the flour is finally brought to a pure and finished state. The bran has meanwhile been collected, its chief use being for feeding cattle.

The best kind of flour is not that which emerges as the result of the first grinding, but that ground from the purified semolina, known as 'patent' flour. Hence the object of the modern 'high-grinding' system is to make as little flour and as much semolina as possible from the first grinding process, whereas under the old 'low-grinding' system the aim was to produce as much flour as possible from one grinding. In consequence of this the hard grain nowadays makes the best flour, whereas formerly it was the soft grain that was in chief demand; and this is one of the reasons why we import such vast quantities of wheat from America, British wheat being comparatively soft.

Different kinds of flour are made according to the different purposes to which they are to be put, and are produced not only by varying the degree of grinding to which the grain is subjected, but also by using different kinds of wheat, that of each country having its own peculiar characteristics. Various kinds of wheat are often blended by the miller to serve different purposes (*see* BREAD). There are big flour-mills at London, Liverpool, Bristol, Leeds, Hull, Glasgow, Edinburgh, Leith, &c., chiefly grinding imported wheat.

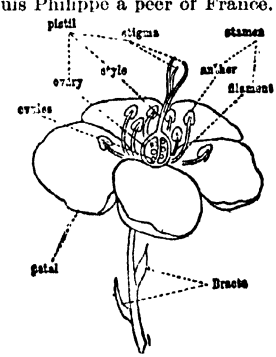
As Great Britain has now the wheat supplies of the world to draw upon,

the imports of foreign wheat are very great, and British millers have no lack of raw material, but a great amount of wheat-meal and flour is also imported annually. Thus in 1932 we imported grain and flour to the total value of £58,046,000. The chief countries supplying the flour are the United States, Canada, Australia and the Argentine. A certain amount comes from India.

In 1932 the exports of grain and flour from the United Kingdom amounted to the value of £3,316,000, sent chiefly to Norway, the Canaries and the Channel Islands.

FLOURENS (flō-rāñ), **Gustave,** French Socialist, born at Paris 1838, died 1871. In 1863 he was deputy professor in the Collège de France, and published his lectures, under the title of *Histoire de l'Homme* and *Science de l'Homme.* After being engaged in democratic movements in Turkey and Italy, he joined the Paris Commune in 1871, and was killed.

FLOURENS (flō-rāñ), **Marie Jean Pierre,** French physician and physiologist, born 1794, died 1867. In 1828 he was elected a member of the Academy of Sciences, and in 1832 was appointed to the chair of comparative anatomy at the Jardin des Plantes, Paris. In 1833 he became permanent secretary to the Academy of Sciences, in 1840 a member of the French Academy. In 1846 he was created by Louis Philippe a peer of France. His

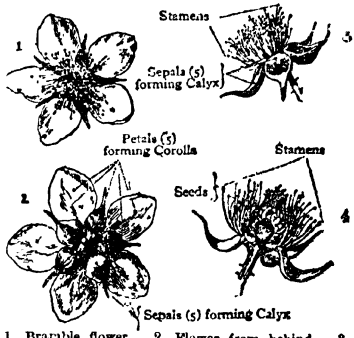


Tea-flower with only a few stamens, ovary cut open (calyx not shown)

works include: *Expériences sur le système nerveux, Développement des os, Anatomie de la peau, Mémoires d'anatomie et de physiologie comparées, De l'Instinct et de l'Intelligence des animaux.*

FLOWER, in popular language, the blossom of a plant, consisting chiefly of delicate and gaily-coloured leaves or petals; in botany, the organs of reproduction in a phenogamous plant. A complete flower consists of *stamens and pistil* together with two sets of leaves which surround and protect them, the *calyx* and *corolla.*

The stamens and pistils are the



1, Bramble flower. 2, Flower from behind. 3, Flower with petals removed. 4, Flower cut through

essential organs of the flower. They occupy two circles or rows, the one within the other, the stamens being in the outer row. The stamens consist of a stalk or *filament* supporting a roundish body, the *anther,* which is filled with a powdery substance called the *pollen.* The pistil consists of a closed cell or *ovary* at the base, containing *ovules,* and covered by a *style* which terminates in the *stigma.*

These organs are surrounded by the corolla and calyx, which together are called the *floral envelope,* or, when they both display rich colouring, the *perianth.* The leaves of the corolla are called *petals,* and those of the calyx *sepals.* Some flowers want the floral envelope, and are called *achlamydeous;* others have the calyx but are without the corolla, and are called *monochlamydeous.*

Flowers are generally *bisexual,* but some plants have *unisexual* flowers; that is, the pistils are in one flower and the stamens in another. *See* BOTANY.

FLOWER, Sir William Henry, zoologist and comparative anatomist, was born at Stratford-on-Avon in 1831, died in 1899. He was a student of University College, London, and studied medicine and surgery at Middlesex Hospital. During the Crimean War he acted as an assistant surgeon, and from 1859 to 1861 he held a post in the Middlesex Hospital. In 1861 he was appointed conservator of the museum of the Royal College of Surgeons, and in 1870 Hunterian Professor of Comparative Anatomy and Physiology. These posts he held

until his appointment in 1884 as director of the Natural History Museum at South Kensington, which he developed very successfully on both its scientific and popular sides. He resigned his position in 1898, and died the following year.

He was for twenty years president of the Zoological Society, a Fellow of the Royal Society from 1864, and in 1889 he was president of the British Association at their Newcastle-on-Tyne meeting. In 1892 he was made K.C.B. The brain was a favourite subject of his investigations.

His works include: *Introduction to the Oscology of the Mammalia* (1870), *Fashion in Deformity* (1881), *The Horse* (1892), and *Essays on Museums and other Subjects connected with Natural History* (1898).—Cf. R. Lydekker, *Sir William Flower* (English Men of Science Series).

FLOWERING-FERN, the popular name of *Osmunda regālis*, nat. ord. Osmundaceæ. It is the noblest and most striking of the British ferns, and grows in boggy places and wet margins of woods. It derives its name from the upper pinnæ of the fronds being transformed into a handsome panicle covered with sporangia.

FLOWERING PLANTS, the most highly organized section of the plant kingdom, distinguished by the possession of flowers and seeds—hence also called seed-plants or Spermatophytes—comprising the two groups Angiosperms and Gymnosperms.

FLOWERING-RUSH (*Butomus umbellātus*), nat. ord. Butomaceæ, a beautiful plant found in pools and wet ditches of England and Ireland, but rare in Scotland. The leaves are 2 to 3 feet long, linear, triangular, their sharp edges sometimes cutting the mouths of cattle, whence their generic name Butōmus (ox-cutting). The scape or flowering stem terminates in a large umbel of rose-coloured flowers.

FLOWERS, formerly a chemical name for fine particles of bodies in the form of a powder or mealy substance, as the *flowers of sulphur*.

FLOWERS, ARTIFICIAL, imitations of real flowers, made of various materials. These are not a modern invention. The Romans excelled in the art of imitating flowers in wax, and in this branch of the art attained a high degree of perfection. The Egyptian artificial flowers were made of thin plates of horn stained in different colours, sometimes also of leaves of copper gilt or silvered over.

In modern times the Italians were the first to acquire celebrity for the skill and taste they displayed in this manufacture, but they are now far surpassed by English and French manufacturers, but more especially by the latter. Among materials used in this manufacture are cambric, muslin, satin, velvet and other woven fabrics, feathers, india-rubber, blown glass, mother of pearl and brass.

FLOWER SHOWS, a class of exhibition which has long enjoyed a well-established popularity, as combining the most practical utility with the pleasures of a social gathering. They were the natural result of the foundation of horticultural societies. The first of these, the Royal Horticultural Society of London, was established by Andrew Knight in 1804, and incorporated five years later. The Caledonian Horticultural Society dates from 1809, and the Royal Horticultural Society of Ireland from 1830. The Temple Flower Show, held annually in May by the Royal Horticultural Society of London, offers a magnificent and possibly unique display; while the grounds of Chelsea Hospital, Holland House, and the Crystal Palace are favourite places for such exhibitions. It was at the Crystal Palace that in 1891 was staged what is probably the record number (4,191) of exhibits at a flower show, held in connection with the National Co-operative Festival.

But, fortunately, flower shows are not confined to such immense displays. Almost every county, many towns—among which Shrewsbury is pre-eminent—and even villages, have their own shows, held under the auspices of local societies. Such exhibitions, which in rural districts frequently offer prizes for the best-kept cottage gardens, excite a healthy spirit of emulation among both professional gardeners and working-class amateurs, of which one consequence is an obvious moral benefit. Many flower shows include fruit and vegetables in their exhibits; others are devoted to roses, sweet-peas, carnations, or to such 'show' plants as the dahlia and pelargonium.

FLUID. Matter is found in three different states or phases—solid, liquid, and gaseous. The name fluid is used as equivalent to non-solid, so that both liquids and gases are fluids. The distinguishing property of a fluid is its incapability of permanently resisting forces tending to change its shape. Judged by this definition, certain substances, usually considered as solids, must be taken to be fluids, e.g. lead, cobbler's wax, ordinary sealing-wax and ice. A piece of cobbler's wax laid on a level table will in course of time become flattened out, that is, it flows; and a leaden bullet placed upon the wax, or a piece of cork placed under it, will in time force its way through to the other side.

Both a liquid and a gas have, per unit mass, a definite volume at given temperature and pressure. A gas, however, fills the whole volume of any closed vessel which contains it, the pressure adjusting itself to the volume and the temperature. A liquid, on the other hand, if placed in a closed vessel, will in general occupy, as liquid, only a portion of the volume of the vessel, but will give off vapour until a certain definite point of equilibrium is reached, depending on the original mass of liquid, the volume of the vessel, and the temperature. *See* ELASTICITY; GASES, PROPERTIES OF; HYDRODYNAMICS; LIQUIDS; VISCOSITY.

FLUKES, or FLUKE-WORMS, a name given to certain parasitic animals belonging to the phylum Platyhelmia or Flat-worms, and included in the class Trematoda. They inhabit various situations in different animals —mostly in birds and fishes, and the life-history is complex. The adult *Distoma hepaticum* exists in large numbers in the livers of sheep, and causes the disease known as 'rot.' Part of its life-history is spent in a small water-snail (*Limnæus truncatulus*), from which it emerges to encyst on grass. Should this be eaten by a sheep, the adult stage may be attained.

FLUOHYDRIC ACID. *See* HYDROFLUORIC ACID.

FLUORES'CENCE, an optical effect in which a body becomes luminous when placed in sunlight or when acted on by certain radiations. Substances such as paraffin oil, uranium or canary glass, and chlorophyll exhibit, in bright sunlight, a surface colour which is different from that of the body of the substance. The effect is brought out in a more striking manner by placing the substances in a dark room in the path of a beam of invisible ultra-violet rays, when these substances become luminous. They have the property of absorbing the short invisible waves and of emitting, in their place, longer waves capable of affecting the eye. The fluorescent light lasts only so long as the body is receiving the stimulating radiation; in the case of paraffin oil, the light is blue, that from uranium glass is green, whilst a solution of chlorophyll gives a dark-red fluorescence. The term fluorescence was derived from fluor-spar, one of the substances in which the effect was first observed.

Some fluorescent solids lose their optical property when in a state of solution; other substances are fluorescent in solution, but not when solid. Fluorescence can be excited by the action of radium and of X-rays. This property is employed in the fluorescent screen, a sheet of stiff paper covered with a thin layer of barium platinocyanide crystals, used in detecting short-wave radiation. Fluorescence may be classed under the more general term of luminescence, or the emission of light by a body which has not been raised to the high temperature usually associated with the emission of light.—BIBLIOGRAPHY: Winkelmann, *Handbuch der Physik*; S. P. Thompson, *Light, Visible and Invisible*.

FLUORIDE, in chemistry, any salt of hydrofluoric acid (HF). Calcium fluoride or fluorspar (CaF_2) and cryolite or sodium aluminium fluoride ($AlF_3{\cdot}3NaF$) are two of the best-known naturally occurring fluorides. Others may be obtained by neutralizing the acid with metallic hydroxides or carbonates.

FLUORINE (symbol, F; atomic weight, 19), an element which occurs widely distributed in small quantity, always in combination with metals, e.g. fluor-spar (CaF_2), cryolite ($AlF_3{\cdot}3NaF$), &c. Owing to the great activity of the element it is extremely difficult to isolate. Moissan in 1886 obtained fluorine by electrolysis of a solution of potassium fluoride in hydrofluoric acid contained in a platinum tube. It is a greenish-yellow gas, and is extremely active, combining readily with most elements with the exception of oxygen. It decomposes water, glass, &c., and explodes on mixing with hydrogen. In the combined state fluorine has been detected in bone, teeth, blood, milk, and urine; in plants and in numerous rocks and minerals. Combined with hydrogen it forms hydrofluoric acid.

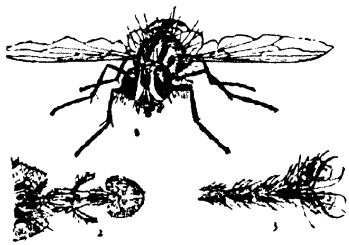
FLUOR-SPAR, DERBYSHIRE SPAR, or FLUORITE (CaF_2), fluoride of calcium, a common mineral found in great beauty in Derbyshire. It generally occurs massive, but crystallizes in simple forms of the cubic system—commonly the cube, and, more rarely, the octahedron. The cleavage is conspicuous, parallel to the planes of the octahedron.

Pure fluor-spar contains 48·7 per cent fluorine, 51·3 calcium. It is of frequent occurrence in limestone and in altered granites, especially in connection with metalliferous ores, as of tin and lead. It is sometimes colourless and transparent, but more frequently it exhibits tints of purple, green, yellow and red. From the general prevalence of a blue tint in the Derbyshire specimens it is there known as *Blue John*. It is often beautifully banded, especially when in nodules, which are much prized for the manufacture of vases, and it is made into a

great variety of articles, chiefly ornamental. It is used as a flux in metallurgy, and is a source of hydrofluoric acid. Its specific gravity is 3·14, but it is of low hardness (4), being scratchable by apatite.

FLUSHING (Du. *Vlissingen*), a seaport in Holland, province of Zeeland, on the Island of Walcheren, at the mouth of the Hond, or West Schelde, here between 2 and 3 miles broad. It is strongly fortified, and has an extensive trade. There is a regular steamer service between Flushing and Queenborough, in Kent. Pop. (1932), 21,755.

FLUTE, a wind musical instrument, consisting of a straight tube having six holes for the fingers, and from one to fourteen keys which open other holes. The sound, which is soft and clear in quality, is produced by blowing with the mouth across an oval aperture at



House-Fly
1, Enlarged view. 2, Highly magnified view of proboscis. 3, Highly magnified view of foot.

the side of the upper end of the instrument. Its useful compass is about two and a half octaves, including the chromatic tones. It is usually made in four pieces, and a box or ebony, sometimes, however, of ivory, silver, or even gold.

FLUTING, in architecture, channels or furrows cut perpendicularly in the shafts of columns. It is used in the Doric, Ionic, Corinthian, and Composite orders, but never in the Tuscan. When the flutes are partially filled up by a smaller round moulding, they are said to be *cabled*.

FLUX, a substance or mixture added to a furnace charge, to combine with the gangue minerals and form a fusible slag. (Gangue is the name given to the earthy or mineral extraneous matter usually found associated with the valuable minerals in ore deposits.) The flux required varies with the nature of the gangue; if this is siliceous, limestone or iron ore is used; but if it is basic, a siliceous flux is added.

In the smelting of iron ores, limestone is largely used as a flux, the slag formed being mainly a silicate of lime and alumina. The fluxes made use of in assays or chemical experiments consist usually of alkalies and alkaline salts, as borax, cyanide of potassium, carbonate of sodium, common salt, which render the earthy mixtures fusible by converting them into glass. The fluxes used in pottery are various, but almost all consist of litharge or red-lead, borax, carbonates of potassium and sodium, and sand. In soldering operations fluxes are used to prevent oxidation and to dissolve any oxide which may be formed, the common fluxes being tallow, resin, and zinc chloride.

FLUXIONS, a term in mathematics. We owe the Doctrine of Fluxions to Newton, who considered variables to be determined by the velocity or rate of flux of their increments. The name fluxion was given to the rate of generation of the variable quantity. This method of analysis is now known as the infinitesimal calculus, but Newton's notation has been replaced by that of Leibnitz, except occasionally in dynamics. The friends of Leibnitz disputed Newton's claim to be the sole discoverer of the calculus, and a long and bitter controversy ensued. There seems no doubt that Leibnitz received his first ideas on the subject from Newton, although he afterwards made valuable advances on his own account. A complete and systematic treatment of fluxions was given by the celebrated Scottish mathematician, Colin Maclaurin. *See* a valuable paper by G. A. Gibson, *The Analyst Controversy*, in the Proceedings of the Edinburgh Mathematical Society, vol. 17, 1899.

FLY, a winged insect of various genera and species, whose distinguishing characteristics are that the wings are transparent and have no cases or covers. By these marks flies are distinguished from beetles, butterflies, and grasshoppers. The true flies or Diptera have only two wings, viz. the anterior pair. In common language, *fly* is the house-fly, of the genus Musca. The house-fly is found wherever man is, and in hot weather not only causes a good deal of annoyance, but also distributes the germs of several infectious diseases. It is furnished with a suctorial proboscis, from which, when feeding on dry substances, it exudes a liquid that dissolves them. From its feet being beset with hairs, each terminating in a disc which is supposed to act as a sucker, it can walk on smooth surfaces, as a ceiling, even with its back down.

The female lays her eggs in dung or refuse; the larvæ are small white maggots. They change into pupæ without casting their skins, and in from eight

to fourteen days the perfect fly emerges. The very small flies and the very large ones often seen about houses belong to other species. *See* BLOW-FLY; BOT-FLY; GAD-FLY.

FLY-CATCHER, a name originally given to certain perching birds of the genus Muscicapa, with a bill flattened at the base, almost triangular, notched at the upper mandible, and beset with bristles.

Two species are British—the spotted fly-catcher (*M. grisola*) and the pied fly-catcher (*M. albicapilla*), both about the size of a sparrow. They perch on a branch, where they remain immovable, watching for insects, only leaving to make a sudden dart at a passing fly, which they seize with a snap of the bill, and then return.

The white-collared fly-catcher (*M. collaris*) is a native of Southern Europe. Numerous other birds receive the name of fly-catchers, and some, as the paradise fly-catchers (Terpsiphone) of the Old World, are brilliantly coloured. In America some of the tyrant birds (Tyrannida) are named fly-catchers.

FLY FISHING, form of fishing in which flies, usually artificial, are used as bait. These are made to look as much like a real fly as possible. They may be used in two ways. In dry fly



Spotted Fly-catcher (*Muscicapa grisola*)

fishing the fly floats on the surface of the water; in wet fly fishing it is immersed. The casting or throwing of the fly is important. Trout are usually fished with the fly. The Fly Fishers Club is at 36 Piccadilly, London W.1.

FLY-FLOWERS, those which are pollinated by flies, such as the ivy; many are carrion-flowers (q.v.).

FLYING BOAT, large seaplane having a boat-shaped body which gives it buoyancy on the water and affords space for the pilot, passengers and cargo. As in the ordinary seaplane its engine and air-screw are



Flying-buttress

placed high up on the boat out of reach of the spray. Flying boats are specially adapted for coast work and for long distances over seas. The German *Dornier "X"* has 12 engines and carries over 100 passengers, as well as a light cargo.

In Great Britain the Air Ministry has several squadrons of flying boats, examples being the *Southampton* and the *Iris*. In 1931 two new boats, having a cruising speed of 100 miles an hour, were tested by making flights to Egypt and back.

FLYING-BRIDGE, a bridge constructed very rapidly for some special purpose, usually one of emergency. During the European War the construction of flying-bridges was carried to a high degree of perfection. A standard design of bridge, consisting of two side girders, made of very light rods, was designed, and the parts were standardized. The parts were few in number and very simple, and the Royal Engineer crews became so proficient that a bridge to carry a load of tanks could be erected over a stream 75 feet wide in 2½ hours by 52 men.

FLYING-BUTTRESS, in architecture, a form of buttress used in Gothic churches. It is designed to take the thrust of the nave vault, and takes the form of a sloping arch between

two vertical buttresses. *See* BUTTRESSES.

FLYING CORPS, or, as it is now called, the *Royal Air Force*, is a separate branch of the armed forces of the State under a Secretary of State for Air. In the years immediately preceding the war two more or less experimental forces were in existence, known respectively as the Royal Flying Corps and the Royal Naval Air Service. Of these the R.F.C. formed a branch of the army, and the R.N.A.S. of the navy, and the personnel was drawn from those services, i.e. officers were seconded from the army or navy for service in one or the other.

In Aug., 1914, the total strength of the two flying services was 285 officers and 1,835 other ranks. During the next three years the two services, still working separately, increased to such an extent that by Dec., 1917, their total combined strength had reached 20,287 officers and 147,289 other ranks. Experiments had also been made with a view to co-ordinate the activities of the two services by the formation of an Air Board (May, 1916), and the appointment of a Director-General of Air Services.

On 2nd Jan., 1918, the status of the Air Board was changed to that of an Air Council under a Secretary of State (Lord Rothermere), and a Chief of the Air Staff (Major-General Trenchard). This was followed three months later by the final amalgamation of the two services under the title of the Royal Air Force (1st April, 1918). By October of that year the strength of the reorganized service had reached 27,906 officers and 263,842 other ranks. In 1931 the total strength of the force was 32,000 officers and men and 4,234 machines, of which 706 were first-class. The distinctions given to airmen are the Air Force Cross and the Air Force Medal. The former is given to officers and warrant officers and the latter to non-commissioned officers and men. A return issued in 1932 showed that Great Britain was the fifth air power in the world, the four with stronger forces being France, United States, Japan and Italy. The full-dress uniform of the R.A.F. is light blue. The commissioned officers rank as follows: marshal of the air, air chief marshal, air marshal, air vice-marshal, air commodore, group captain, wing commander, squadron leader, flight lieutenant, flying officer, or observer, and pilot officer. The non-commissioned officers are flight sergeant, sergeant and corporal. The rank and file are aircraftsmen, who enter the service as apprentices. Officers enter after competitive examination, and a course at Cranwell. Air forces are organized in groups, wings and squadrons. A Cadet College for the training of applicants for commissions as pilot officers was opened at Cranwell in Feb., 1920.

THE AIR FORCE AS A CAREER. The Air Force offers a permanent career which is in general no less advantageous than either the Navy or the Army, and the inclusive cost, including the provision of uniform, at Cranwell, is at a maximum £250 for the two-year course. The curriculum comprises a wide variety of subjects, and a satisfactory standard of educational attainments coupled with a high degree of physical fitness are essential to success.

Boys enter the R.A.F. College as Flight Cadets at the age of 17½–19½, the necessary qualifications being success in the examination for admission thereto which is open to boys possessing the Schools Certificate or equivalent education qualifications, or who are nominated to take the entrance examination by the Headmaster of an approved school. Permanent Commissions may also be obtained through a recognized university by graduates between 20 and 25 years of age, and a limited number of exceptionally able men are promoted from Short Service Commissions or from the ranks.

In the ranks of the Air Force, which embrace many skilled trades, facilities are always offered for further education and for training to enter a civil career.

FLYING DUTCHMAN, a phantom ship said to be seen in stormy weather off the Cape of Good Hope, and thought to forebode ill-luck. One form of the legend has it that the ship is doomed never to enter a port on account of a horrible murder committed on board; another, that the captain, a Dutchman named Vanderdecken, swore a profane oath that he would weather the Cape though he should beat there till the last day. He was taken at his word, and there he still beats, but never succeeds in rounding the point. He sometimes hails vessels and requests them to take letters home from him. The legend is supposed to have originated in the sight of some ship reflected from the clouds. It has been made the groundwork of a novel by Marryat (*The Phantom Ship*), and an opera by Wagner (*Der Liegende Holländer*).

FLYING-FISH, a name common to various fishes which have the power of sustaining themselves for a time in the air by means of their large pectoral fins. Generally, however, the name is limited to the species of the genus Exocetus, which belongs to the family Scomberesocidæ (mackerel-pikes). The

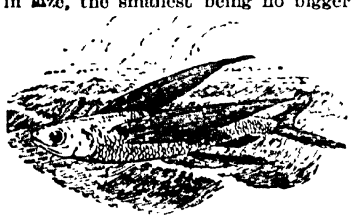
pectoral fins, which are very large, are the principal instruments in their flight, serving to sustain the fish temporarily in the air after it has acquired an initial velocity in its rush through the water. It can pass through the air to a considerable distance, sometimes as much as 200 yards, which it does to escape from the attacks of other fishes, especially the dolphin (Coryphæna).

It is most common between the tropics. The best-known species are *E. volitans*, abundant in the warmer parts of the Atlantic, and *E. exiliens* of the Mediterranean. The name is also applied to the flying gurnards (Dactylopterus), native to the hotter regions of the Atlantic and Indian Oceans. These fishes move their large pectoral fins rapidly, but their 'flights' are less extended than those of Exocetus.

FLYING-FOX. *See* FOX-BAT.

FLYING-LEMUR, a name given to insectivorous mammals, natives of the Indian Archipelago and belonging to the genus Galeopithēcus, which constitutes a sub-order (Dermoptera) of the Insectivora. They possess a flying-membrane, which extends as a broad expansion from the nape of the neck to the tail. By means of this membrane they can parachute from branch to branch.

FLYING-PHALANGER, a popular name of the members of a genus of nocturnal marsupials (Petaurus) nearly allied to the true phalangers. A fold of the skin extends along the flanks, and this, acting as a parachute, enables the animal to glide for great distances, its heavy tail serving as a rudder to guide its course in the air. These animals inhabit New Guinea and Australia, where they are known as 'flying-squirrels.' The species vary in size, the smallest being no bigger

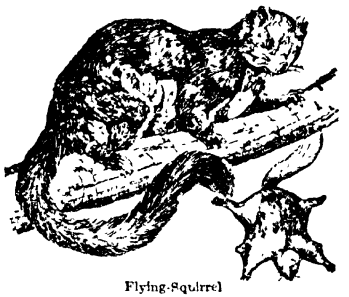


Flying-Fish

than a mouse. They feed on fruit, leaves and insects.

FLYING SQUAD. Team of motor-cars, equipped with wireless, originally attached to London police, but now attached to all police forces. Its purpose is the pursuit of criminals, particularly those escaping by motor-car.

FLYING-SQUID, the popular name of a genus of cephalopodous molluscs (Ommastrēphes), allied to the calamaries or squids, having two large lateral fins, which enable them to leap



Flying-Squirrel

so high out of the water that they sometimes fall on ships' decks.

FLYING-SQUIRREL (Sciuroptĕrus, Ptĕrŏmys, and Eupetaurus), three genera of rodent animals, family Sciuridæ (squirrels), to which the skin of the flank, extending between the fore and hind legs, imparts the faculty of supporting themselves in the air, as by a parachute, and gliding for considerable distances. The European flying-squirrel (*Sciuropterus sibiricus*) is a native of the forests in the colder parts of Europe and Asia; the American flying-squirrel (*P. volucella*) lives in troops in the western parts of North America. Pterŏmys includes larger forms native to the Oriental region, and Eupetaurus includes a single species from North India and Tibet.

FLY-TRAP, the only species known of a genus of plants (Dionæa), nat. ord. Droseraceæ, also called Venus's fly-trap.

FLY-WHEEL, a cast-iron wheel designed to provide an engine or appliance with rotational inertia. The bulk of the weight of the wheel is in the rim at the maximum distance from the axis of rotation. In this way the maximum rotational inertia is obtained with the minimum amount of material. In designing the wheel the governing principle is to make it massive enough to give the necessary rotational inertia, and strong enough to resist the centrifugal force to which it will be subjected when in rotation.—BIBLIOGRAPHY: D. A. Low, *Applied Mechanics*; *Modern Mechanical Engineering* (Gresham Publishing Company).

FOCH, Ferdinand, French soldier, was born in Tarbes, in the department of Hautes-Pyrénées, on 2nd Oct. 1851. Tarbes is a city of some 20,000

inhabitants, and at the time of Ferdinand's birth his father held the position of Secretary-General of the Prefecture. Through his mother, Foch is descended from an officer who attained a considerable eminence under Napoleon. M. Foch's position as a civil servant making periodical changes of residence a matter of course, Ferdinand was, in his earlier life, sent to different local schools; and it was not till his eighteenth year that he was entered as a pupil in the College of St. Clement at Metz, with a view to preparing himself for the École Polytechnique.

The outbreak of the Franco-German War caused an interlude in his studies,



Marshal Foch

and the young Foch joined the army and was posted to an infantry depot. On the conclusion of peace in 1871 he returned to Metz to complete his studies, and, in November of the same year, entered the École Polytechnique. Here he remained till early in 1873, when he was transferred to the École d'Application at Fontainebleau, a school for artillery and engineers.

In Oct., 1874 he was gazetted lieutenant in the artillery and posted to the 24th Regiment of Artillery at Tarbes, his birthplace. Three years later he went through the cavalry school at Saumur, and on leaving it was promoted captain. During his period at Saumur he married Mlle. Julie Bienvenue. In 1885 Captain Foch was sent to the École Supérieure de Guerre in Paris. After two years at the war school or staff college, he was appointed to the staff of a division, till in 1891 he was recalled to Paris as a major on the General Staff. After this he had an interval of regimental duty in command of a horse-artillery battery, and in 1895 he was appointed professor of military history, strategy, and applied tactics at the École Supérieure de Guerre. Here he made his mark, as is evident from a contemporary appreciation of him in the *Correspondant*.

In 1900 Lieutenant-Colonel Foch left the École de Guerre, and, after a period of regimental and staff service, was promoted brigadier-general on the General Staff, and was offered and accepted the post of Director-in-Chief of the École de Guerre. In 1911 Foch was promoted to the rank of general of division, and took over command of the 13th Division at Chaumont. The following year saw him transferred to the command of the 8th Army Corps at Bourges, and in 1913 to that of the 20th Corps at Nancy, forming part of General de Castelnau's Second Army. This was his command when the European War broke out.

At the head of his corps Foch took a prominent part in the operations in Lorraine in the month of Aug., 1914, though towards the end of that month he was ordered by General Joffre to report himself for duty at General Head-quarters. Here he found that he had been selected to take command of the Ninth Army, then in process of formation out of corps and divisions taken from other armies. The retreat to the Marne was in progress, and it was in view of an eventual counter-stroke, that reorganizations were being carried out.

Foch established his head-quarters temporarily at Châlons, and proceeded to form and know his new command. When the great retreat at last came to an end on 5th Sept., 1914, Joffre issued his orders for the counter-attack which will be known to all time as the first battle of the Marne. In this series of operations the duties assigned to the Ninth Army were as follows: "The Ninth Army will cover the right of the Fifth Army, and hold the southern approaches to the marshes of Saint Gond. A portion of its forces will occupy the plateau north of Sézanne." The distribution of the various armies was such that, according to this arrangement, Foch's command was in the centre, and was opposed to the Second and part of the Third German Armies under von Bülow and von Hausen.

The offensive started on 6th Sept., and by the 8th Foch's command had been severely handled. It was in accordance with his invariable teaching, that the best defence is offence,

that he is said to have sent the following laconic message to General Headquarters: "My centre is giving way, my right is falling back; the situation is excellent. I shall attack." And he attacked with such success that on the 10th the Germans retreated. For his services on this occasion General Foch was awarded the Grand Croix of the Legion of Honour.

Early in October, Foch was appointed associate to the Commander-in-Chief, to co-ordinate movements of all Allied troops defending the coast, i.e. from the Oise to the sea, unity of command being thus established in some small measure and being made possible by his personality. During 1916 Foch had much to do with the preliminary arrangements for the battle of the Somme, and, when in September of this year he reached the age limit, he was specially retained on the active list and given the Médaille Militaire, which, given to a general officer, is the highest honour which the French Government can award. He also became head of the Board for the Investigation of Inter-Allied Military Questions. In May, 1917, he became Chief of the Staff vice General Pétain, appointed Commander-in-Chief; in October he visited Italy to discuss with the Italian General Staff the measures necessary to stabilize matters there.

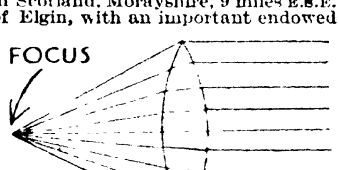
At the same time he was President of the Inter-Allied War Council which had been constituted at Versailles, and which was faced with the problem of deciding on the measures necessary to meet the expected German attack on the Western Front. Not until this great attack had taken place, and all but succeeded, was the principle of the single command finally recognized and agreed to. Foch becoming Generalissimo of the French, British, Belgian and American armies on 26th March, 1918; and to Foch in his new position is due the credit of the great counter-stroke which saved the situation at the second battle of the Marne, and which was the beginning of the end. The French Government marked their thankful appreciation of his great services by bestowing upon him the dignity and rank of a Marshal of France, and on 23rd Aug., 1918, the *bâton* was presented to him by the President of the Republic at General Head-quarters. He died in 1929.

As an author Marshal Foch's fame rests principally on two books, both of which grew out of lectures at the École de Guerre. These are *The Principles of War* and *The Conduct of War*. It is interesting to compare an extract from the first, published in 1900, with the opening section of the British *Field Service Regulations*, part i, of 1909.

"A battlefield does not give any opportunity for study; one does what one can to apply what one already knows, therefore it is necessary that one should know thoroughly and be able to use one's knowledge quickly." (*Principles of War.*)

"The principles . . . should be so thoroughly impressed on the mind of every commander that, whenever he has to come to a decision in the field, he instinctively gives them their full weight." (*Field Service Regulations*, part i, section 1, paragraph 1.)—BIBLIOGRAPHY: Raymond Recouly, *Foch*; R. Puaux, *Marshal Foch*; A. H. Atteridge, *Marshal Ferdinand Foch*; E. G. Marks, *How Foch makes War*.

FOCHABERS (*foh'a-berz*), a village in Scotland, Morayshire, 9 miles E.S.E. of Elgin, with an important endowed



Focus

school and a library and reading-room. In the vicinity is Gordon Castle, the magnificent seat of the Duke of Richmond and Gordon. Pop. 972.

FOCŞANI, (*-shă'nĕ*), or **FOKSHANI**, a town of Rumania, in Moldavia, on the Miklov, 104 miles N.E. of Bucharest, with an important trade. Pop. 32,799.

FOCUS, (1) in optics a point through which all the rays of a beam of light pass, after their directions have been changed either by reflection at a mirror, or refraction by a lens. A focus may be *real*, or *virtual*. It is real if the light actually goes through it, virtual if the rays have to be produced backwards in order to come to a point. In practically all cases, the rays do not pass exactly through a focus, but only near it.

(2) In geometry, a point having properties of a special kind in relation to a curve. A conic section, e.g. may be defined as the *locus* of a point whose distance from a fixed point, called the focus, bears a constant ratio to its distance from a fixed line, called the directrix. The eclipse and the hyperbola have two foci. In the ellipse the sum, in the hyperbola the difference, of the distances of any point on the curve from the foci is constant. In modern geometry, a focus of any curve

is defined as a point of intersection of tangents to the curve from the circular points at infinity.

FOG, a cloud at or near the surface of the earth, produced by the condensation of the invisible vapour of the atmosphere into minute watery particles, this condensation being caused by a cold current of air, or the contiguity of a cold surface. Fogs are more frequent in those seasons of the year when there is a considerable difference of temperature in the different parts of the day. In low, moist places, and in confined places, as valleys, bays, or lakes, surrounded by high lands, they are much more prevalent than in open



Foggia Cathedral

countries or elevated spots, where they are quickly dispersed by the winds.

The disagreeable pungency of fogs in large towns is due to the presence of smoke and other impurities. In fact, fogs may be produced by accumulation of smoke. This happens particularly when there is what is called an inversion of temperature, that is, when the air near the earth is colder than that above. This condition prevents the rising of the surface air and its warming by mixing with the higher air. The fog also hinders the sun's rays warming the earth, and thus in a calm type of weather such fog may be very persistent. Various experiments have been made with a view to finding a means of dispersing fogs, but none have as yet been successful.

FOGAZZARO, Antonio, Italian novelist and poet, born at Vicenza in 1842, died in 1911. He studied divinity and literature, law and music at Padua and Turin, and published his first poetic romance, *Miranda*, in 1874. This was followed in 1876 by *Valsolda*, a volume of lyrics, which brought him only little recognition. Fogazzaro then turned to fiction, published *Malombra* (1881) and *Daniele Cortis* (1887), and obtained a considerable success with his idyll *Il Misterio del Poeta* (1888). His greatest work, however, upon which his fame chiefly rests, is his *Il Santo* (The Saint, 1905), which has been translated into several European languages. It is the last of his famous trilogy, the first two being *Piccolo Mondo Antico* (1895) and *Piccolo Mondo Moderno* (1901). In this work, which caused a great stir, the author expressed his sympathy with the principles of Modernism, and endeavoured to reconcile the teaching of the Catholic Church with the theories of evolution.

FOGGIA (foj'á), a town of S. Italy, province of Foggia, 79 miles N.E. of Naples, with regular and spacious streets. Its principal edifice is a Gothic cathedral erected in 1179, destroyed in 1731, and afterwards rebuilt. The trade is chiefly in corn, for which immense granaries have been formed under the streets. Pop. (1931), 57,232.

The province, which is partly bounded by the Adriatic, has an area of 2,715 sq. miles. It possesses rich pastures, and produces saffron and wine. Pop. (1931), 505,586.

FOG-SIGNALS, signals given by means of sound to warn vessels during fogs, when lights or other visible signals cannot be perceived. Various kinds of fog-signals are used, among which may be mentioned bells, drums, gongs, guns, compressed-air whistles, steam-whistles, and fog trumpets or horns.

One of the most powerful signals is the siren fog-horn, the sound of which is produced by means of a disc perforated by radial slits made to rotate in front of a fixed disc exactly similar, a long iron trumpet forming part of the apparatus. The discs may each contain, say, twelve slits, and the moving disc may revolve 2,800 times a minute; in each revolution there are, of course, twelve coincidences between the slits in the two discs; through the openings thus made steam or air at a high pressure is caused to pass, so that there are actually 33,600 puffs of steam or compressed air every minute. This causes a sound of very great power, which the trumpet collects and compresses, and the blast goes out as a

sort of sound beam in the direction required. Under favourable circumstances this instrument can be heard from 20 to 30 miles out at sea.

Fog-signals are also used on railways during foggy weather; they consist of cases filled with detonating powder, which are laid on the rails and exploded by the engine when it comes up to them. In recent times radio-signals have been used for the purpose of determining positions in fogs.

FÖHN, dry warm wind experienced in the eastern Alps. It blows down the mountain valleys, its warmth being due to the increasing pressure and consequent rise in temperature as it descends from a high altitude. As the snow rapidly melts when the Föhn is blowing, it is of great value to agriculture in these regions.

FÖHR (*feur*), one of the North Frisian Islands in the North Sea, off the west coast of Schleswig; area, 32 sq. miles; pop. about 4,500, mostly Frisians engaged in fishing, the capture of wild fowl, and agriculture.

FOILS, the exercise associated with the use of the fencing-foil, a small sword 33 inches in length, tapering gradually from hilt to point, manufactured as light as possible, and tipped with a leather button to prevent injury. It is essentially a weapon to thrust with and not to cut. It was used in this country for the first time in Elizabeth's reign, and since then it has been regarded as a particularly suitable weapon for duelling. Whilst originally the education of every man of quality and fashion was regarded as incomplete without considerable practice in the use of the foil, the exercise of fencing has fallen into disuse, more so in this country than on the Continent. The Continental nations display very marked superiority in international contests such as the Olympic Games.

In Great Britain prominent contests are exceedingly few and restricted to very few competitors, as in the Public Schools Championships, which are conjoined with boxing and gymnastics, the Inter-'Varsity meeting (Oxford and Cambridge), and the Amateur Championships. A few fencing-clubs are also in existence, often associated with well-known schools and teachers of the art, and the gymnasium of every public school possesses in its sergeant, usually a retired non-commissioned officer, a competent instructor. Nevertheless, considering the excellence of the exercise, its comparative neglect is to be deplored.

FOIX, Gaston de. *See* GASTON.

FOIX (fwâ; Lat. *Fuxum*), a town of France, capital of department of Ariège, in a valley at the foot of the Pyrenees, with remains of the old castle of the Counts of Foix, and an old church and abbey. Pop. 6,080.

FOKKER, a German type of aeroplane, built by a Dutch aviator, A. H. S. Fokker, and employed during the European War.

FOLC-LAND, that is Folkland, the land of the people, that portion of Anglo-Saxon England which was retained on Thalf of the community. It might be occupied in common or possessed in severalty, but could not become allodial estate or absolute private property except with the consent of the Witan or highest council in the land. From time to time large grants were made both to individuals and to communities; and land thus cut off from folc-land was called *boc-land* or 'book-land.' Ultimately the king practically acquired the disposal of it, and the remnant of folc-land became Crown lands (*see* FEUDAL SYSTEM).

FOLESHILL, a town of England, in Warwickshire, 2½ miles north-east by north of Coventry, of which it is practically a suburb. The principal trade is in ribbons, fringes and elastic. There are coal- and ironstone-mines in the neighbourhood. Pop. (1931), 18,100.

FOLEY, John Henry, sculptor, born in Dublin 1818, died at Hampstead 1874, and is buried in St. Paul's Cathedral. He was admitted a student of the Royal Academy in 1835. In 1848 he was elected an associate, and in 1858 an academician. His works are numerous, and include statues of Selden and Hampden at Westminster; Goldsmith, Burke and O'Connell in Dublin; Lord Hardinge and Outram in Calcutta; Lord Clyde in Glasgow; the group *Asia* and the colossal statue of Prince Albert for the Albert Memorial, Hyde Park; Stonewall Jackson in Richmond, U.S.A. Without showing much imagination, his work is competent and dignified.

FOLIGNO (fo-lēn'yo), a town of Central Italy, province of Perugia, in a beautiful vale of the Apennines, watered by the Clitumnus. Public buildings worthy of notice are the cathedral and the Palazzo Communale. Pop. (commune), 28,373.

FOLIO, book of the largest size, comprising sheets of paper folded once. If folded again the sheets would become quarto, and so on. The term designates also the numbered page of a book or manuscript. Shakespeare's works were printed in folio volumes; hence the phrase, first 'folio.' In law writing a folio comprises 72 words, in parliamentary and chancery documents 90, in the U.S.A. 100.

FOLKESTONE (fōk'ston), a municipal borough and seaport, England, Kent, terminus of the Southern Railway, and a chief station for steamers to and from Boulogne. It is a favourite watering-place, and has fisheries, besides a shipping trade. Folkestone is included in the parliamentary borough of Hythe. Pop. (1931) 35,890.

FOLK-DANCING, dancing uninfluenced by urban or professional tendencies. The term has loosely become synonymous with country-dancing. It may be classed under two heads, (1) social, when it is danced purely as a pastime by all; (2) ceremonial, when performed by selected performers to mark a definite occasion.

FOLK-LORE. This term refers to the lore (knowledge) of the folk (people) surviving in living tradition, and not acquired from books. It was first used by William J. Thoms ('Ambrose Merton',) F.S.A., the founder of *Notes and Queries* (1849), which he edited till 1872, and the author of books on early romances, lays and legends.

Folk-lore has been a subject of serious study since the brothers J. L. K. and W. K. Grimm made collections of *Märchen* (published 1812-5), and showed that these had not only a psychological but historical value. They adopted the view that Teutonic, Greek, and Indian myths were of Indo-European origin.

Mannhardt (1865) paid special attention to the lore associated with the agricultural mode of life surviving among peasants, and found traces of an ancient pagan religious system that had been supplanted by Christianity. His views, especially in connection with vegetation deities, strongly influenced later writers.

Hugh Miller, in his *Scenes and Legends* (1835), adopted Dr. W. Robertson's stratification theory. "Man in a savage state," he wrote, "is the same animal everywhere, and his constructive powers, whether employed in the formation of a legendary story or of a battle-axe, seem to expatiate almost everywhere in the same rugged track of invention. For even the traditions of this first stage may be identified, like its weapons of war, all the world over."

Tylor, Lang, and Frazer, strongly influenced by Mannhardt and Miller, have emphasized, in their studies of comparative religion, the importance of the 'lower mythology' of folk-lore. W. H. R. Rivers and Elliot Smith have, however, subjected their evolution theory to severe criticism, contending that the resemblances in the beliefs and customs of far-separated peoples are due to direct and indirect cultural contact which took place in ancient times. Differences as well as resemblances must, the anti-evolutionists contend, be accounted for; these, they consider, are due to the mixing of local and imported cultures at various periods and in different districts. They hold it to be hazardous to draw analogies from biological evolution, and adopt instead the historical method. In the folk-lore of agriculture they find the elements of religious beliefs that were distributed from centres of ancient culture with seeds and implements; in the folk-lore of seafarers they detect beliefs that were disseminated by the ancient searchers for pearls, precious stones, and precious metals which had originally a religious value. Laufer, the American Orientalist, has shown that the potter's wheel, which was invented in ancient Egypt, was associated with a complex culture that can be traced in centres of culture in Asia and Europe into which the wheel was introduced.

The study of folk-lore, which has become a science, is of great importance in dealing with the development of religious beliefs and symbolism, political institutions, the sciences of medicine, astronomy, and chemistry, the art of story-telling, architecture, painting, sculpture, music, various crafts, &c. Although some of the hypotheses popularized by folk-lorists during the latter half of the nineteenth century have been found to be based on hazardous assumptions, the cumulative influence of these undoubtedly stimulated research, and every country in the world has been gleaned for collections of folk-lore. A great deal of excellent work has been accomplished in this connection by Christian missionaries. The more intensive study of local folk-lores is nowadays strongly advocated. It has been found, for instance, that even in one small country there are communities that have perpetuated distinctive customs and beliefs, and especially those associated with definite modes of life.

As a particular language is not necessarily a certain indication of racial affinities, it is likewise not necessarily associated with identical beliefs in adjoining areas. The folk-lores of Gaelic Ireland and Gaelic Scotland, for instance, are not identical. A pork taboo existed in ancient Scotland and is not yet entirely extinct, while in Ireland pork was eaten as far back as the early years of the present era. The Celts on the Continent kept pigs and cured and ate pork. Although the Celts reached Scotland, and Celtic languages were spoken in that country from an early period, the folk-lore of Scotland reveals in this connection and in other connections traces of the

intellectual life of a non-Celtic people or peoples. At the same time certain beliefs and traditions are common to Ireland and Scotland.

The folk-lore of England similarly reveals the persisting influences of more than one ancient religious cult, while there are elements in Welsh folk-lore that impart to it a local colouring, the culture-mixing in Wales, despite the existence there of a Celtic language, having apparently been not quite the same as that of Ireland or of Scotland. Folk-lore may be found, when studied in association with archæology, language, race-types, and artifacts (objects made by man), to throw light on the early history of a country.

Some writers regard folk-lore as the floating material from which early mythological systems were framed, and others as the scattered fragments of half-forgotten mythologies. It is possible that both views have in them the elements of truth. In ancient times mythologies were often reflections of local politics, and did not supplant older systems and the stories, beliefs, and customs associated with them. Imported complex beliefs and beliefs of local origin may be found persisting in the living tradition of a single area. Although stories containing mythological elements are rapidly dying out in folk-memory, many ancient superstitions and ceremonies still linger. In the customs associated with Christmas, New Year's Day, Easter, May Day, Hallowe'en, &c., are some of great antiquity. Charms, mascots, &c., are still worn for 'luck,' which in ancient times meant everything desired by man, including good health, longevity, good fortune, offspring, and happiness. —BIBLIOGRAPHY: Sir J. G. Frazer, *The Golden Bough*; W. H. R. Rivers, *Presidential Address, British Association Section H*, 1911; Elliot Smith, *The Migrations of Early Culture*; W. J. Perry, *The Megalithic Culture of Indonesia*; Laufer and Nichols, *The Beginnings of Porcelain in China*; A. Lang, *Custom and Myth*; Sir G. L. Gomme, *Folk-lore as an Historical Science*; J. Rhys, *Celtic Folk-lore*; W. R. S. Ralston, *Songs of the Russian People*; *Transactions of the London Folk-lore Society*.

FOLK-MUSIC. An art which fails to give expression to those feelings which are inborn in human nature is thereby declared a failure. To this rule music is no exception. The elaborate art of Bach, Beethoven and Wagner may be compared to a gorgeous flower-garden on which all that culture and knowledge can devise has been expended; but the most highly cultured rose derives ultimately from the flower in the hedge, and without the hedge-flower as a prototype the flower in the garden would be an impossibility. So it is with music; if we are to believe in it as an art and not as a series of tricks without spiritual significance, we must be able to prove that it has its initial impulse in that which is spontaneous to man.

How are we to prove this? How are we to find out whether musical expression can ever be spontaneous, and whether this spontaneous expression, if it exists, has any relation to beautiful music as the great composers have taught us to regard it? To do so we must imagine a man whose musical expression must of necessity be spontaneous and unpremeditated. Such a man must be unlettered, otherwise he could by reading obtain a superimposed musical culture; untravelled, otherwise his music might be imported from outside; unsophisticated, otherwise his music might not be genuinely self-expressive. Unless such a man were given to inventing music, unless his music contained in it the seed of those principles of design and expression which we recognize as beautiful, then, indeed, the whole structure of the art is without foundation.

Now this unsophisticated man is no mere abstraction—even to this day we can find such people, and have proved that they, or their forefathers, have, from time immemorial, invented music; music which is not only often beautiful in itself, but obeys or rather illustrates those principles of artistic beauty which we find in the music of great composers. This is what is known as folk-music.

Some musicians profess surprise that an uneducated countryman should be capable of making beautiful music; but in reality it is the opposite which would be surprising. If we had not actual evidence of the existence of folk-music, we should have to presuppose it as an essential condition of the existence of music as a true art; and, having presupposed it, we should have to argue further that the later developments of music must be true to type (as indeed they are), being nothing else than further stages along the road of evolution of which these primitive utterances were the starting-point.

Folk-music is, of course, bounded in its scope; the very conditions of its origin necessitate certain limitations. (1) It is spontaneous and, therefore, unselfconscious. Music-making for its own sake does not occur to the primitive man; it is the occasion, not the resultant expression, which is important to him. Primitive music is an applied art, a vehicle for the declamation of a story or the accompaniment to dancing; it is, therefore, limited in length by the stanza of a ballad or the

figure of a dance. (2) The means of performance are limited to the human voice or some primitive instrument, therefore it is almost always purely melodic in its character. (3) It is never written down, since one of the conditions of its existence is that its inventor is unlettered; therefore it exists only in the minds and memories of those who perform it, and must be short enough and simple enough to be learnt by heart.

Now these limitations are not entirely to the disadvantage of folk-music, for they carry with them certain characteristics and qualities which sophisticated music has, to a large extent, lost. (1) The actual shortness of a folk-tune, the fact that it has to be repeated many times in a long ballad or dance, gives a peculiar concentration to the finest examples. The effect of a fine folk-tune is cumulative; it is often not till after several repetitions that its full beauty is realized. (2) Its purely melodic nature gives to folk-music a wide range of melodic character which harmonic music for a long time lost, and which it has only comparatively recently regained. (3) The fact that folk-music exists only by oral tradition has far-reaching effects. Grimm says, "A folk-song composes itself." This is often held to be a mere rhetorical exaggeration. It is argued that if we go back far enough we must eventually come to a moment when any particular melody was invented by some individual man, and that therefore there is no essential difference between a folk-tune and any simple melody which has been composed and written down in the ordinary way.

Without discussing whether primitive music was not actually often communally conceived at festivals or religious ceremonies, we will take it for granted, for the sake of argument, that folk-music had its origin in individual invention. Let us grant that the primitive man invented his tune exactly as Beethoven invented a sonata, with this important difference that he cannot write down what he intends. What happens next? He sings his composition to his friends and neighbours, he teaches it to his children and grand-children, and after he is dead they continue to sing their versions of it and to pass it on in turn to others.

Now it is a well-known fact that each individual performer of a piece of music puts a little of himself into his performance which makes it slightly different from that of anyone else. Where music is stereotyped by print these differences never get very far, since each performer starts with the original printed copy. But we must remember that if the supposed inventor of a folk-song could not write down his invention, neither could his hearers, with the result that in a very short space of time widely varying versions of the same tune will be current; if we add to this the undoubted fact that tunes were often adapted to new words with different metres, or changed from song-tunes into dance-tunes, the possibilities of variation become wider still.

It is a common experience among collectors of traditional music to find widely divergent versions of the same tune, and, conversely to find in different tunes certain characteristics which point to a common origin. Nor does this chain of variations point to a process of corruption and disintegration, but of gradual development to meet varied needs and different times; for any tune which does not please its hearers will not be preserved by them, and as there is no written document to keep it alive it will die with its inventor. So that folk-music may be said to be the combined invention, and to represent the combined musical taste, of all its singers and hearers. In one sense it is as old as time itself, in another it lives afresh as something new at the hands of each individual singer.

FOLK-PSYCHOLOGY, an anthropological study of the psychology of races, nations, and social groups. Whilst folk-lore deals with the study of survivals, folk-psychology is concerned with the mental products in primitive peoples. It studies the effect of climate on mental endowments, and the evolution of national characteristics, and thus deals not only with the food conditions of a people and its habitat, but also with its somatology, æsthetics, jurisprudence, and pathology.

Folk-psychology is to be distinguished both from social-psychology, and from race-psychology. In the study of mental development social-psychology is concerned only with the part played by the social factor, whilst the term race-psychology has been applied by Spencer to the science of the evolution of mind in men and animals. Among students of folk-psychology are Felix Adler, Baldwin, Lombroso, Wundt, and Lévy-Bruhl. —Cf. G. le Bon, *Psychology of Peoples*.

FOMENTATION, in medicine, the application of warmth and moisture to a part of the body, by means of flannels or other cloths dipped in hot water or medicated decoctions, for the purpose of easing pain or increasing the blood-supply by dilating the vessels and so hastening the natural curative processes.

FOMES, a genus of Basidiomyce-

tous Fungi, family Polyporineæ. Some, such as *F. annosus*, are dangerous tree-killing parasites.

FOMORIANS, the monstrous deities of Irish mythology who are overcome in battle with the beneficent Danann deities. According to De Jubainville, the French Celtic authority, the Irish mythological system resembled that of ancient Greece. He regards the Dananns as Gaelic Olympians, and the Fomorians as Titans. Balor, the leader of the Fomorians, is slain with a stone (the sun) flung by Lugh (pronounced *Loo*), the Danann god, as Argos is slain with a stone by Hermes. De Jubainville's view is that Argos and Balor personified night, while Hermes and Lugh personified the dawn.

The derivation of 'Fomorian' or 'Fomore' is uncertain. Rhys suggested *fo-murib*, 'under-seas,' but afterwards abandoned this view. In Scottish Gaelic *Fomhair* (pronounced *foo'ar*) signifies 'giant,' and the Scottish Fomorians have no particular association with the sea or with darkness. They occupy headlands, and fling boulders at one another across valleys and arms of the sea. Others occupy caves or islands. There are no Dananns in Scotland.

According to ancient Irish references, the Fomorians were the gods of the pre-Celtic peoples, the Fir-bolgs (men with the sacks), the Fir-Domnann, the Dumnonii, or Damnonians who occupied Devon and Cornwall, the Strathclyde area of Scotland, and part of Central and South-Western Ireland. Apparently the gods of the earlier people became the demons of the later, or were identified with the demons in their mythological system. Originally 'Fir-bolg' had a definite racial significance, but it was in time applied to subject peoples. 'Fomorian' was likewise loosely applied to seafarers from the Hebrides, &c., who invaded Ireland. It was probably a pre-Celtic term.

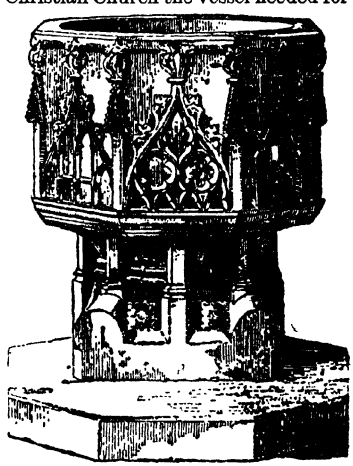
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FONBLANQUE (fon'blangk), **Albany William,** English journalist, born in 1793, died 1872. He was educated for the Bar, but, devoting himself to journalism, he gained a position on the *Times*, the *Morning Chronicle*, and succeeded Leigh Hunt as editor of the *Examiner*. A reprint of many of his articles, under the title *England under Seven Administrations*, appeared in 1837. In 1852 he was appointed chief of the Statistical Department of the Board of Trade.

FOND DU LAC, a city of the United States, Wisconsin, at the mouth of Fond du Lac River, which opens on Lake Winnebago, 148 miles N.N.W. of Chicago. It is the centre of several railways, and has a large trade. The manufactures include ironfounding, carriage and wagon making tanning, and saw-milling. Pop. (1930), 26,449.

FONDI, a town of South Italy, near a coast lagoon to which it gives name, province of Caserta. It is a bishop's see, and contains a cathedral. Fondi stands in a plain, the ancient *Cæcubus Ager*, which produced the famous Cæcuban wine. Pop. 11,378.

FONT. In the early days of the Christian Church the vessel needed for



Font, Offley, Hertfordshire
Decorated Gothic Style

the rite of baptism took the form of a tank, admitting the complete immersion of adults. It was usually placed in a special building called a baptistery, though bathrooms in large private houses were occasionally used.

By the eighth century the baptism of infants was general, and, the rite having been administered in churches as early as 578, the need for economy of space reduced the size of the vessel and produced the font. The earlier form was that of an unmounted and undecorated tub, such as occurs at Tangmere, Sussex, and in still ruder shape at Old Radnor, Radnorshire. For greater convenience the font was presently mounted on legs, at first often five in number, but soon generally combined into a central shaft or pillar. The height was gradually in-

creased, partly by elongation of the shaft, and partly by the whole being mounted on a dais or platform, an elevation which gave the vessel a more imposing and ceremonial appearance. The basin, though sometimes of local stone, was occasionally of marble or alabaster, polished. Its shape was round, square, or octagonal, the last-named form becoming very general in the fifteenth century; a beautiful specimen is seen at Snape, Suffolk.

Decoration, in the form of carving, had become usual in Norman times, resulting in such fine examples as those at Castle Frome and Eardisley, both in Herefordshire, and both apparently by the same designer. Such decoration, when including figures, was usually sacred in character, but the font at Lostwithiel, one of many interesting Cornish specimens, exhibits the Cross, the Virgin, and a mitred abbot in proximity to a huntsman and hound. The use of fonts was forbidden under the Commonwealth, and many were certainly destroyed at this period, but vandalism of a later date is responsible for the loss of others.

Among exceptional fonts must be mentioned the twenty-nine English examples in lead, of which no fewer than eight occur in Gloucestershire. Pewter and bronze were also used, while fonts of brick and wood are not unknown, and Guernsey possesses a small silver font. Font-covers, often large and highly decorative, originated in the custom of leaving consecrated water in the font, and in the fear of this being taken for employment in unhallowed magic rites.

FONTAINE, Jean de la. *See* LA FONTAINE.

FONTAINEBLEAU (fon-tān-blō), a town of France, department of Seine-et-Marne, in the midst of the forest of same name, about 2 miles from the Seine and 37 miles S.S.E. of Paris. It owes its origin chiefly to the palace, and is a quiet place, with broad, clean streets. Pop. 17,075.

The castle or palace of Fontainebleau is one of the most magnificent in France. It occupies the site of a fortified château founded by Louis VII in 1162; this was converted into a magnificent palace by Francis I; much added to by Henry IV, Napoleon I, Louis Philippe, and Napoleon III. The palace was the residence of Madame de Montespan, Madame de Pompadour, and Marie Antoinette, and it was here that Napoleon I signed his abdication. The park is laid out like a vast garden, and adorned with statues, temples, fountains, lakes and waterfalls. The forest, which is about 50 miles in circumference, covers an area of 42,500 acres, affords numerous pleasant walks, and abounds with game.

FONTA'NA, Domenico, Italian architect and engineer, born in 1543, died 1607. He was employed by Pope Sixtus V in many great works, among the chief of which was the erection of the Egyptian obelisk in front of St. Peter's. Among other buildings erected by Fontana were the Lateran Palace and the library of the Vatican. He also executed important works at Naples.

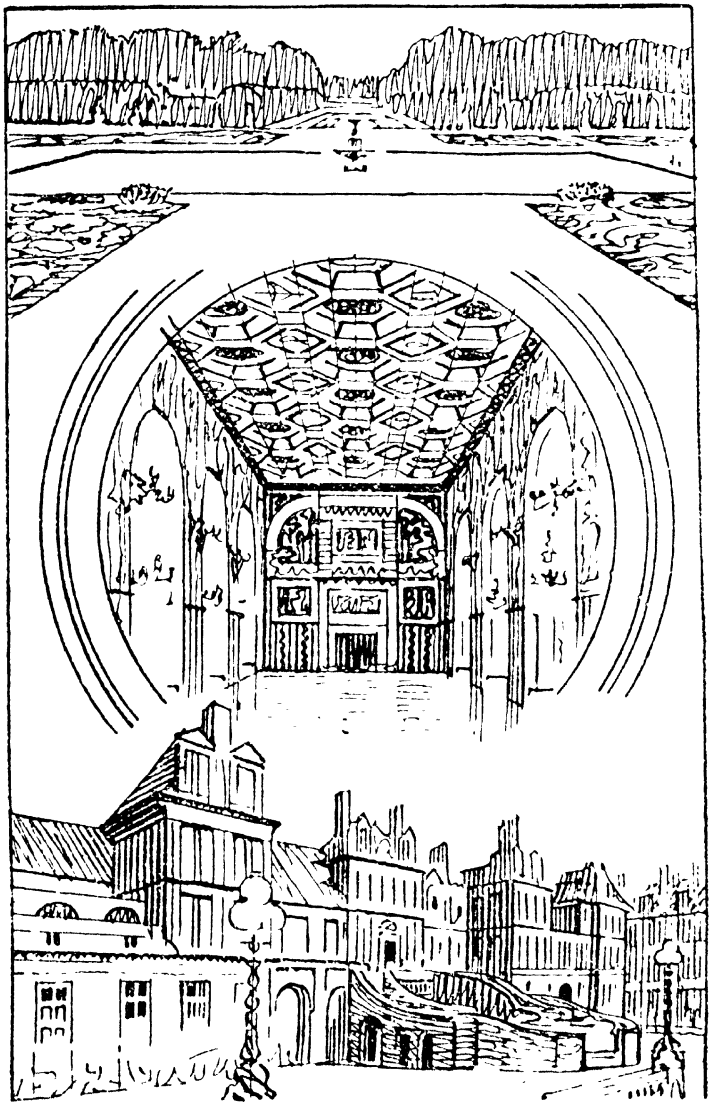
FONTANA, Prospero, Italian painter, born at Bologna 1512, died there 1597. He modelled his style mainly on Giorgio Vasari, especially in his decorative historical work at Rome, Fontainebleau, Genoa, and Bologna. He also painted many portraits. Among his pupils were his daughter Lavinia (born 1552, died 1614), whose best work is in portraiture, and the brothers Caracci.

FONTENAY-LE-COMTE (font-nā-lē-kōnt), a French town, department of Vendée, N.E. 27 miles of La Rochelle. It has a fine church with Gothic spire 311 feet high; manufactures coarse linen and woollen cloths, and is an entrepôt for the Gironde and Charente wines. Pop. 10,379.

FONTENELLE (font-nāl), **Bernard le Bovier de,** French author, born at Rouen 1657, died 1757. In 1674 he went to Paris, and soon became known by his precocious talents and versatility. Before the age of twenty he had assisted in the composition of the operas of *Psyche* and *Bellerophon*, which appeared under the name of his uncle, Thomas Corneille. In 1681 he brought out his tragedy *Aspar*; but it and the other dramas and pastorals with which he opened his literary career were on the whole unsuccessful. In 1683 appeared his *Dialogues of the Dead*, which were favourably received. His *Discourse on the Plurality of Worlds* (1686) was the first book in which astronomical subjects were discussed in a popular style. Among his other works are the *History of Oracles* and an *Essay on the Geometry of the Infinite*.

FONTENOY, a village in Belgium, province of Hainaut, celebrated for the battle of 11th May, 1745, in which the French under Marshal Saxe defeated the British, Austrian, and Dutch allied forces under the Duke of Cumberland.

FONTEVRAULT (fon-tē-vrō), a village of N.W. France, department of Maine-et-Loire, in a valley 10 miles south-east of Saumur. Here was formerly a rich Benedictine abbey (now a prison) founded by Robert d'Arbrissel in 1099, containing both monks and nuns, and governed by an abbess. The abbey became the head of an order, and had many dependencies. The old monastic buildings, covering from 40 to 50 acres, are now used as a central



FONTAINEBLEAU
The Gardens Henry II Gallery. Front of the Palace

prison. The abbey church contained the tombs of several of the Plantagenet kings; and there are still the effigies of Henry II and of Richard I, Kings of England and Counts of Anjou, of Eleanor, wife of Henry II, and Isabella, wife of John, King of England.

FONTHILL, village of Wiltshire. It is near Hindon and is known for its association with William Beckford. Here, on the site of an abbey, he built a magnificent house. It was pulled down, but in the 19th century the 2nd Marquess of Westminster built another, which has now passed out of his family.

FOOCHOW, a town of China, capital of the province of Fukien, on the Min, 125 miles N.E. of Amoy. It consists of the town proper, surrounded by walls, and of extensive suburbs stretching along both sides of the river, and communicating by a stone bridge. Foo-chow was one of the five ports thrown open by the Treaty of 1843. The trade is very extensive, but the navigation of the river from the sea to the harbour is difficult. The town was bombarded by the French in 1884. It has a large arsenal and dockyard superintended by European officers; it is also a great literary centre. Pop. (1931), 322,725.

FOOD-CONTROL. The control of the supply and consumption of foodstuffs during the war from 1914 to 1918 was one of the gravest problems which the Governments of the European belligerent countries had to face. The food-stuffs chiefly concerned were bread, sugar, meat, and butter and margarine. Of these only sugar was rationed in every European belligerent country, but in nearly every country three out of the four groups of food—if not all—were rationed to the inhabitants.

Royal Commissions. The earliest step taken in the United Kingdom in the direction of food-control was the appointment of a Royal Commission on Sugar Supplies, which was set up in Aug., 1914. A Royal Commission on Wheat Supplies was set up in Oct., 1916. In their early stages both these Commissions confined themselves to regulating the wholesale purchase and distribution of wheat and sugar respectively, but they played a prominent part in the stricter control which followed the establishment of the Ministry of Food. Both bodies later became international in character, and bought for the European Allies, and in the case of the Wheat Commission also for some neutrals as well as the British Government.

Rationing. So far as the consumption of food-stuffs by the population was concerned, economy was for some time enforced in the United Kingdom, as in the United States, by appeals for voluntary abstention, but in the United Kingdom the disturbing forces which had come to operate on the country's food-supply began to make themselves acutely felt towards the end of 1917, as a result of the shortage of shipping caused by the submarine campaign, and of the need for a reduction of the amounts spent in the purchase of foodstuffs abroad. Accordingly, first sugar and then meat and butter were 'rationed,' i.e. the amount of each food which might be consumed in a week by each inhabitant was fixed, and the purchase of supplies above this amount was prevented by wartime legislation enforcing the presentation of a 'coupon' from a 'ration-book,' covering a period of several months, on each occasion when supplies were purchased.

The quantities of food allowed were varied in the case of heavy workers and of invalids. In the case of bread, compulsory rationing was not resorted to, but the normal worker not engaged on heavy labour was urged not to eat more than four pounds a week, and economy was secured by milling of wheat to a higher extraction of flour, by increasing the admixture of other cereals, and to some extent by the importing of flour instead of wheat.

The introduction of rationing (whether compulsory or voluntary, for in the case of bread the voluntary limit was generally observed) made possible an equitable division among the whole population of the limited supplies available, and also steadied prices. The period preceding rationing had been marked by a rapid rise in prices, and also by local panics due to temporary exhaustion of supplies in particular districts. These panics manifested themselves in 'queues' of purchasers, generally women of the working-classes, who gathered at shops which were rumoured to have supplies of the food-stuffs which it was difficult to obtain.

Ministry of Food. The administration of food-control for the whole country was in the hands of the Ministry of Food, a department created in 1917 which continued in existence till March, 1921, when its surviving functions were transferred to the Board of Trade. The first Food Controller was Lord Devonport, but the greater part of the ministry's constructive work was carried out under Lord Rhondda. The local administration was in the hands of Local Food Committees in cities, towns, and rural areas, under the direction of fifteen Commissioners, who represented the Food Controller in divisions comprising a number of counties. The Ministry of Food did

not confine itself to dealing with food-stuffs the supplies of which were rationed, but also controlled the distribution of many other kinds of food-stuffs to retailers, with a view to watching the situation and being prepared to ration if occasion arose. Further important economy, both in shipping-space and in finance, was effected by centralizing in the hands of the ministry the purchase abroad and importation of a number of food-stuffs.

As the difficulties became more severe, steps were taken in 1918 to develop a system of inter-allied organization of food-supply, and accordingly food-control also had extensive international ramifications. In the case of a number of important food-stuffs, such as meat and fats, oil and seeds, as well as wheat and sugar, all purchases on behalf of the Allies were jointly determined by a single body in London, and carried out by a single body in the country in which purchases were made. Among the articles thus dealt with were meat, bacon, hams, lard, butter, poultry, fruit and vegetables, condensed milk, oleo oil and stock oil, margarine oleo and stearine, wheat, and sugar.

The results of these methods were far-reaching, as they undoubtedly kept prices down by eliminating competitive buying by the European Allies in the United States, South America, and elsewhere, and at the same time rendered possible the most effective use of shipping, both by the most economical routing of vessels bringing food-stuffs to Europe, and by the rationing of each of the Allies, so that as large a quantity of tonnage as possible might be diverted to the carriage of munitions of war.

In 1925 as a result of the investigations of a Royal Commission into profiteering, a Food Council was appointed. It did not effect much of importance. One piece of legislation, however, brought about by the Council was the Weights and Measures Act, 1926.

FOODS AND FOOD VALUES. One of the most significant events that marked the separation of the ancestors of man from those of the apes was a tremendous change in diet. Although the apes and the lowlier Primates often eat eggs, grubs, and a variety of insects, or even small birds and reptiles, their diet is mainly vegetarian. But the human family is omnivorous. Mankind makes use of an infinitely more varied vegetable diet than the apes rely upon, but in addition it exploits almost every class of the animal kingdom for meat. Lowly races like the aboriginal Australians eat a variety of seeds and roots, but their diet is varied by shell-fish, fish, grubs, lizards, snakes, birds, and mammals.

The earliest members of the human family of whose habits we know anything seem to have hunted wild cattle and horses, no doubt to obtain meat. But they also showed a partiality for coasts and river banks, and the great piles of shells (kitchen middens) and the number of harpoons found in association with the earliest known members of the species *Homo sapiens* reveal the important part oysters and other molluscs and fish played in the dietary of early man.

Civilization can be said to have had its origin when man began to cultivate barley and millet. At about the same time, and probably by the same people, cow's milk and butter were added to the diet. As culture spread in the region of the Eastern Mediterranean, wheat was added, and in India the methods of cultivating barley and wheat in Egypt and Mesopotamia were applied to the cultivation of rice.

As culture spread, the diet of the people living in the centre of civilization became more and more varied as new kinds of food were brought in from the periphery. Hence at the present day the food of any civilized community includes a bewildering assortment of animal and vegetable products, as well as not a few synthetic substances made by chemists. In spite of this illimitable variety and complexity in the materials man uses for food, the essential ingredients are virtually restricted to the three categories, proteins, fats, and carbohydrates, with, of course, a necessary addition of water and certain inorganic salts. To test the value of any food-material the relative amounts of these three classes of substances must first be determined.

Potential Energy of Food-stuffs. The usefulness of any of these substances is measured by its potential energy, by which is meant the amount of energy which can be obtained, either in the form of work, heat, &c., by the oxidation of the food-stuffs to the same extent as occurs in the living body, where the materials supplied to the body as food are in part absorbed and assimilated into the substance of the body and in part rejected (along with the waste products resulting from the bodily metabolism) as the excreta.

In order to express in figures the total potential energy of a food-stuff, the term *calories* has been adopted. By burning a weighed quantity of dried food-stuff in oxygen in a calorimeter, the heat-value of any given food can be obtained and expressed as the amount of large calories given out by the substance on complete combustion with oxygen. A *large calorie*

signifies the heat required to raise the temperature of a kilogram of water from 0° C. to 1° C. As illustrations of the value of common articles of food the following examples may be given: cane sugar 4·116, starch 4·191, lean meat 5·656, and butter 9·231.

But there are great differences in the case of different foods between the absolute heat-value (as tested in a calorimeter) and the physiological heat-value (as expressed in the living body of a human being). Some of the food-materials, like the carbohydrates (sugars and starches) and the fats, are completely oxidized in the body and ultimately converted into water and carbonic acid, so that their absolute heat-values are available and become expressed in work and heat in the body.

But the protein foods (meat and certain parts of vegetable food) do not undergo complete oxidation in the body. There is only a partial oxidation, so that, instead of free nitrogen being given off (as it is when protein is heated in a calorimeter), in the living body the nitrogen is excreted as urea and other relatively complex bodies. Hence it is necessary to estimate the heat-values of such substances, and subtract the figures from the absolute heat-values of proteins, to obtain the physiological heat-value, i.e. the actual usefulness of these foods to the living body.

After making these necessary corrections the average physiological value of the three classes of food-stuffs can be expressed as follows:

1 gramme of fat = 9·3 calories.
1 gramme of carbohydrate = 4·1 calories.
1 gramme of protein = 4·1 calories.

"The average starvation metabolism of a vigorous man at light work and weighing 70 kilograms approximates 2240 calories, or 32 calories per kilogram. It is obvious that this amount of energy must be contained in the daily food, and a little more to counter-balance the 'specific dynamic' or heat-increasing power of the food-stuffs, if the individual is to be maintained in calorific equilibrium. When an average mixed diet is ingested, the maintenance requirement is between 11·1 and 14·4 per cent above the starvation minimum. This would amount to from 2488 to 2562 calories, or from 35·5 to 36·6 calories per kilogram of body weight" (Lusk).

Sufficient food must be taken to supply these minimum requirements;

	Weight (ozs).	Protein (grammes).	Fat (grammes)	Carbo-hydrate (grammes).	Calorific Value.
Fresh meat (with 20 per cent bone)	9·6	32·24	39·42	—	49
Meat, preserved	3·5	25·55	20·04	—	290
Bread	15	34·02	2·12	212·7	1031
Biscuit	4	18·82	1·67	90·34	463
Cheese	2	15·1	18·4	·14	233
Butter	1	·36	23·24	—	217
Condensed milk (1 tin for 12 men) ..	—	3·31	3·12	20·86	126
Bacon (waste 8·7 per cent)	4	10·85	60·53	—	696
M. and V. ration	5·5	18·28	20·86	9·12	304
Vegetables (fresh potato)	8	4·08	·22	33·31	155
Sugar	3	—	—	76·55	313
Jam	3	—	—	52·3	214
Mustard	$\frac{1}{10}$	—	—	—	—
Pepper	$\frac{1}{16}$	—	—	—	—
Salt	$\frac{1}{4}$	—	—	—	—
Tea	$\frac{1}{8}$	—	—	—	—
	58·6	162·61	189·62	495·35	4449

but it is clear that the number of calories to be supplied will vary not only with the size of the body but also with the kind and amount of work done. While a small body requires fewer calories than a large, owing to the *relatively* greater extent of skin-area in the former, the number of calories per body weight is greater. An illustration taken from Rubner (quoted by Lusk) will make this more intelligible.

Weight in Kgm.	Area in Sq. M.	Calories of Metabolism	Calories per Kgm.
80	2·283	2864	35·8
70	2·088	2631	37·6
60	1·885	2368	39·5
50	1·670	2102	42·0
40	1·438	1810	45·2

The required number of calories can be provided by proteins, fats, or carbohydrates; but for several reasons it is important that all three kinds of food-stuffs should be included in the

diet, and combined in proper proportions to form a satisfactory ration. A proper ration has been defined by Voit as "a well-tasting mixture of foodstuffs in proper quantity and in such a proportion as will least burden the organism" (Lusk). He gives the following ration of food administered in a digestible form for the use of an average labourer working from eight to ten hours a day: protein, 118 grammes; carbohydrates, 500 grammes fat, 56 grammes. This represents 3055 calories.

A great deal of discussion has taken place with reference to a proper dietary, and much important work on the subject was done during the European War. The British field-service ration in June, 1916, was as above.

	Protein	Fat	Carbohydrate
Actual proportion	1·0	1·16	3·05
Theoretical requirements	1·0	1·5	3·5

For purposes of comparison the following ration values in calories for different armies are given:

	British	U.S.A.	Russian	French.	German
Peace Ration ..	—	4179	4060	3426	3161
Field Service Ration	4149	4199	4891	3064	2891
Emergency Ration	2595	4110	—	2130	2786

The following figures are given in an official British document:

Calories required per diem

For sedentary life ..	2450
„ slight muscular work	2700
„ light to moderate work	3050
„ moderate work ..	3400
„ very hard work ..	5500

Vitamins. One of the most important advances in the scientific understanding of the problems of nutrition has been the recognition of the fact that a proper diet to maintain the growth and healthy metabolism of the body must contain something more than proteins, fats, carbohydrates, and salts. "There are some substances existing in natural foods, in very minute quantities, which are absolutely essential to the harmonious fulfilment of the life processes" (Lusk). Funk gave the name 'vitamins' to these substances.

Writing in 1906, Professor Gowland Hopkins, of the University of Cambridge, who is one of the pioneers in this far-reaching advance in our knowledge, explained the significance of what he called the 'accessory factors' of diet. "No animal can live on a mixture of pure protein, fat, and carbohydrate, and even when the necessary inorganic material is carefully supplied the animal still cannot flourish. The animal is adjusted to live either on plant tissues or the tissues of other animals, and these contain countless substances other than proteins, carbohydrates, and fats."

The lack or insufficiency of these important materials in the food can cause such diseases as rickets, scurvy, pellagra, beri-beri, and other so-called 'deficiency diseases.' These vitamins have been differentiated into the 'fat-soluble A' and the 'water-soluble B.' The latter is regarded as identical with Funk's 'vitamins.' It cures the disease beri-beri.

Under the normal conditions of life human beings are constantly ingesting in fresh vegetable and animal food an adequate supply of these essential vitamins. But when such fresh foods are lacking and reliance is placed solely on tinned food or on cereals completely deprived of their pericarps, 'deficiency diseases' are apt to occur.

The epoch-making discovery of vitamins has given a fresh impetus to the scientific study of food, and at the present time intensive investigations are being made into the complex and many-sided problems relating to this subject.—Cf. Graham Lusk, *The Elements of the Science of Nutrition* (3rd edition, 1917). *See* VITAMINS.

FOOD-SUPPLY. Of the four chief manufacturing and commercial countries, Britain, Germany, France, and the United States, only the last is practically self-supportive in respect of food-supply, but even in this case there is a considerable importation of sugar, coffee, and tea. The other three countries are all more or less dependent upon importation for some essential elements in their food-supply, and this dependence upon other lands is most marked in the case of Britain.

Before the European War the United Kingdom imported annually food and drink to the value of no less than £230,000,000 (roughly speaking), which was fully two-fifths of the total value of her whole annual import trade. Her annual import of grain and flour alone was valued at over £70,000,000, more than half of this representing wheat, wheat-meal, and flour. In the five years 1910–4 the United Kingdom imported 80 per cent of its wheat and wheat-flour, as well as large quantities of oats, barley, and maize; altogether of the total cereal requirements of the country over 60

per cent were imported during that period.

This dependence has been widely regarded in recent years as a serious weakness in Britain's economic and strategical position, and various proposals have been made for diminishing or removing it. Some are of opinion that Britain can obtain the whole of her food-supply from within the empire, and advocate the adoption of fiscal arrangements intended to bring about this state of imperial self-sufficiency. Others maintain that the empire cannot, at last for a very long time, supply the needs of the mother country in regard to food out of its surplus production, and hold that all the definite plans of imperial preference and reciprocity that have actually been proposed would entail serious economic evils out of all proportion to any benefits which might follow from their adoption.

Others, now comparatively few, seek to return to the old agricultural protectionism in order to increase the agricultural output of the United Kingdom, and still others hope for a revival of British agriculture from a radical reform of the land system, such as would give greater freedom and security to the farmer, a more honourable and independent position to the labourer, and a more effective co-ordinating control to public authorities.

Royal Commission. In view of the special importance of the food-supplies of the country in time of war, a Royal Commission was appointed in 1903 "to inquire into the conditions affecting the importation of food and raw material into the United Kingdom in time of war, and into the amount of the reserves of such supplies existing in the country at any given period, and to advise whether it is desirable to adopt any measures, in addition to the maintenance of a strong fleet, by which such supplies can be better secured, and violent fluctuations avoided."

The Commissioners, who reported in 1905, assumed that the stock of wheat in the United Kingdom, which was usually about 17 weeks' supply in September, would never fall below 7 weeks' supply except in August, when it might be 6½ weeks. They held that "not only is there no risk of a total cessation of our supplies, but no reasonable probability of serious interference with them, and during a maritime war there will be no material diminution in their volume." They considered various schemes for preventing the dangers that might accrue from a 'panic' rise of prices during war time, and held that a large stock of grain existing within the United Kingdom would be the most powerful means of attaining this end but they felt bound to reject nearly all the proposed schemes for increasing the stock of grain. They strongly approved the introduction of a system of national indemnity against loss from capture by the enemy, on the ground that it would operate as an additional security to the maintenance of our oversea trade and as an important steadying influence upon prices.

European War. The conclusions of the Royal Commission were confirmed by experience in the European War (1914–8), as food-stuffs flowed freely into this country from its numerous sources of supply overseas. It was not until 1916 that the need for economy of purchases abroad, and the shortage of shipping due to other demands and to submarines, caused the Government to encourage tillage by guaranteeing the prices of wheat, oats, and potatoes.

In 1917 the position became more serious as the result of unrestricted submarine warfare, and the Corn Production Act was passed. This secured to the farmer minimum prices for wheat and oats over a period of five years gave the agricultural labourer a minimum wage fixed by agricultural wage boards; and gave the Board of Agriculture powers of entry on land and of requiring better cultivation.

About the same time a special Food Production Department of the Board of Agriculture was set up, whose functions were to secure an adequate supply of labour for agriculture; to mobilize and increase the supply of horses and agricultural machinery; and to arrange the supply and distribution of seed and fertilizers. The department worked largely through county and local agricultural committees, and some idea of its work is given by the fact that the number of women working on the land was increased from ninety to three hundred thousand, and that over four thousand tractors were made available for ploughing, &c., while the tillage area was increased by three million acres between 1916 and 1918. As a result, it was possible very largely to reduce the quantity of cereals imported.

After the close of the war, however, the amount of land under crops speedily fell again, and the question arose whether, and if so what, steps should be taken permanently to increase the proportion of food-stuffs consumed in the United Kingdom which is produced at home.

Agriculture Act. In 1920 the Agriculture Act was passed, the first part of which continued the system of guaranteed prices, minimum wages, and enforcement of good cultivation

which had been instituted as a war-time measure by the Corn Production Act, 1917. In 1921, however, the collapse of cereal prices threatened to involve the Government in very heavy expenditure to maintain guaranteed prices to British farmers, and accordingly the first part of the Agriculture Act was repealed, which involved a return to pre-war conditions as regards food production in the United Kingdom.

FOOL, in olden days a jester, but now a person without sense. Kings and noblemen had fools at their courts who were expected to amuse them and their guests by their tricks and sayings. The fool wore a special dress and carried a stick with a bladder at the end of it. There are many references to fools of this kind in literature, instances being Touchstone in Shakespeare's *As You Like It* and the fool in *Tranhoe*. The keeping of fools died out in the 17th century. In the Middle Ages one of the recognised feasts was called the FEAST OF FOOLS.

FOOLS, FEAST OF, the name given to festivals regularly celebrated, from the fifth to the sixteenth century, in several countries of Europe, by the clergy and laity, with the most absurd ceremonies. The Feasts of Fools was an imitation of the Roman Saturnalia, and, like this, was celebrated in December.

The chief celebration fell upon the day of the Innocents, or upon New Year's Day: but the feast continued from Christmas to the last Sunday of Epiphany. The young people, who played the chief parts, chose from among their own number a mock pope, archbishop, bishop, or abbot, and consecrated him, with many ridiculous ceremonies, in the chief church of the place. They often travestied the performance of the highest offices of the Church, while others, dressed in different kinds of masks and disguises, engaged in indecent songs and dances, and practised all possible follies in the church.

Except from their association with the Saturnalia, nothing is known of the origin of these extravagancies, which appear to have been very ancient. They were most common in France, but the feast was also observed in Spain, Germany, England, and Scotland. In France it survived till the year 1664.—Cf. Du Tilliot. *Mémoires pour servir à l'histoire de la fêtes des fous.*

FOOLSCAP, paper of the smallest regular size but one (about 13½ by 16½ inches); so called from its watermark in early times being the outline of a fool's head and cap, for which British paper-makers now substitute the figure of Britannia.

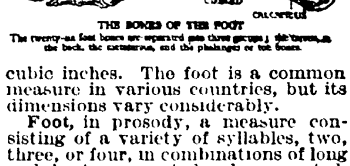
FOOL'S PARSLEY, the popular name of *Æthusa Cynapium*, nat. ord. Umbelliferæ, a common British weed, growing in cultivated grounds. It is commonly believed to be poisonous, and serious accidents are said to have occurred from its being mistaken for parsley; but if poisonous, it is so only in certain localities. Its unilateral reflexed floral leaves distinguish it from most plants to which it is allied.

FOO-SHAN, a town, China, province of Kwang-tung, 21 miles S.W. of Canton, on one of the branches of the delta of the Si-kiang. Pop. 200,000.

FOOT, a measure of length, the name of which is derived from the length of the human foot, containing 12 linear inches.

Square foot is a square whose side is 1 foot, and is therefore equal to 144 sq. inches.

Cubic foot is a cube whose side is 1 foot, and the cube contains 1728



THE BONES OF THE FOOT
The twenty-six foot bones are separated into three groups: the instep, the back, the metatarsus, and the phalanges or toe bones.

cubic inches. The foot is a common measure in various countries, but its dimensions vary considerably.

Foot, in prosody, a measure consisting of a variety of syllables, two, three, or four, in combinations of long and short, or accented and unaccented. In Greek and Latin verse the feet depend on the *quantity* or length of the syllables, each foot having a distinctive name—*trochee, iambus, dactyl, anapæst,* &c. The same names are applied to English measures, an accented syllable in English being held to be equivalent to a long syllable in Latin or Greek, and an unaccented syllable to a short.

Foot, in animals, the lower extremity of the leg; the part of the leg which treads the earth in standing or walking, and by which the animal is sustained and enabled to step; or that surface of the body by which progression is effected among the mollusca.

The foot of man is composed of twenty-six bones seven of which constitute the tarsus or ankle, which articulates with the leg and corresponds to the carpus (wrist). Five bones form the metatarsus, which corresponds to the metacarpus, and articulates with the tarsus behind, and with the toes in front. The foot is narrow and thick in its posterior part, thinner and broader

anteriorly; it forms a right angle with the leg, and rests upon the ground at the extremities only. The middle portion is in the form of an arch, and, in consequence, resists shocks and supports pressure much better than it could if it were flat and touched the ground throughout its whole length.

FEET, SORE. The causes are corns, bunions, blisters, in-growing nails, falling arch, etc., all of which can be relieved by proper care and attention.

Corns, horny growths occurring on the toes or soles of the feet—should be removed by the application of a plaster or by soaking in hot water with bath salts or common washing soda, and then paring with a sharp instrument.

Bunions (inflamed swelling of the bursa over the large joint of the big toe) may be relieved by applying hot fomentations. Bunions are caused by wearing tight, pointed shoes; the inner side of the shoe should be straight, allowing the big toe to lie in its natural position.

Blisters should be punctured near the edge with a sharp, sterilised instrument such as a needle, and when the fluid has run out boracic ointment or lint should be applied and the part covered with a dressing. Feet which blister easily may be hardened by adding methylated spirits to the water in which they are bathed.

In-growing Toe-nails should be treated by a chiropodist if they are bad, but slight tendency may be corrected by cutting the nails straight across, and then cutting a small v from the centre.

Falling Arch, engendered by too much standing—a doctor must be consulted and a support worn inside the shoe.

FOOTA-JALLON, or **FUTA-JALLON,** a large district forming the inland portion of French Guinea; area, 40,500 sq. miles; pop. about 700,000. It is extremely mountainous, and is the source of the Rivers Senegal, Gambia, and Grande. Large herds and flocks are pastured in the highlands; and the soil produces in abundance oranges and bananas, and palm trees, which furnish dates, wine, and oil.

FOOT-AND-MOUTH DISEASE, a highly contagious eczematous affection which attacks the feet and mouths of cattle, manifesting itself by lameness, indisposition to eat, and general febrile symptoms, with ultimately eruptions of small vesicles on the parts affected, and general indisposition of the animal. The disease occasionally spreads to the udder of milch-cattle, and it is believed that it may be communicated to persons who drink the milk of cows so affected.

FOOTBALL, a game which, as the name implies, consists in imparting motion to a ball with the feet. The extreme simplicity of materials required explains the great antiquity (and nowadays remarkable popularity of the game.

Historical Survey. In some form or other it existed beyond doubt among the Greeks, and evidence is available that the form then in vogue bore some resemblance to the present Rugby form, since, in addition to kicking, the ball was held in the hand. The game was introduced into this country by the Romans, and for long it maintained a doubtful popularity, principally on account of the roughness of the methods, an objection which induced James I to forbid the heir-apparent to play.

No definite rules appear to have been formulated until Rugby schoolboys drew up a code for themselves, and a classical description of the game then played is familiar to readers of *Tom Brown's Schooldays.* Up till then, and indeed at that time, the system of limiting the number of players on the opposing sides had not been adopted. Provided that opposition was afforded, no other distinction appeared necessary, and even to this day, in various parts of the country, Shrove Tuesday remains the football day of the year, when the whole of a small town or district engage in a contest unlimited as to the number of participants, the field of play, and the duration of the game. Such an annual game is, of course, only a traditional persistence, and at the present, wherever football is played, a number of rules govern the players' methods according to the code—Rugby or Association.

To conclude the historical survey. It has been mentioned that Rugby School developed a game with the first definite rules, constituting the basis of Rugby football as we know it to-day. It appears that during the course of a game one enterprising player spontaneously introduced the innovation of taking the ball in his hand and running with it, an innovation suggesting such desirable possibilities that Rugby football soon came into being. So that, although the first of the two codes to be played under proper rules, it was actually a modification of a game of genuine football which had been in existence for centuries.

Apart from the school, the game received little support until the middle of the nineteenth century. It was still unattractively rough; actually the system of hacking an opponent was not forbidden until 1877. Other schools, however, gradually followed, and clubs came into existence, but a want of

uniformity proved a great disadvantage until the establishment of the English Union in 1871, followed by the International Board in 1889 to settle any disputes which inevitably arose, since various unions adopted rules of their own not accepted by their opponents.

Even at the present day the Northern Union has remained separate from all others, with a number of minor distinctions in its rules, and the important difference that its players may be financially subsidized. Outside the Northern Union there is no professional Rugby football, a very striking contrast, as will shortly be shown, to Association football.

Rugby Football. Rugby Football is played between sides of fifteen, and the usual arrangement is to divide them into eight forwards, two half-backs, four three-quarter backs, and one full back. Rigidity as to this formation is not essential. There has of recent date been a tendency to reduce the number of forwards to seven, and increase the three-quarter back-line, or, as is the case among the South African players, to modify the construction of the team so as to present seven forwards, two half-backs, two 'five-eighths,' three three-quarter backs, and a full back. The opposing captains toss a coin for choice of position, the advantage afforded by the prevailing wind and slope of the ground, and, to a lesser degree, by the sun, dictating the selection, although, as the teams change ends at half-time, the captain successful in the toss must exercise some judgment in selecting the period of the game in which he will employ the advantage of the better position.

The details of the game and the rules which govern it are far too numerous to describe, but the essential feature is to score goals by kicking the ball *over* the cross-bar of the opposing side, with the alternative of carrying the ball over the line behind the goal-post and touching it down, thus scoring 'a try,' which carries with it the privilege of attempting to kick a goal from a point reached by proceeding directly backwards from the position where the try was scored to an arbitrary distance, at the discretion of the player who attempts the kick. It is obvious that the nearer to the goal the try was scored, the easier it will be to kick a goal, since very much greater skill will be required to kick a goal at an acute angle, which will be necessary if the ball has been touched down near the touch-line. It remains to be added that the try in itself ('unconverted') scores a smaller number of points, so that the game is won according to the total points—goals and tries—scored. A goal may also be kicked not from a fixed place, but as a 'drop-kick' from any part of the field.

Essential rules of the game are that a player who is not at the time holding the ball may not be molested, and that even when in possession of the ball, although he may be 'tackled' or 'collared' to prevent his proceeding farther or from passing the ball to one of his colleagues, he may not be tripped up. If such fouling occurs, the side is penalized by giving their opponents an opportunity to kick a goal, or at any rate to improve their position in the field of play by a kick forwards. The ball may be 'passed,' that is, thrown or kicked to a colleague, but always in a backward direction. And finally, should a player kick the ball forward, it may not be touched by any other player of his side until (1) a player of the other side has touched it, or (2) unless he was behind the player who kicked it at the moment when the kick took place. This is known as the 'off-side' rule.

The game is started by the ball being kicked from the centre of the field by a member of the team that lost the toss for choice of ends. Subsequent occurrences depend upon the skill of the opposing sides. The idea, as has been stated, is to carry the ball across the goal-line of the other side, and this is achieved by running, dodging, and swerving, and passing to a colleague at the critical moment, drawing the opposition, perhaps, so that he has a clear run at the time when he receives 'the pass.'

The three-quarter backs are essentially the players who are expected to score in this way. It may be crudely said that the forwards open up the game as a whole, the half-backs develop the game and get the ball for their three-quarters, whilst the *métier* of the full back is defence, so that he is usually selected for his strength in tackling and his powers in long-distance kicking. The three-quarter backs should combine speed with skill; they should be able to get into their stride with the minimum of delay, to swerve at speed, and yet be strong enough to 'hand-off' opponents who endeavour to stay their progress, and to break up the combination of the opposing three-quarter line. It will be readily believed that a player who unites all these attributes is not often obtainable, and a compromise in selection is inevitable. Many Rugby football players of great pace have been far inferior to less speedy runners who had a better general conception of the game and were more clever in their tactics.

The duration of the game is from an hour to an hour and a half, divided into two equal periods of play, with a

short interval at half-time, when the teams change ends.

Whilst the game is slowly increasing in popularity to the extent that it is being adopted by certain of the great public schools, e.g. Harrow, who have hitherto preferred the other code, it is certainly not the favourite of the masses. The great exponents of the Rugby game are the Scottish public schools, particularly Fettes, Loretto, and Glenalmond; English public schools, such as Bedford, Rugby, Uppingham, Dulwich, Merchant Taylors, St. Paul's, Oundle, The Leys, and Mill Hill; the hospitals, colleges, and universities throughout the British Isles; and a number of clubs in London, such as Blackheath, Richmond, and The Harlequins, who usually draw upon old public school and university players.

In addition, many towns may be mentioned as the homes of Rugby football, e.g. Leicester, Gloucester, Coventry, Northampton, whilst the vogue in South Wales is greatest of all, so that even a comparatively small town has a first-class team, and the teams of the larger towns, such as Newport, Swansea, and Cardiff, challenge comparison with the best.

Association Football. The Association code of football was originally devised in the old public schools. At Westminster School a form of football, suitable to the cloisters, was practised 200 years ago. Almost since the school's foundation football was played at Harrow. In greater or less degree matches were played among the boys at the schools of Shrewsbury, Charterhouse, Uppingham, Winchester, Eton, and Rugby. The area of the playing spaces, as well as the ideas of the masters and the pupils, produced different rules, which are set forth under such titles as "The Uppingham Game," "The Winchester Game," "The Rugby Game," and "The Eton Game" (in two styles). When the boys went to the universities, and into other spheres of life, they desired to continue such manly exercise, but the wide divergence of rules was a serious difficulty.

Obviously universal laws for the game were essential, and in 1863 an effort was made to obtain such uniformity by players in London and by a committee at Cambridge University. But on 26th Oct., 1863, the representatives of thirteen London clubs held a meeting and resolved: "That the clubs represented at this meeting now form themselves into an association, to be called the Football Association." The scheme of the promoters was to include the best points of all rules, and to bring all players into one body. They were not successful, for the Blackheath Club, adhering to the practice of carrying the ball, withdrew, and the rules finally ratified on 8th Dec., 1863, were in principle, but not in detail, the same as those drawn up by Cambridge University. Thus there was a cleavage which has endured, the Football Association, the pioneer body of governing Associations, maintaining the control of the game, which for some years was chiefly confined to clubs formed by the former pupils of the public schools, and by middle-class men connected with the law and banking.

Progress was slow, for at the beginning of 1866–7 only Barnes, Civil Service, Crystal Palace, Kensington School, London Scottish Rifles, the No Names, Royal Engineers, Sheffield, The Wanderers (all public school men) and Worlabye House were affiliated to the Association. The game was popular in Sheffield, and the Sheffield club proposed a match between London and Sheffield. The game was played on 31st March, 1866, at Battersea Park—the first representative match. The game spread farther afield, and in July, 1867, the Queen's Park Football Club, Glasgow, was formed, having obtained a copy of the rules from Mr. John Lillywhite, of London, who had published them.

Clubs were organized at many centres, and in the last three months of 1867, 300 matches were played under the laws of the Association, compared with 122 for the same period in 1866—these figures being founded on reports in newspapers of the day. In 1870 Queen's Park became members of the Football Association, and sixteen clubs in Sheffield were affiliated.

On 20th July, 1871, the Football Association resolved: "That it is desirable that a Challenge Cup should be established in connection with the Association for which all clubs should be invited to compete." This was carried into effect, and the £25 necessary for the purchase of the Challenge Cup (now known popularly as The English Cup) was subscribed by the clubs. Fifteen clubs, including Queen's Park, entered, and this competition not only brought the game into considerable popularity, but was the indirect means of bringing about the first match between England and Scotland on 30th Nov., 1872, at Partick, Glasgow. The Queen's Park arranged the match and supplied the team.

Between 1867 and the middle of the 'seventies various other organizing and controlling bodies came into existence. Clubs were formed in all parts of England and Scotland—provincial clubs which had their own county and district administrative executives, and

these in turn became allied with national associations. Owing to the initiative of Queen's Park, the Scottish Football Association was founded on 13th March, 1873, and the pastime gained ground far more speedily in Scotland than in England. Thus in 1875 the Scottish Association had 27 clubs in membership; in 1876–7, 91 clubs; and in 1880, 140 clubs. The Scottish Association in 1876–7 had an entry of 81 clubs for the Scottish Cup, while the parent Association in London had but 37. Scotland began a series of international matches with Wales at Glasgow in 1876, and after that encounter the Welsh Association was brought into being on 24th May, 1876. In 1878 Queen's Park and the Glasgow Caledonians played an exhibition game on the ground of the Ulster Cricket Club, at Belfast. Thus were the seeds of "the noxious Scottish weed" planted in Ireland, and in 1879 the Cliftonville Club was established. The example was followed, and the Irish Association was organized in Nov., 1880.

With all Great Britain playing this game, the Association code was carried overseas, and became recognized throughout the world. The outcome of the foundation of these governing bodies in the British Isles was the International Board, which first met in London during June, 1887. This consisted of two representatives of each of the four national Associations, who discussed and decided "proposed alterations in the laws of the game, and generally any matters affecting Association football in its international relations." When the game extended to most parts of the world, an International Federation was established at Amsterdam, and this body was eventually permitted to send delegates to the International Board, which, however, maintained its power as the makers of the laws. As Great Britain eventually seceded from the Federation, the Board remains, as always, the supreme authority on the laws.

The spread of the game throughout the industrial centres of England, and the entrance of many ambitious clubs for the English Cup, brought in a democratic element. Eventually intense rivalry induced clubs to seek out capable players, without any local attachment, and make them members. Many men left Scotland for English clubs between 1880 and 1884. There was no doubt that these importations were secretly paid, and, after great arguments for a year or two, the Football Association, in the summer of 1885, made payments—which they were powerless to prevent—legal, and thus gave official sanction to professionalism. The Scottish Association published a list of 'outlaws,' but in spite of that in 1890 there were 230 Scottish professionals in England. In May, 1893, the Scottish Association legalized payments to players, and other countries eventually accepted what was considered inevitable.

From 1885 there was thus a distinct division in English football, the players being classified as amateur and professional. The professional side of the game has become entirely spectacular, and has attracted more public attention, but there is far more amateur football. In order to obtain money to pay wages, the big clubs in England met in April, 1888, and formed the Football League. This consisted of Preston North End, Wolverhampton Wanderers, Bolton Wanderers, Aston Villa, West Bromwich Albion, Everton, Derby County, Notts County, Burnley, Stoke, Accrington, and Blackburn Rovers. There were only five rules. The first bound the clubs not to cancel League Matches, and the third decreed that League Matches must be played in full strength.

This departure caused the institution of preliminary qualifying stages for national trophies, and the exemption of powerful clubs so that they could carry out their League programmes. The Football League gradually grew in importance, and in the season of 1921–2 had 86 clubs, in four sections, playing matches under its management. The League system has not only been of great value to clubs employing professionals, but has tended to the order and discipline of amateur clubs both in football and other sports.

In 1890 the Scottish Football League was arranged, the clubs then consisting of the Heart of Midlothian (who took the first steps), Glasgow Rangers, Glasgow Celtic, Paisley St. Mirren, Third Lanark, Paisley Abercorn, Dumbarton, Cambuslang, Vale of Leven, and Cowlairs. The Queen's Park, which has ever remained the most prominent amateur club in the world, declined an invitation to join the League, but in 1900–1, after holding out for ten years, Queen's Park joined the League, but preserved their Constitution, thus being the only amateur club associated with either the English or Scottish Leagues.

A federation of eight clubs banded themselves together to make the Irish League in 1890–1, and for the season of 1921–2 the Welsh League, conceived on a national basis with northern and southern sections, commenced its operations.

The pastime of the schools has become a highly organized spectacular

sport provided by professionals, rigidly controlled by associations and leagues. With all this development of one side of the game, it should not be overlooked that in England, where there are 8,000 registered professionals (the great majority being artisans attached to relatively small clubs), there are 800,000 amateurs. For every one professional there are 100 amateurs—a fact which is too often overlooked because the professionals' matches attract mammoth crowds, whereas the amateurs play for their own recreation and amusement, and not to entertain those who look on at games. —BIBLIOGRAPHY: K. R. G. Hunt, *Association Football*; J. E. Raphael, *Modern Rugby Football*; Sir Montague Shearman, W. J. Oakley, G. O. Smith, and Frank Mitchell, *Football* (Badminton Library); *Official Football Guide* (Spalding's Athletic Library); R. H. Barbour, *The Book of School and College Sports*.

FOOTE, Samuel, English comic writer and actor, born about 1720 at Truro, died at Dover, 1777. He was educated at Oxford, and entered the Temple; but after a course of dissipation, to which his small fortune fell a sacrifice, he turned his attention to the stage. He appeared first in *Othello*, but had little success as a tragedian. In 1747 he opened the theatre in Haymarket with a dramatic piece which he entitled *The Diversions of the Morning*. It consisted of some very humorous imitations of well-known characters, in detached scenes, written by Foote, who always took the leading parts himself. After 1752 he performed alternately in London and Dublin. He did not obtain a patent for the Haymarket till 1766. Among his numerous plays, above twenty in number, are *The Liar*, *The Mayor of Garratt*, and *The Devil on Two Sticks*, but none are memorable. His humour is described by Dr. Johnson and other witnesses as irresistible.

FOOTPATH. Narrow way for pedestrians only. Right of way over a footpath may be established by grant of the freeholder, or by user. In the latter case, if the public have had uninterrupted use of the path for 20 years, a right of way is established, the law presuming an ancient grant to have been in existence before that time. The owner of land who permits the public to use a path over it, but does not wish it to become a permanent right of way, can avoid it by closing the path once a year. **The Commons and Footpaths Preservation Society** in London closely watches reported encroachments on public rights of way. There is also a Peak District and Northern Counties Footpath Preservation Society.

FOOT-POUND, in physics, the practical unit measuring the work done by a mechanical force. A foot-pound represents the work done against gravity when 1 lb. weight is raised through a vertical height of 1 foot. *See* HORSE-POWER, WORK.

FOOT-ROT, a disease in the feet of sheep, the more common form of which is an inordinate growth of hoof, which at the toe, or round the margin, becomes turned down, cracked, or torn, thus affording lodgment for sand and dirt. In the second form of the disease the foot becomes hot, tender, and swollen; there are ulcerations between the toes, followed by the sprouting of proud flesh.

FOOT'S CRAY, urban district or town of England, in Kent, on the River Cray, 6 miles S.S.E. of Woolwich. Since 1920 the official name of Foot's Cray is Sidcup. Pop. (1931), 12,360.

FOOTSTALK, (1) in botany, a petiole; the stalk supporting the leaf, or connecting it with the stem or branch. (2) In zoology, a process resembling the footstalk in botany, as the muscular process by which certain of the Brachiopoda are attached, the stem which bears the body in barnacles, the stalk which supports the eyes in certain crustaceans.

FORAIN, Jean Louis, French artist, born in 1852, at Rheims. He studied under Gerôme at the École des Beaux-Arts, and soon distinguished himself by his satirical talent and his humorous sketches. In 1876 he began to contribute his humorous sketches, wherein he castigated contemporary French life, to *La Cravache*, the *Figaro*, *Journal Amusant*, *Vie Parisienne*, and *Le Rire*, and to his own paper, *Psst*. In this sheet, founded by himself and Caran d'Ache in 1898, during the Dreyfus agitation, he expressed anti-Semitic sentiments. In June, 1930, he was made an Honorary R.A.

FORAMINIFERA, an order of animals of low type belonging to the class Rhizopoda, phylum Protozoa, furnished with a shell or test, simple or complex, usually perforated by pores (*foramina*), whence the name. The shell may be composed of horny matter, or of carbonate of lime, secreted from the water in which they live. Owing to the resemblance of their convoluted chambered shells to those of the nautilus, they were at first reckoned among the most highly organized molluscs. In reality they are among the simplest of the protozoa.

The body of the animal is composed of slimy protoplasm, which not only fills the shell, but passes through the perforations to the exterior, there giving off long thread-like processes

called *pseudopodia* interlacing with one another so as to form a net like a spider's web. Internally the protoplasmic body exhibits no structure or definite organs of any kind, but several nuclei are present.

Foraminifera appear very early in the geological formations. The great formation known as white chalk is largely composed of foraminiferous shells, while another remarkable formation known as Nummulitic Limestone receives its name from the presence of coin-shaped foraminifers, generally about as large as a shilling.

FORBES, town of New South Wales. It is 289 miles to the west of Sydney, and is the centre of a district wherein sheep are reared. Pop. 4,650.

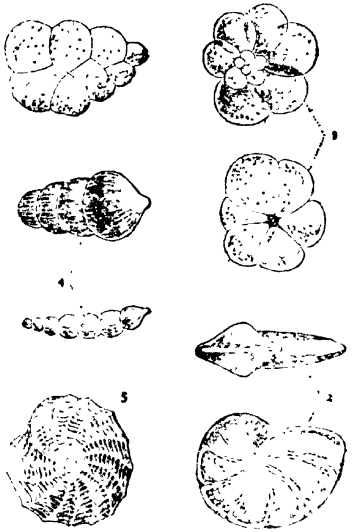
FORBES, Archibald, journalist and war correspondent, the son of a country minister in Scotland, was born in 1838, and died in 1900. He received a university education at Aberdeen, served for some years in the Royal Dragoons, but gave up the army for journalism. As war correspondent of *The Daily News*, he was with the German army in 1870-1, subsequently visiting Paris at the time of the Commune, India during the 1874 famine, and Spain. During 1875 and 1876 he accompanied the Prince of Wales in his Indian tour, and was an eye-witness of the Serbian War of 1876, and the Russo-Turkish War of 1877, going to Cyprus in 1878.

He was under fire during the Afghanistan campaign of 1878-9; next visited Mandalay, and accompanied Lord Chelmsford's army in Zululand, being the first to telegraph home news of the victory of Ulundi (1880). His health now began to break down, and he devoted himself chiefly to lecturing.

His chief publications were: *My Experiences in the Franco-German War*; *Glimpses through the Cannon Smoke*, *Chinese Gordon*; *Souvenirs of Some Continents*; *William I of Germany*, *Barracks, Bivouacs, and Battles*; *Havelock*: *The Afghan Wars*; *Czar and Sultan*; *Colin Campbell, Lord Clyde*; *Memories and Studies of War and Peace*; and *Life of Napoleon III*.

FORBES (for'bes or forbz), **Duncan**, of Culloden, Scottish lawyer and politician, born 1685, died 1747. He studied law at Edinburgh and Leyden; was called to the Bar in 1709, and appointed Sheriff of Midlothian. He helped to crush the rebellion of 1715; in 1716 was Advocate-Depute, in 1722 member of Parliament for the Inverness Burghs, in 1725 Lord-Advocate, and in 1737 Lord-President of the Court of Session. In 1734, in consequence of the death of his brother, he fell heir to the estate of Culloden.

He devoted himself to the improvement of the industry of Scotland, and materially aided in laying the foundations of that commercial prosperity to which his country has since attained. He also effected many improvements in the procedure of the Court of Session. It was mainly owing to his exertions that the rebellion of 1745 was prevented from spreading more rapidly among the clans; but so ungratefully was he treated by the Government, that he was never able to obtain repayment of the large sums he had expended to uphold it. He wrote



Foraminifera (shells enlarged)
1, Globigerine. 2, Cristellaria. 3, Textularia. 4, Nodosaria. 5, Polystomella

several religious works: *Thoughts on Religion*, *Reflections on the Sources of Incredulity in Regard to Religion*, and *Letter to a Bishop*.

FORBES, George William, New Zealand politician. Born at Lyttelton in 1868, he was educated at Christchurch and became a farmer. In 1908 he was elected to the House of Representatives and in 1928 was made Minister of Lands and Agriculture under Sir Joseph Ward. He acted as premier during Sir Joseph's illness and succeeded him in that office in May, 1930, becoming also Minister of Finance. Later in the year he attended the Imperial Conference in London.

FORBES, Henry Ogg, Scottish naturalist and traveller, born in 1851, and educated at Aberdeen Grammar

School and Aberdeen and Edinburgh Universities. He studied medicine for a time, and after two years' biological and geological investigations in Portugal (1875–7), he began in 1878 a six years' course of exploration in the islands of the East Indian Archipelago, where he made large collections and numerous observations, ethnological, biological, and geographical. Subsequently he led expeditions to explore Mount Owen Stanley, in New Guinea, and held the post of Acting Deputy-Commissioner in British New Guinea from 1886 to 1889. From 1890 to 1893 he was Director of the Canterbury (N.Z.) Museum, and in the latter year explored the Chatham Islands. He also explored the Island of Socotra (1898–9).

His most important publication is *A Naturalist's Wanderings in the Eastern Archipelago*. Dr. Forbes was Director of Museums to the Corporation of Liverpool from 1894 to 1911. He is LL.D. of Aberdeen University and Fellow of the Royal Geographical Society. From 1917 to 1920 he was on the Council of the Royal Geographical Society, and from 1883 to 1917 a Fellow of the Royal Anthropological Institute, when he resigned his fellowship owing to the retention of enemy members.

FORBES, James David, Scottish scientist, born 1809, died 1868. He was educated at Edinburgh University, and admitted to the Scottish Bar. In 1833 he was appointed to the chair of natural philosophy in the University of Edinburgh. In 1860 he became principal of the United Colleges of St. Salvator and St. Leonard in the University of St. Andrews. His fame rests chiefly on his study of glaciers. His chief publications on this subject are: *Travels through the Alps of Savoy, Norway and its Glaciers, Tour of Mont Blanc and Monte Rosa*, and *Occasional Papers on the Theory of Glaciers*. Forbes's theory of the glacier was that it was a viscous body, urged down slopes of a certain inclination by the mutual pressure of its parts.

FORBES, Joan Rosita, English traveller and writer. Born 16th Jan., 1893, a daughter of H. J. Torr, of Morton Hall, Lincolnshire, she travelled extensively in Africa and other countries. In 1920 she was with the expedition to the Kufra Oasis in Libya. In 1922-23 she visited Asir and went with a cinema expedition through Abyssinia in 1924–25. She is the author of several novels and books of travel and adventure, including *The Jewel in the Lotus*, 1922; and *From Red Sea to Blue Nile*, 1925. Her novels include *Sirocco*, 1927, and *Conflict*, 1931. She married firstly, Col. Ronald Forbes and, secondly, Col. A. T. McGrath.

FORBES, Sir John, a Scottish physician, a homœopathist, phrenologist, and believer in mesmerism, born 1787, died 1861. He received his professional education at Aberdeen and Edinburgh, graduating M.D. at the latter in 1817. In 1840 he settled in London, and soon became physician extraordinary to the Prince Consort, and physician to the queen. In 1853 he was knighted. His first works were his translations of the writings of Avenbrugger and Laennec on auscultation and the use of the stethoscope. To the *Cyclopædia of Practical Medicine*, of which he was joint-editor with Drs. Tweedie and Conolly, he contributed some of the best articles in the work. He was the founder of the *British and Foreign Medical Review*, and published a number of professional and other works.

FORBES, Stanhope Alexander, British artist. Born in Dublin, 18th Nov., 1857, he was educated at Dulwich and studied art. He won a reputation by his paintings of English rural life. 'The Health of the Bride' is in the Tate Gallery, London. The 'Fish Sale' and 'Forging the Anchor' are two of many popular works. In 1892 he was elected A.R.A. and in 1910 R.A.

FORBES MACKENZIE ACT, the popular title of an Act for the better regulation of the public-houses of Scotland, passed 15th Aug., 1853. It was introduced in the House of Commons by Forbes MacKenzie, member for Liverpool, although its author was Lord Kinnaird. *See* LICENCE.

FORBES-ROBERTSON, Sir Johnston, British actor, born in London in 1853. Educated at the Charterhouse, he studied art at the Royal Academy School, and elocution under Samuel Phelps, making his first appearance on the stage in 1874. He soon became one of the foremost actors of his time. Among the plays wherein he obtained great success were: *For the Crown* (1896), *Mice and Men* (1902), *The Light that Failed* (1903), and *The Passing of the Third Floor Back*. Among his Shakespearean roles are Hamlet, Othello, Shylock, and Macbeth. He married Gertrude Elliot, the actress, in 1900, and was knighted in 1913 at the termination of his farewell season at Drury Lane. He wrote *A Player under Three Reigns* (1925).

FORCE, in a general sense, is any cause of physical action. In the special sense of ordinary dynamics (q.v.), force means that which changes or tends to change the motion of matter. More definitely, according to Newton's second law of motion, a force is

measured by the momentum (product of mass and velocity) which it produces in a body in the unit of time. By Newton's laws, the force acting on any body, or on any particle of the body, can be calculated when the motion is known. Some writers regard force as simply a name for the result of this calculation, and maintain that we ought to think and speak of what we directly observe, which is not force, but mass-acceleration or rate of change of momentum. As against this view other authorities point out that in some cases we perceive force directly by our muscular sense, so that it ought to be considered to have a real physical existence. When, for example, a man holds a weight above the ground, it would certainly seem more natural and convenient to describe what is happening to the man and to the weight in terms of force than in terms of motions which have only a hypothetical existence.

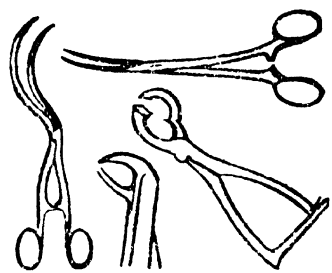
A force can be represented graphically by a straight line, which indicates its position, direction, and magnitude. Since the force may act either backwards or forwards along the given line, an arrow-head is usually added to make the specification complete. A force may be either a tension or a pressure, in other words, a pull or a push; but the distinction between the two types only becomes important when we take elastic properties into account. The conception of a single force acting along a mathematical straight line is of course only a convenient abstraction. What we have in nature is always a more or less continuous distribution of force, either throughout a volume, like weight, or over an area, like the pressure of the atmosphere. *See* ELECTRO-MOTIVE FORCE; MAGNETO-MOTIVE FORCE; also references under DYNAMICS.

FORCE MAJEURE, a term used to denote the occurrence of events which could not have been anticipated by human foresight or obviated by human agency.

FOR'CEPS, a general name for a two-bladed instrument on the principle of pincers or tongs, used for seizing and holding, and for extracting objects which it would be impracticable thus to treat with the fingers. Such instruments are used by watchmakers and jewellers in delicate operations, by dentists in forcibly extracting teeth, for grasping and holding parts in dissection, for extracting anything from a wound, taking up an artery, and by accoucheurs.

FORD, Edward Onslow. English sculptor. Born at Islington, 27th July, 1852, he studied at Antwerp and Munich and at an early age attracted attention with his busts and statues. His group statuary is represented by the Gordon Memorial in London and the Shelley Memorial at Oxford; other works of his are the Gladstone statue in London, the Huxley statue in the National History Museum, London, and a number of portrait busts of well-known people, all showing great skill in modelling. He was elected A.R.A. in 1888 and R.A. in 1895. He died in London, 23rd Dec., 1901.

FORD, Henry, American automobile manufacturer, born in Michigan in 1863. As a boy he worked in an engineering shop, and subsequently became chief engineer at the Edison Illuminating Company. In 1903 he founded a business of his own, the Ford Motor Company, which became the largest automobile factory in the



Forceps

world. During the European War Ford at first adopted the policy of bringing about peace as speedily as possible. For that purpose he brought over a party of Americans to Europe, but soon convinced himself of the fact that the Allied nations would not listen to the voice of peace as yet. When America entered the war, Ford abandoned his peace policy, and placed his resources at the disposal of his country, producing war material on a very large scale. In 1920 and 1921 he started an Anti-Semitic campaign in the United States. Ford is the author of *My Life and Work* (1922), *Today and Tomorrow* (1926), *My Philosophy of Industry* (1929), *Moving Forward* (1930) and *Edison as I Know Him* (1930).

FORD, John, English dramatist, was baptized at Islington, Devonshire, 17th April, 1586. Very little is known about his life, and it is quite uncertain when he died. He may have been at Exeter College, Oxford, for a while; he was admitted a member of the Middle Temple in 1602. As a young man he wrote some poetry of no outstanding merit: it is as a dramatist that he is famous. He is believed to

have been of independent means, and so was less dependent on the stage for a livelihood than any contemporary playwright. *The Sun's Darling*, a masque in which Ford collaborated with Dekker, appeared in 1624.

Ford's first independent play was *The Lover's Melancholy* (1628), a play strongly influenced by Burton's *Anatomy of Melancholy*. It contains the famous story of the nightingale's death, taken from Strada's *Prolusiones*. His next play, *The Broken Heart* (printed 1633), is one of the best and most celebrated of Ford's plays, and its plot is touching if somewhat melodramatic. *Love's Sacrifice* (also printed 1633) has an absurd plot, but much fine writing in it. *'Tis Pity she's a Whore* (printed 1633), like the lost *Æolus* of Euripides, turns upon the incestuous love of a brother and sister. In spite of its revolting subject, and in spite of the sensationalism that mars much of Ford's work, it is an arresting play, and it is most skilfully constructed.

Perkin Warbeck (printed 1631) is a return to the chronicle history-play which had long been out of fashion. The background of reality has helped Ford to check the extravagances of his fancy, and the play is a good one. *The Fancies, Chaste and Noble*, and *The Lady's Trial* (1638) both mark a distinct decline. After the publication of the latter play Ford drops out of sight.

Ford had no sense of humour, and sinks below all the other Jacobean dramatists in the bad quality of his attempts at comic relief. He was, however, a beautiful writer of blank verse, he had great mastery over some of the technical difficulties of his art, and above all he had a deep knowledge of the passions and contradictory impulses of the human heart.—BIBLIOGRAPHY: A. C. Swinburne, *Essays and Studies*; Sir A. W. Ward, *History of English Dramatic Literature*.

FORD, Richard, English writer on Spanish subjects, was born in 1796, and died in 1858. He was educated at Winchester and at Trinity College, Oxford, where he took his B.A. degree in 1817. He then studied law and was called to the Bar, but never practised. From 1830 to 1834 he lived with his family in Spain, and in many riding-tours acquired an intimate knowledge of the country. Returning to England, he took up his residence near Exeter, and contributed several articles to the *Quarterly* and *Edinburgh Review* and other periodicals, dealing with Spanish art and architecture.

In 1845 appeared the original edition of his excellent *Handbook for Travellers in Spain*, a veritable storehouse of information, rich alike in knowledge and in wit and humour. In subsequent editions this work underwent various changes, and was much reduced in bulk.

FORDINGBRIDGE, town of Hampshire. It stands on the River Avon, 11 miles from Salisbury and 93 miles from London by the S. Rly. It has an agricultural trade and was once a market town. Pop. 3,394.

FOR'DUN, JOHN OF, the father of Scottish history, born probably at Fordoun, Kincardineshire, soon after 1300, died about 1386. He wrote the first five books of his history known as the *Scotichronicon*, or *Chronica Gentis Scotorum* (in Latin), bringing it down to 1153, and part of the sixth, and left materials for its continuation down to his own period. It was resumed about 1441 by Walter Bower, abbot of the monastery of Inchcolm, by whom the five books of Fordun were enlarged, and eleven new ones added, bringing the history down to 1437. It exists in numerous MS. copies, and several printed editions have been published, the best of which is that of W. F. Skene, Edinburgh, 1871–2, with translation.—Cf. Sir Herbert E. Maxwell, *The Early Chronicles relating to Scotland: being the Rhind Lectures in Archæology for* 1912.

FORDWICH, village of Kent. It is on the Stour, 3 miles from Canterbury and in the Middle Ages was an important port, being a member of the Cinque Port of Sandwich. It decayed owing to the closing of the channel of the Stour and for other reasons. It was a corporate town until 1884. Pop. 250.

FORECASTLE, a short deck in the forepart of a ship of war, or forward of the foremast, above the upper deck. In merchant ships it is the forepart of the vessel, where the sailors live.

FORECLOSURE, in English law, is the right of a mortgagee, or of anyone having interest in a mortgage, in the event of the conditions of the mortgage being violated, to compel the mortgager to redeem the pledge or forfeit his right of redemption.

FOREIGN EXCHANGES are the system under which the value of the money of one country in terms of that of others is determined. In London, the *rate of exchange* with any country usually expresses the number of units of the currency of that country which go to the pound sterling; sometimes, as in the case of the rupee, the quotation gives the number of shillings and pence to the foreign unit. Published lists, as a rule, give two rates, one at which a banker is prepared to buy, the other at which he will sell, or sometimes one representative 'best'

paper, and the other good commercial bills.

The chief influences affecting the foreign exchanges are (1) the relative demand for and supply of bills of exchange on the two countries concerned; (2) the comparative purchasing power of the currencies of the countries. When, for example, French merchants have many payments to make in London, and only a limited number of bills in London are in the market, the number of francs given for a pound increases, and the rate moves in favour of London.

The supply of and demand for bills of exchange is mainly determined by (*a*) the balance of imports and exports between the countries. Increased imports into one country means not only an increased supply of bills on that country, but increased demands for bills on the other to pay for the goods, and so move the exchange against the importing country. (*b*) Relative rates of discount, which determine whether it is worth while to transfer money from one country to another, thereby making it dearer or cheaper. (*c*) Political or other events which affect confidence, and so encourage or hinder investment in a country. The comparative purchasing power of currencies is to-day of supreme importance in determining rates of exchange.

Owing to the currency of most countries now consisting of inconvertible paper, and to restrictions on the movement of gold, prices (which express the value of the currency limit in terms of commodities) in each country are largely independent of those in other countries, and with movements in comparative price level come movements in the exchange. Given the possibility of gold movement, the exchange may move so that it is cheaper to send gold one way or the other than to buy bills, and the exchanges are then said to have reached gold or specie point.

The Gold Standard was suspended by Britain on 21st Sept., 1931. Money rates since that date are purely nominal.

Among other countries, in which the Gold Standard has recently been suspended, are India, Canada, New Zealand, Norway, Sweden, South Africa, and the U.S.A. BIBLIOGRAPHY: Lord Goschen, *Foreign Exchanges*; G. Clare, *A.B.C. of Foreign Exchanges*; H. Deutsch, *Arbitrage*; Ottomar Haupt, *Arbitrages et Parités*; H. Withers, *Money Changing*; W. F. Spalding, *A Primer of Foreign Exchange*.

FOREIGN LEGION, a unit of the French army, consisting of four regiments stationed at Sidi-bel-Abbis and Saida in Algeria, and first raised in the time of Louis Philippe. In 1914 the strength of the four regiments was in the neighbourhood of 25,000 men, of which Germans, Alsatians, Swiss, and Dutch provided some 50 per cent, French 15, Austrians 12, Italians 10, Spaniards 6, and other nationalities, including English, 7 per cent. It is thus evident that the Foreign Legion is, as its name implies, composed of representatives of every nation; the officers, however, are all French. Enlistment is voluntary, and is for a period of five years in the first place, which can be extended by further periods to complete the fifteen years' total service which qualifies for a pension. The Legionary can rise to the rank of under officer, and in rather exceptional cases to that of officer.

FOREIGN OFFICE, the centre and head-quarters of the relations of Great Britain with all foreign powers, is, in its present organization and under its present name, a comparatively modern institution; but its first foundation may perhaps be traced to 1253, in which year, if not before, a Secretary to the Sovereign existed, the holder of that position being one John Maunsell. An assistant secretary seems to have been appointed 180 years later; while in 1539 the post of King's Principal Secretary was shared between two persons of equal standing, having charge respectively of the Northern and Southern 'Departments' or 'Provinces.' The Northern Department included the Low Countries, Germany, Denmark, Sweden, Poland, and Russia; English relations with France Italy, Switzerland, Spain, Portugal, Turkey, &c., being the concern of the Southern official. The earliest use of the title 'Secretary of State' occurs in 1601, Sir Robert Cecil being styled by Queen Elizabeth "our Principal Secretary of State."

The head-quarters of the two departments mentioned above were long the Cockpit, Whitehall, and Cleveland Row, St. James's, the two frequently exchanging offices. In 1782 the system of Northern and Southern Departments was abandoned, the first Secretary of State for Foreign Affairs as a whole being appointed in the person of Charles James Fox. Among the most distinguished of Fox's successors in office may be mentioned: George Canning (1812); Lord Palmerston (1830–4, 1835–41, and 1846); the Duke of Wellington (1834–5); Earl Granville (1846–52, 1868–74, 1880–5); Lord John Russell (1852, 1859–65); the Marquess of Salisbury (1874–80, 1885–6, 1886–92, and 1895); the Earl of Rosebery (1886 and 1892–4); the Marquess Curzon of Kedleston (1919–24); J. Ramsay MacDonald (1924);

Sir Austen Chamberlain (1924); Arthur Henderson (1929); and the present Foreign Secretary, Sir John Simon. In 1793 the headquarters of the Foreign Office, which had been since 1786 at the Cockpit, Whitehall, were transferred to a block of houses leased in Downing Street; and finally, after a temporary removal to 7 and 8 Whitehall Gardens, to the present historic building in Downing Street, erected in 1868.

The Secretary of State for Foreign Affairs receives a salary of £5,000, and invariably occupies a seat in the Cabinet. He is assisted by a parliamentary under-secretary, a permanent under-secretary, and three assistant under-secretaries, legal adviser, and large staff of clerks. The presence at the Foreign Office of responsible officials not liable to be displaced upon a change of ministry removes, or at least greatly minimizes, the danger of any sudden and violent change in the foreign policy of the country, which the advent to office of a new Foreign Secretary might otherwise produce.

The duties of the Foreign Secretary and his staff range from such highly delicate matters as the negotiation of treaties and the selection and appointment of ambassadors, to a watchful care for the rights of every British subject, however obscure, residing in or visiting a foreign land, with a prompt attention to any well-founded complaints of such receiving improper treatment. The appointment of consuls and vice-consuls, with the issue of passports, is likewise in the hands of the Office.

FOREIGN TRADE is the commercial exchange, between different states or self-contained communities, of goods and services. In the United Kingdom trade with all parts of the empire as well as with foreign countries is included in the returns of foreign trade. Exports are those goods which are sent out of the country, and imports those which are received, while re-exports are goods which have been imported, but are exported without any material change beyond repacking.

History. In some degree foreign trade has always existed. The Phœnicians were early pioneers, while Rome, which drew tribute of foodstuffs and luxuries from all parts of its empire, became the greatest trading city of ancient times. After the collapse of the Roman Empire conditions became too chaotic for settled commerce, but trade revived during the Middle Ages, although it was mainly confined to exchanges between adjacent countries such as England and the Low Countries.

The Age of Discoveries opened up immense fields for enterprise, and started again great currents of foreign trade across the oceans, but generally such trade was of a speculative nature, as the common name of trading bodies, 'Merchant Adventurers,' indicates.

It was not until the industrial revolution revealed the possibilities of large-scale production that men realized that exchange between different countries might be greatly to the advantage of both, by giving each the opportunity to concentrate on that work for which they were best fitted. When the invention of steamships and railways followed the industrial revolution, and made possible the systematic opening up of new territories and the establishment of regular and speedy communication all over the globe, the great age of international trade began.

In estimating how much trade has grown in the last century, and to what degree various countries have shared in this growth, certain difficulties arise. Comparison between different periods is rendered difficult by changes in the level of prices, while comparisons between different countries are dangerous owing to differing methods of calculation. For instance the United Kingdom calculates its imports on the basis of c.i.f. values, while the values of imports into the United States are given f.o.b.; again, a number of states assess their foreign trade in terms of official values fixed by law or otherwise, which may differ considerably from the market value of the produce. Nevertheless, the growth of British foreign trade is sufficiently brought out by the following figures of trade to and from the United Kingdom:

BRITISH FOREIGN TRADE
(in millions)

	Imports	Exports	Re-exports
	£	£	£
1801 ..	31·8 ..	24·9 ..	10·3
1911 ..	522 ..	278 ..	65
1913 ..	768·7 ..	525·3 ..	109·6

Before the European War the United States and Germany were the only countries which had developed a foreign trade comparable in dimensions with that of the United Kingdom, and while both closely approaching this country in total value, calculating in proportion to population neither of these countries approached the British figures:

UNITED STATES IMPORTS AND EXPORTS
(in millions)

	Total Imports	Domestic Exports
	£	£
1901 ..	171·5 ..	304·3
1911 ..	318·2 ..	419·5
1913 ..	362·6 ..	485·7

GERMAN EMPIRE IMPORTS AND EXPORTS, SPECIAL TRADE
(in millions)

	Imports £	Exports £
1901 ..	266·5 ..	217·9
1911 ..	477·2 ..	398·5
1913 ..	560·3 ..	70

FOREIGN TRADE IN 1913
(per head of populaton)

	Imports £	Exports £	Total £
United Kingdom	17 ..	12 ..	29
United States	3 6 ..	4·9 ..	8·5
German Empire	9·4 ..	8·1 ..	17·5

Post-War. The European War of 1914–8 cut across the lines of trade which had developed during the nineteenth century, and the reconstruction of international trade is perhaps the most serious and difficult problem of the post-war period. The figures of trade returns, owing to the great fall in the value of the money in which they are stated, should only be compared with pre-war returns after full allowance has been made for changes in value. British foreign trade in 1931 and 1932 (provisional figures) was as follows:

	1931	1932
Imports	£861,252,638	£703,132,725
Exports	£390,621,598	£365 137,785
Re-exports	£ 63,867,549	£ 50,913 593

apparent difference in any case is due to the absence of certain items, generally called 'invisible imports or exports,' from the returns of trade, in which account is only taken of material commodities.

The invisible items fall under two headings, viz. services and payment of interest or capital. Among proceeds of services the most important are the earnings of shipping and of insurance and financial businesses, which are remitted to the country rendering them in bills, with the proceeds of which goods are bought, while in some instances the expenditure of foreign tourists is a large item. In the other case a country investing capital abroad sends goods abroad against a promise to pay interest or dividends as these may accrue; the goods exported appear in the return, while the consideration for which they are sent is an 'invisible import.' Later, when a country has invested large amounts of capital abroad, it receives interest on these sums in the form of goods.

The United Kingdom has long had a large balance of imports over total exports, and the table below is a rough estimate of the way in which the balance is accounted for.

It will be seen that the 'invisible exports' were in reality greater than the adverse balance of trade, leaving a true balance of exports over imports

	1930	1931
Excess of Imports over Exports	£386,000,000	£411,000,000
Excess of Government receipts from Overseas	19,000,000	16,000,000
Net National Shipping income	105,000,000	80,000,000
Net Income from Overseas Investments	220,000,000	165,000,000
Net receipts from short interest and commissions	55,000,000	30,000,000
Net receipts from other sources	15,000,000	10,000,000
Total	414,000,000	301,000 000
Estimated Credit balance . ..	+28,000,000	−110 000 00[illegible]

Balance of Trade. A feature of foreign trade which has always commanded much attention is the relation between the quantities of imports and exports, the difference between these two being generally known as the Balance of Trade. For centuries it was held that a prosperous state should show a balance of exports over imports and such a balance received and has retained the name 'a favourable trade balance.' This view was the result of themercantilist fallacy that the object of foreign trade was the importation of precious metals to swell the treasure within the country. It is now realized that money in all its forms is only the denominator in international trade, and that unless a country is piling up debts or credits abroad its imports and exports must balance, when all the items are taken into account. The which is accounted for by investments of British capital abroad, or by repayments of debt owed by Great Britain abroad, during the year in question.

FOREN'SIC MEDICINE, the branch of medical education which applies the principles and practice of the different branches of medicine to the elucidation of doubtful questions in a court of justice; otherwise called medical jurisprudence.

FORE'SHORE, part of the seashore between high water and low water marks at ordinary tides. Its extent varies with the amount of slope and the tidal height. Except when vested individually by grant, charter or prescription, the foreshore belongs to the crown, with public right of use for navigation or fishing. A right of passage to the foreshore does not necessarily lie over adjacent land.

FORESHORTENING, in drawing and painting, is the application of the rules of perspective in representing objects so as to convey to the mind an impression of the full length of any object which is pointing more or less directly towards the spectator standing in front of the picture. The object is represented as shorter the more nearly it is perpendicular to the plane of the picture, and, at the same time, its proportions are so altered that the more distant parts become smaller relatively to the nearer parts.

FOREST-FLY, the popular name of a family (Hippoboscidæ) of two-winged flies, parasitic on birds and quadrupeds. In the narrower sense the name is applied to a species (*Hippobosca equina*) which infests horses and cattle. Some members of the family are wingless, as the ked or sheep 'tick' (*Melophagus ovinus*) and the bee-louse (*Braula cæca*), parasitic on the hive-bee.

FOREST HILL, a suburb of London (south-east), near Sydenham in the metropolitan borough of Lewisham. The Horniman Museum, opened to the public in 1901, is here. Pop. 22,594.

FOREST LAWS. In English law a forest signified a certain territory, whether wooded or not, privileged for game, generally belonging to the sovereign and set apart for his recreation, under special laws, and having officers of its own to look after it. It was defined as containing eight things; soil, covert, laws, courts, judges, officers, game, bounds. It comprised both 'vert'—trees, underwood, and turf; and 'venison'—the hart, the hind, the hare, the boar, the wolf, which were beasts of forest; the buck, doe, fox, marten, which were beasts of chase; the rabbit, pheasant, partridge, quail, mallard, heron, &c., which were beasts and fowls of warren. The forest laws at one time were very oppressive. There are still several royal forests not disafforested, as Windsor Forest, the New Forest, the Forest of Dean, and Epping Forest.

FOREST MARBLE, in geology, an argillaceous laminated shelly limestone, alternating with clays and calcareous sandstones, and forming one of the upper portions of the English Middle Jurassic series; named from Whychwood *Forest*, in Oxfordshire. The finer bands have been quarried as marble.

FOREST-OAK, the commercial term for the timber of trees of the genus Casuarina, belonging to Australia. Called also She-oak, Swamp-oak, and Beef-wood.

FOREST ROW, village of Sussex. It is 3 miles from East Grinstead on the Southern Railway. It is near Ashdown Forest, hence its name. Pop. 3,500.

FORESTRY, the science of the right use and preservation of wooded areas; or the science and art of establishing and maintaining forests, and of managing them to the best advantage. The great forest tracts which have yielded and still yield the world's supplies of timber have been entirely the outcome of natural agencies, but in the future human agencies will no doubt be more and more brought into play in forestry along with these, as the natural forests become used up. Arboriculture, as distinct from forestry, is the cultivation of trees for ornamental purposes or scientific objects. Forests are of the utmost importance to a country, not only from the direct value of their timber and other produce, but also from the equilibrium in temperature and humidity which they tend to produce where they exist, regulating, as they do, the steady flow of water in springs and rivers, and correspondingly reducing the violence of floods, and preventing denudation of the earth and silting up of streams.

Germany was the first country to reduce forestry (as distinguished from mere arboriculture) to a science, the subject being taught, both theoretically and practically, in several forest academies, and the curriculum including botany, mineralogy, zoology, surveying, mensuration, embanking, draining, &c. The German forests are all mapped out in blocks, for the management of which elaborate working plans are drawn up. Grazing is allowed wherever practicable, also the use of the forests for recreation.

France, Norway, Sweden, Denmark, and Italy are not far behind Germany in this important respect, but Great Britain is very backward, owing partly to the fact that so little of the small area at present devoted to forest (4 per cent of the whole area of the country) is in Government hands. Forestry, however, has been taught for years in connection with the Indian Forest Service first at Cooper's Hill College, and from 1903 at Oxford, and elementary instruction in the subject has been given at Cambridge, Edinburgh, Glasgow, Aberdeen, Dublin, Newcastle, Bangor, Wye, and the Royal Agricultural College at Cirencester (until its closure in 1915). Forest schools for working foresters have been established in the Forest of Dean, Rathdrum, and Penicuik. In British India, a system of Government forest administration has been developed with astonishing success, and has had an important bearing upon the pressure of famines, besides yielding a revenue of (1932 3) £133,125

to the Central Government and £3,084,195 to the Provincial Governments.

The only considerable timber-exporting countries in the world are Russia, Sweden, Norway, and Canada, and the first and last have still forests of enormous value. America is, of all regions of the world, the most largely covered with wood; yet in Canada more vigorous Government action is urgently needed, the wastage having been so enormous that some kinds of trees, notably the Weymouth pine, are almost extinct. In the United States the forest wealth has been vastly decreased, yet the States have still 495,879,000 acres of forest or about one-fifth of the total area of the country, and more than twenty forest associations show and maintain the public interest in forestry. In Britain, since the European War, a Government Forestry Authority has been created. Its headquarters are at 22 Grosvenor Gardens, London, S.W. Since 1920 it has been responsible for planting 80,000 acres of new forest. The Government also maintains a board for research into forest products, which has a laboratory at Princes Risborough.

Scientific Forestry. In the practice of scientific forestry there are two main objects kept in view. (1) To provide timber and various by-products. Different qualities are requisite in the kinds of wood used for different purposes, as, for instance, in the building of houses, ships, bridges, vehicles, &c., in house decoration, in the manufacture of furniture, musical instruments, sporting implements, pencils, &c. Hence great attention must be paid to the quality and value of the wood produced. By-products, too, are often of great importance, sometimes of more importance than the timber itself; among these may be mentioned tar, turpentine, resin, tanning materials, &c. (2) To furnish such a condition of cover as will most favourably affect the climate of the neighbourhood. Situation, density, extent, and height are important considerations in this respect.

Where an existing forest is being brought under organization, the problems presented are far simpler than where a new forest area is being formed. Broadly, they may be grouped under surveying, valuation, and administration. In constructing a new forest, after the site has been selected, it becomes necessary to consider the question of profit on capital expenditure, and this will depend largely on the judicious selection of trees suitable to the soil and climate, on easy communication with important markets, and on the attention paid to by-products. The grouping of trees, the division of the forest into districts, the methods of felling, the amount felled yearly, questions of pruning and thinning, &c., need the most careful attention. In forming a new forest it is generally advisable to plant densely (about 6,000 or even more per acre). Mixed growths are generally preferable to the cultivation of one kind of tree only. Very often the planting of seedlings, from two to three years old, will be found more profitable in the long run than the sowing of seeds, though the latter is cheaper at the beginning. Several ingenious tools and machines for planting seedlings at a rapid rate have been invented, and have been used with great success. Forestry is a subject of study at the Imperial Forestry Institute, Oxford, under a professor, the students being trained for the forest services in India and other parts of the Empire.—BIBLIOGRAPHY: Forbes, *The Development of British Forestry*; J. Nisbet, *The Elements of British Forestry*: Sir W. Schlich, *Manual of Forestry*; F. F. Moon and N. C. Brown, *Elements of Forestry*; W. H. Whellens, *Forestry Work*.

FORFAR, now officially **ANGUS,** a maritime county on the east of Scotland, bounded north by Aberdeen and Kincardine, west by Perth, south by the Firth of Tay, and east by the North Sea; area, 559,037 acres. The surface is covered in the west and north-west by a portion of the Grampians, and in the south by part of the Sidlaw Hills. Between the Grampians and the Sidlaw Hills lies part of the valley of Strathmore, and between the Sidlaw Hills and the Tay is the level but rich and highly cultivated tract of which the Carse of Gowrie forms a part. The chief rivers are the North Esk and the South Esk.

All the operations of agriculture are carried on in the most approved manner, and nearly half the area is under crops. Cattle-rearing is carried to great perfection, the chief breeds being Shorthorns and polled Angus. The manufacture of linens or jute goods is carried on in all the towns (Dundee, Arbroath, Forfar, Brechin, Montrose, &c.), but has its central locality at Dundee. Sandstone flags are quarried in the Arbroath district. The county returns one member to Parliament. Pop. (1931), 270,190.

FORFAR, the county town of Forfarshire, is a royal and parliamentary burgh, 14 miles north by east of Dundee. The public buildings include, besides churches and schools, a town house, county buildings, and public hall. The staple manufacture is linen, especially of the coarser varieties, there being several large factories in

connection with which are bleach-works. Forfar is one of the Montrose burghs which return one member to Parliament. Pop. (1931), 9,660.

FOR'FEITURE, a punishment annexed to some illegal act or remissness of an owner or tenant of property, whereby he loses his interest therein, together with his title: the loss of goods entailed by some breach of law with which they are associated.

FORGERY (Fr. *forger*, to fabricate), at common law, the fraudulent making or alteration of a writing to the prejudice of another man's rights, or the making, *malo animo*, of any written instrument for the purpose of fraud and deceit: the word *making*, in this last definition, being considered as including every alteration of or addition to a true instrument; also, the counterfeiting of a seal.

The punishment of forgery at common law is, as for a misdemeanour, by fine, imprisonment, and such other corporeal punishment as the court in its discretion shall award. The punishments ordained for the offence by the statute law in England were once, with scarcely an exception, capital. Capital punishment for forgery was abolished by Acts of 1832 and 1861. The punishment now varies from penal servitude for life, or not more than fourteen or seven years, to imprisonment for not more than two years. The law on the subject has been consolidated by the Forgery Act, 1913.

FORGET-ME-NOT, the name of *Myosōtis palustris*, nat. ord. Boragineæ, a common British plant growing generally in damp or wet places. Scorpion-grass is also a name for it and others of its genus. It is a very beautiful plant, and considered to be the emblem of friendship in almost every part of Europe.

FORGING comprises the operations used in changing the shape of metal, generally iron and steel, by striking it with sharp blows by means of a hammer or some other suitable instrument, and the object this produced is also known as a forging. If produced by a hammer worked by hand or by a steam-hammer, the process is known as hammer-forging, but where numerous objects are to be made of the same size and shape, drop-forging methods are used, which consists in forging a suitable piece of metal between prepared dies under a hammer, the lower part of the die being fitted to the anvil, and the upper part to the hammer itself and moving up and down with it. With simple shapes, one set of dies may be sufficient, but with complex shapes, two or more sets of dies may have to be used successively to produce the finished article.

Hollow forgings are made by boring out the central portion and forging out on a mandrel. The term 'hydraulic forging' is often applied to a similar operation carried out by means of a hydraulic press, but as the action in this case is more of a steady squeeze, the term 'pressing' would be a more suitable expression. The various processes included in the operations of forging are swaging, which consists in the reduction or drawing down from a larger to a smaller section; upsetting, which is an enlargement of a smaller to a larger section; bending to any angle or curvature; welding, or uniting of pieces of metal to one another whilst in a plastic condition; punching, or the formation of holes and cutting off to suitable sizes.

FORLI', a town of North Italy, capital of a province of the same name, 38 miles south-east of Bologna. It is handsome and well built, has manufactures of silk ribbons, silk twist, and woollen stuffs, and a considerable trade. Forli has a cathedral and is a bishop's see. Pop. (1931), 60,824.

FORLI, a province of Italy, bounded on the east by the Adriatic; area, 1,122 sq. miles; pop. (1931), 422,831.

FORMALDEHYDE, simplest of the aldehydes, which are oxidation products of alcohols. The gas formic aldehyde ($H.COH$) is produced by passing methyl alcohol vapour over heated platinum. A 40 per cent solution in water (formalin) is a disinfectant, an antiseptic, and renders gelatine insoluble in water. In recent years formaldehyde has become of great importance in the manufacture of synthetic resins and plastic substances.

FORMALIN, a commercial product containing about 40 per cent of formaldehyde (CH_2O) in solution in water. It is prepared by passing the vapour of methyl alcohol, mixed with air, over glowing platinum or copper. Formalin is a pungent-smelling liquid which acts as a reducing agent, separating gold and silver from solutions of their salts. It is used industrially as an antiseptic and disinfectant, in the coal-tar industry, in tanning, in waterproofing of fabrics, and for pharmaceutical purposes.

FORMBY, urban district, market town and seaside resort of Lancashire. It is 7½ miles from Southport, on the L.M.S. Rly. Pop. (1931) 7,957.

FORMENTE'RA, one of the Balearic Islands, about 12 miles long and 8 miles broad, hilly, woody, and but little cultivated. Pop. 2,050.

FORMI'CA, the genus to which some of the ants belong. A familiar

form is the red wood-ant (*F. rufa*), the only British species that enslaves other ants.

FORMIC ACID (CH_2O_2), an acid originally extracted by water from crushed ants (Lat. *formica*, an ant), but now prepared from a mixture of glycerine and crystallized oxalic acid. It is contained in human sweat and the common nettle. It is a monobasic acid, and yields salts known as formates. It is a colourless volatile liquid, with pungent odour, and produces intense irritation on the skin.

FORMO'SA, or TAI-WAN, a Japanese island in the Chinese Sea, separated from China by a strait about 80 miles wide; length about 225 miles; average breadth, 70 miles; area, 13,890 sq. miles. A range of mountains (rising to over 14,000 feet) divides it into a western and an eastern part, the former of which (mostly a plain) is occupied by numbers of immigrant Chinese and Japanese, and highly cultivated, producing in abundance rice, sugar, tea, pepper, camphor, oranges, and bananas. East of the mountains is a narrow strip steeply facing the sea. In the mountainous parts are wild tribes of Malayan race. Northern Formosa is liable to earthquakes.

Railways have been and are being constructed, and several ports opened to European commerce, chiefly Taihoku (formerly Tai-peh, the capital), Tai-nan, Kärun, Tauchu, Tam-sui, Ke-lung, and Takow; and the trade since then has greatly increased. The chief exports are tea, camphor, sugar, rice; the imports are cottons, woollens opium, &c. Formosa was ceded to Japan by China in 1895. Roads, railways, telephones, &c., are being developed by the Japanese on modern lines, and a university was opened in 1928. Pop. (1930), 4,592,537.

FORMOSA, a West African island, one of the Bissagos (q.v.).

FOR'MULA, a fixed form of words or symbols. In mathematics it is a general theorem, a rule or principle expressed in algebraic symbols. In chemistry it is a mode of expressing the composition of a compound by means of symbols and letters. Thus water is represented by H_2O, in which H_2 stands for 2 atoms or 2 parts by weight of hydrogen, and O for 1 atom or 16 parts by weight of oxygen.

FORRES (for'es), a royal and municipal burgh of Scotland, county of Elgin, beautifully situated in a finely wooded country. Forres Castle was the residence of the early Scottish kings, and Shakespeare has made this neighbourhood the scene of the chief events in *Macbeth*. Forres is one of the Inverness district of parliamentary burghs. Pop. (1931), 4,169.

FORREST, John, First Baron, Australian explorer and statesman, was born in Western Australia in 1847, died in 1918. He entered the Survey Department in 1865, and in 1869 commanded the expedition sent into the interior in search of Leichhardt. He was subsequently at the head of an exploring expedition along the coast from Perth to Adelaide, and of another which penetrated, with the aid of horses only, 2,000 miles from Champion Bay through the middle of Australia, a service for which he received the gold medal of the Royal Geographical Society (1876).

Appointed Deputy Surveyor-General of Western Australia in 1876, he conducted several trigonometrical surveys, and in 1883 was appointed Commissioner of Crown Lands and Surveyor-General, with a seat in the Executive and Legislative Councils. Forrest was the first Premier and Treasurer of Western Australia under responsible government (1890–1901), and introduced the system of free land grants of 160 acres, resigning office to become Minister of Defence in the first Federal Cabinet (1901–3). He was subsequently Minister for Home Affairs (1903–4), and several times Commonwealth Treasurer. He was made a G.C.M.G. in 1901, and was raised to the peerage in 1918, shortly before his death. His works include: *Explorations in Australia* (1876), and *Notes on Western Australia* (1884–7).

FORST, a town of Germany in the Prussian province of Brandenburg, on the Neisse, founded in the thirteenth century, 15 miles east by south of Cottbus, with important cloth manufactures and tanneries. Pop. 35,962.

FORSTER, Baron, English politician. Henry William Forster was born 31st Jan., 1866, and educated at Eton and New College Oxford. He played cricket for his university and in 1892 entered Parliament as Unionist M.P. for the Sevenoaks division. He was a Lord of the Treasury, 1902–05, and Financial Secretary to the Treasury in 1917. In 1919 he was made a peer and from 1920–25 was Governor-General of Australia. Lord Forster is one of the largest landowners in the London area.

FORSTER, Edward Morgan, British novelist, born 1879. He was educated at Tonbridge School and King's College, Cambridge. His early novels are: *Where Angels Fear to Tread*, *The Longest Journey*, and *A Room with a View*.

Howard's End and *The Celestial Omnibus*, a collection of short stories,

attracted much attention. They were followed some years later by *A Passage to India* and *Aspects of the Novel*, a volume of criticism.

His work is distinguished by keen observation, wisdom, and humour.

FORSTER, Johann Georg Adam, German traveller, son of Johann Reinhold Forster, was born in 1754, died at Paris in 1794. He accompanied his father to Russia and England, and both accompanied Cook in his voyage round the world (1772–5). Subsequently he taught natural history at Cassel, held a professoral chair at Wilna, and became librarian to the Elector of Mainz. An excellent account of Cook's second voyage round the world was written by him in connection with his father. He also wrote: *Essays on Geography, Natural History*, and *Views of the Lower Rhine.*

FORSTER, Johann Reinhold, German writer, father of the foregoing, born in 1729, died in 1798. He studied theology at Halle, and became preacher at Nassenhuben. He chiefly devoted himself, however, to his favourite studies — mathematics, history, and geography. After having been engaged on a mission by the Russian Government, he migrated to London in 1766, and supported himself and his son Johann Georg partly by teaching. He was finally invited to accompany Captain Cook in his second voyage as naturalist of the expedition. An account of the voyage was published in his son's name (*Observations upon a Voyage around the World*, London, 1777). In 1780 he was invited to Halle as professor of natural history, and continued there until his death.

FORSTER, John, English writer, born at Newcastle 2nd April, 1812, died 1st Feb., 1876. While studying for the Bar in London he contributed to *The Examiner* and other periodicals. In 1843 he was called to the Bar, but his main interests were literary. He became editor of *The Daily News* in 1846 and shortly afterwards of *The Examiner*. In 1848 he published his *Life of Goldsmith*. In 1856 he retired from the editorship of *The Examiner*, having been appointed the year previous secretary to the Lunacy Commission, of which he became in 1861 a commissioner. During this period he devoted himself to historical studies, the result of which appeared in his *Arrest of the Five Members, Debates on the Grand Remonstrance*, and *Life of Sir John Eliot*. He also published biographies of Landor and Dickens, but died before completing his *Life of Swift*.

FORSTER, The Rt. Hon. William Edward, English statesman, born at Bradpole, Dorset, 11th July, 1818, died 6th April, 1886. He was the son of an eminent minister of the Society of Friends, and entered into the woollen trade at Bradford. In 1850 he married the eldest daughter of Dr. Arnold of Rugby. He was returned to Parliament for Bradford in 1861; became successively Under-Secretary for the Colonies (1865), vice-president of the Education Committee (1868), and a member of the Cabinet (1870). He had charge of the Education Bill of 1870 and the Ballot Bill of 1872.

In 1880, the Liberals having just returned to power, Forster accepted the post of Chief Secretary for Ireland at a time when that country was distracted by agrarian and political tumults. The suppression of the Land League and the arrest of Parnell and the more violent agitators were carried out by Forster, but on the Government resolving to change its policy and release the Parnellites Forster resigned (1882). After this he was often found voting in opposition to the Government, particularly in matters of foreign and imperial policy.

FORSYTH (for-sith'), **William,** English lawyer and writer, born 1812, died in 1900. After a brilliant career at Trinity College, Cambridge, he studied law, was called to the Bar in 1839, and became a queen's counsel in 1859. He represented the borough of Marylebone in the House of Commons from 1874 to 1880. Besides legal works, he wrote: *Hortensius, or the Duty and Office of an Advocate*; *History of Trial by Jury*: *Napoleon at St. Helena and Sir Hudson Lowe*; *Life of Cicero*; *Novels and Novelists of the 18th Century*; and *Hannibal in Italy*, a drama.

FORSYTHIA, a genus of Chinese shrubs, ord. Oleaceæ, cultivated for their flowers, which appear early in spring, before the leaves.

FORTALEZA, now called **CEARA.** Seaport of Brazil, capital of the state of Ceara. It stands near the mouth of the River Ceara, 350 miles from Pernambuco. There is a harbour, but it is small and cargoes are landed by means of surf boats from vessels that lie in the roadstead. The trade is chiefly in rubber and other products of the country. Pop. 98,848.

FORT AUGUSTUS, a village of Scotland, county of Inverness, on the Caledonian Canal, about 34¼ miles S.W. of Inverness. It is a tourist centre and has its name from a fort erected in the vicinity in 1734 to overawe the Highlanders, who, however, succeeded in capturing it in 1745. It was occupied by a garrison till 1857, was purchased by Lord Lovat in 1876,

and now forms the site of a Roman Catholic abbey and college. Pop. 900.

FORT DE FRANCE, or **FORT-ROYAL,** a town and seaport, French West Indies, Island of Martinique, of which it is the capital. It has a fine harbour and strong fortifications. There is a considerable trade in the produce of the island. Pop. 43,000.

FORT DUQUESNE (dū-kēn'). American fort, on the site of Pittsburg. It stood where the Monongahela River falls into the Allegheny, and was begun by the English in 1754. The French took it and finished it, calling it after one of their leaders. The English settlers, aided by troops from home, tried to retake it, but failed on two occasions. In 1758, however, the French destroyed and abandoned it, whereupon the English built a new one on the same spot. This was named Fort Pitt and grew into the city of Pittsburgh (q.v.).

FORTEVIOT, a village in Scotland, where was the ancient capital of the Pictish kingdom of Fortrenn. It is 7 miles south-west of Perth. Pop. (parish, 1931), 467.

FORT GARRY. Early name of the city of Winnipeg. In 1835 the Hudson's Bay Co. built a fort on the Red River and around this a settlement grew. In 1873 the name was changed to Winnipeg. A gate at the end of Broadway is the sole relic of the fort.

FORT GEORGE, a fortress of Scotland, in the county of and 10 miles north-east of Inverness, at the extremity of a low point of land projecting into the Moray Firth. It was built after the rebellion of 1715, and can accommodate about 2,000 men. A ferry crosses the Moray Firth from here.

FORTH, a river of Central Scotland, formed in Perthshire by the junction of two streams, the Duchray and the Dhu, about 1 mile w. of Aberfoyle. From Aberfoyle the river flows south-east, forming for a considerable part of its course the boundary between the counties of Stirling and Perth, winding in its lower course in a series of curves known as the **Links of Forth,** and expanding thereafter into the **Firth of Forth,** which forms the most important harbour of refuge north of the Humber. Its chief ports are Leith, Granton, Bo'ness, and Grangemouth. The Forth is navigable for small vessels to Alloa. Its length is 68 miles to Kincardine, where the firth begins, from Kincardine to the sea is 48 miles. There are several islands in the estuary. The Isle of May and Inchkeith have lighthouses. The firth is crossed at Queensferry by a bridge. *See* FORTH BRIDGE.

FORTH AND CLYDE CANAL, a canal in Scotland, constructed between 1768 and 1790, and extending from the Forth at Grangemouth to the Clyde at Bowling, thus giving communication by water from the east to the west coast. It is 38 miles long. The Union Canal, 31¼ miles long, joins it near Falkirk and connects it with Edinburgh.

FORTH BRIDGE, the railway viaduct over the Firth of Forth at Queensferry. The firth here is about 4,000 feet wide at low water. The small island of Inchgarvie is used as the central support of the two chief spans, which are 1,710 feet wide each. These spans are each made up of two cantilevers extending towards each other from the opposite sides and connected by a girder, the cantilevers being 343 feet deep where they rest on the supporting piers and 10 feet at the free ends, and projecting 680 feet, while the central connecting girder is 350 feet in length. There are two other spans of 680 feet each, fifteen of 168 feet each, and seven small arches totalling about 400 feet. Including piers, there is about a mile of main spans and over half a mile of viaduct approach. The clear headway under the centre of the bridge is 150 feet above high water, while the highest part of the bridge is 361 feet above high water.

Each of the main piers consists of a group of four cylindrical granite and concrete piers 49 feet in diameter at the top and from 60 to 70 feet at bottom. The deepest pier is about 70 feet below low water, and the rise of the tide is 18 feet at ordinary springs. In the piers there are about 120,000 cubic yards of masonry, and in the superstructure about 45,000 tons of steel. All the foundations are either on rock or on a boulder-clay which for all practical purposes is as hard as rock; and the whole structure presents a network of bracing capable of resisting stresses in any direction and of any probable severity. The bridge carries two lines of rails. It was projected by a company in which the North British, Great Northern, North Eastern, and Midland Railways are interested. The engineers were Sir John Fowler and Sir B. Baker, C.E., and the contract price was £1,600,000. Operations were commenced in Jan., 1883, and the work was completed in the end of 1889.

FORTIFICATION. Art and practice of protecting a town or position against an enemy. From the earliest times fortification has been practised in warfare. Earthworks and palisades were among the earliest forms. Later stone was used, and walls and citadels

were built as fortifications. A notable instance is the Roman wall between the Tyne and the Solway. The main fortifications of the Middle Ages were the walls which surrounded every town of importance, but the invention of gunpowder destroyed the utility of these.

The next stage in the history of fortification was the erection of earthworks and other defences around a fortress. These were defended by men and guns, and usually formed a formidable obstacle to the enemy. Such were the works of Torres Vedras erected in Portugal by Wellington. In the 19th century fortifications took the form of protecting vulnerable cities by a ring of detached and hidden forts, Antwerp being a notable example. The experience of the Great War, however, showed that these were almost useless against modern artillery.

Fortification still has its uses, although immobile fortresses are of very little value in modern warfare. Positions protected by barbed wire, machine gun pits and other devices, such as those adopted during the Great War along the Western Front, proved very difficult indeed to overcome, even with the aid of all the resources of modern artillery. Coast defences are still powerful fortifications and, as was shown in the Dardanelles and on the Belgian coast, they are still able to keep the battleship and its attendant craft at bay.

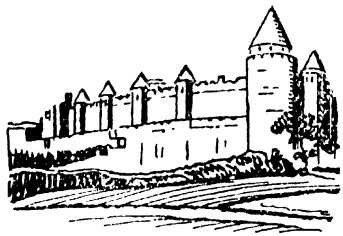
FORT MADISON, a town of the United States, Iowa, on the Mississippi, with railway works, meat-packing houses, &c. Pop. 13,779.

FORTNIGHTLY REVIEW, an English magazine so named from its having at first been published every two weeks, founded in 1865 under the editorship of G. H. Lewes. It has long appeared monthly. It was designed as a vehicle for philosophical Radicalism, but has since opened its columns to all schools of political thought.

FORTRESS, place occupied by soldiers and protected by walls or defences of other kinds. From very early times fortresses have been a feature in warfare, although at first, perhaps, their protections were little more than a fence of wood, or a mound of earth. Stone fortresses soon came into existence and the Greeks appear to have had such in the time of Homer, as Troy was evidently a very strong fortress. The Roman fortresses took the form of protected camps, such as were on the Roman wall in England.

The mediæval castle with its keep and other features was the fortress of the Middle Ages, although the word was also used for walled towns. These castles were gradually built in important positions, so that their occupants could watch a river, a mountain pass, or a harbour entrance. The value of the walled town as a fortress ended with the increasing power of artillery and fortresses of a new type came into being. These were towns protected by earthworks and the like, such as stood between France and the Netherlands in the 18th century and such as figure in the history of the Peninsular War.

Finally, in the 19th century, came the modern fortress, protected by detached forts and hidden guns. Such were Metz and Antwerp, but in the Franco-German War and still more in the Great War, these failed to fulfil



Fortress—the fortified city of Carcassonne

the expectations of their builders. The experiences of the struggle showed that the value of the fortress in modern warfare is very slight indeed.

FORTROSE', a seaport, royal and municipal burgh of Scotland, Ross and Cromarty, on the inner Moray Firth, one of the Inverness and Ross and Cromarty burghs. Its two portions, Chanonry and Rosemarkie, were constituted a royal burgh in 1590. It has a good harbour and attractions for visitors. At one time it had a cathedral of which there are some slight remains. Pop. (1931), 875.

FORT ST. GEORGE, the old citadel of Madras, and the earliest British settlement in India (1639), the name being sometimes used as equivalent to that of the city itself. It still contains the council chambers, barracks for European soldiers, and Government offices.

FORT SCOTT, a town in the east of Kansas, United States, an important railway centre. Chief products are cotton and maize, the manufactures are chiefly furniture, oils, wagons, &c. Pop. 10,763.

FORT SMITH, a town of the United States, in Arkansas, on the southern bank of the Arkansas River. Pop. 31,429.

FORT ST. DAVID, name of an old fort in Madras. It stood on the Coromandel Coast, a little south of Pondicherry, and remains of it may still be seen. The land was bought by the English in 1690, and here the East India Co. had a fort until it was taken by the French in 1758. The French destroyed it, but the territory was given back to Britain in 1785.

FORT SUMTER, a fort on the entrance to Charleston Harbour, South Carolina, United States. At the opening of the War of Secession it was taken by the Confederates from the small body of United States troops by whom it was garisoned (13th April, 1861). It repulsed an attack of nine iron-clads on 7th April, 1863, and was heavily bombarded in August of the same year, but maintained its defence till the final evacuation of Charleston, 18th Feb., 1865. It has been rebuilt on a modified plan.

FORTU'NA, the Roman goddess of success, corresponding to the Greek *Tyche*. She is generally delineated with a rudder, emblem of her guiding power; or, later, with a bandage over her eyes and a sceptre in her hand, and sitting or standing on a wheel or globe.

FORTUNA'TUS, the hero of an old popular legend. He obtained a wishing-cap and inexhaustible purse of gold, which finally ruined him and his sons. The first printed edition of the story appeared in Germany in 1509, but in various forms it has appeared in most of the languages of Europe. Thomas Dekker's play *The Pleasant Comedie of Old Fortunatus*, a dramatization of the story, appeared in 1600.

FORTUNATUS, a Latin poet, born in Northern Italy about A.D. 530; Bishop of Poitiers in 597; died about 609. His works were numerous, but he is remembered only by his hymns, one of which (*Vexilla regis prodeunt*) was adopted by the Church, and is well known in the modern version of J. M. Neale (*The royal banners forward go*).

FORTUNE TELLING, professed disclosure by non-rational methods of future events in the life of another. As one of the aims of divination, it is traceable in ancient Mesopotamian records, and was brought from Asia into mediæval Europe by gipsies, who practised it under society patronage in England in the 17th century. The Witchcraft Act, 1753, punished it with a year's imprisonment and the pillory: the Vagrancy Act, 1824, directs the imprisonment as rogues and vagabonds of persons pretending to tell fortunes. It is still practised by gipsies and others, often for charitable purposes, but is none the less illegal.

FORT WAYNE, a city of Indiana, United States, situated in a beautiful and well-cultivated country at the junction of the St. Mary's and St. Joseph's Rivers, which here unite to form the Maumee. It has railroad and machine works, and derives its name from a fort erected here in 1794 by General Wayne. It is the seat of a Roman Catholic episcopal see. Pop. 114,946.

FORT WILLIAM, a burgh of Scotland, county of Inverness, at the foot of Ben Nevis, near the south end of the Caledonian Canal. At Fort William is one end of the tunnel through Ben Nevis in connection with the Lochaber hydro-electric scheme. Near are the works of the British Aluminium Co. Pop. (1931), 2,527.

FORT WILLIAM, a port and city of Canada, province of Ontario, on the Canadian Pacific and Canadian National Railways, near Port Arthur and the shore of Lake Superior. The chief industry is the handling of grain which is shipped here to be conveyed to Europe. For this there are docks, large elevators, and other accommodation. Pop. 26,277.

FORT WORTH, a city in Texas, United States, on the south bank of the Trinity River. The numerous railways which enter the city from all sides give it a great importance: and there are numerous manufactures and industries, of which the woollen and flour are the chief. It is the seat of a university and of a technical college. Pop. 163,447.

FORUM, among the Romans, any open place where the markets and courts of justice were held. There were a number of such places in Rome, by far the most celebrated being the great Roman forum (*Forum Romanum*) between Mount Palatine and the Capitoline Hill. This place, once adorned with the most beautiful statues and buildings, had become almost a waste known as the *Campo Vaccino*, or cattle-field, but since the end of last century the Government has made clearances and excavations and taken charge of the valuable relics which are still left.—In legal phrase *forum* signifies the court or place where an action is instituted.—*The Forum* is the name of an influential review published in New York.—BIBLIOGRAPHY: Middleton, *The Remains of Ancient Rome*; Platner, *The Topography and Monuments of Ancient Rome*; Smith, *Dictionary of Greek and Roman Antiquities*.

FOS'CARI, Francesco, Doge of Venice, born about 1372, elected in

1423, and died 1st Nov., 1457. The whole period in which he governed the republic was one of war and tumult, campaigns being undertaken against the Turks, the Visconte of Milan, and others, in which Venice was mostly victorious, extending her dominion to the Adda. In his private life the doge was less fortunate. Three of his sons died in the service of the republic, and the fourth, Jacopo, being accused of receiving bribes from foreign princes, was condemned to torture and exiled to Crete, where he died. When eighty-five years of age Foscari was deposed from the dogeship at the instigation of a rival, Jacopo Loredano, and died a few days after. On the story of Jacopo Foscari is founded Byron's tragedy of *The Two Foscari*. Verdi has written an opera *I due Foscari*, and there is also a tragedy by Miss Mitford (1786–1885) *The Foscari*.

FOS'COLO, Ugo, an Italian poet and prose writer, born about 1776, died 10th Sept., 1827. He was educated at the University of Padua, and before the age of twenty he produced his tragedy *Il Tieste* (*Thyestes*), which was received with applause. His next work of importance was a romance somewhat in the style of Goethe's *Werther*, called *Ultime Lettere di Jacopo Ortis* (Last Letters of Jacopo Ortis). He then procured a commission in the army (First Italian Legion).

After some military experiences under Masséna at Genoa and elsewhere, in 1805 he retired and wrote *I Sepolcri*, one of the finest of his poems. He was subsequently appointed to a professorship at Pavia, of which Napoleon, displeased at his freedom of speech, soon deprived him. In 1812 he produced his tragedy of *Ajax*, and soon after that of *Ricciarda*. On the fall of Napoleon, Foscolo, who was obnoxious to the Austrians, retired to Switzerland; but finally, in 1815, went to London, where he met with a most favourable reception, and where he died. Besides the works already mentioned his critical writings, *Essays on Petrarch* and *Discourses on the Texts of Dante and of Machiavelli's Il Principe*, are well known.

FOSDICK, Henry Emerson, American preacher and writer. He was born on 24th May, 1878, and is now (1932) pastor of Park Avenue Baptist Church, New York. His *Manhood of the Master* (1913) is said to have had the largest sale of any modern religious book.

FOSSA'NO, a town in North Italy, on the Stura, 13 miles north-east of Cuneo. It is surrounded by old walls and defended by a castle. It is a bishop's see and has a cathedral. Pop. 18,250.

FOSSE WAY, or FOSSE ROAD, one of the great Roman roads, from Cornwall by Bath, Coventry, and Leicester, to Lincoln. It is still traceable nearly all the way.

FOSSILS, in geology, any trace of an organism, animal or vegetable, found in rocks older than those forming at the present day. As time passes, and as modern deposits become antique, the bulk of fossil forms increases, and it is already permissible to speak of 'fossil man,' when his bones are found entombed in the gravels of bygone rivers or the stalagmite of caves. The term fossil was originally applied to minerals also, in the broad sense of the Latin verb *fodere*, *fossum*, meaning 'to dig.' When William Smith (*see* GEOLOGY) wrote in 1816 he correctly referred to the remains described by him as "organized fossils," and these objects were often known as 'petrifactions,' since mineral changes had commonly made them denser and more stony than when they were first formed by organic processes. In museum catalogues of the close of the eighteenth century minerals were still included under fossils.

Fossils, in the modern sense, may be merely natural moulds of objects that have been dissolved away; they may even be casts of foot-prints, or the tracks of animals that crawled over the slime of drying shores. But in the vast majority of cases they are shells, or bones, or the carbonized relics of vegetation, to which an organic origin must readily be assigned. The substance may have become denser: new mineral material may have replaced the old; but the external form remains, embedded in the preserving rock.

The preservation of vegetable fossils has depended almost entirely on their becoming entombed in water; the flora of the Coal-measures is thus best studied in the stems and branches washed out into some estuary from the forest-edge along the shore; and the coal-seams themselves, in which the specimens are massed together and in consequence obscured, owe their existence to the swampy conditions prevailing in the localities where they are found. For similar reasons, the marine fauna of all geological periods is far better known than that of the land. Lakes, like those of the Devonian period, may occasionally assist the record; but terrestrial remains are liable to be broken up and scattered long before they can be covered by a protective mantle of mud or sand.

Clays, owing to their impermeable nature, preserve fossils almost unchanged. The organic matter dis-

appears: the wealth of colour passes from the shells; but even the most delicate foraminifera escape abrasion or solution. In sandstones or limestones the aragonite deposited to form the hard parts of corals and many shell-fish is soon replaced by the less dense mineral calcite, a change that must be accompanied by the removal of some of the original calcium carbonate; but unaltered aragonite shells have been traced in impermeable shales as far back as the Jurassic period. In some sandstones the change into the more stable form of calcite has not taken place before the shell has begun to crumble down and dissolve away, leaving only a mould to show its former presence.

The shell-substance of fossils may be replaced by chalcedonic silica (flint), iron carbonate (siderite), or even iron disulphide (pyrite or marcasite). In some cases the calcareous mud in filling the shell becomes thus altered, while the calcite shell remains. Phosphatized fossils, such as those of the Cambridge Greensand, are often mere internal moulds, the substance of which has been replaced by calcium orthophosphate (apatite); but the actual shell may at times be thus replaced. Fossil bones tend to lose their calcium carbonate and to increase their percentage of calcium phosphate and fluorine. The teeth of sharks are sufficiently abundant in some deposits to furnish an agricultural fertilizer.

The bones of land-animals are sometimes preserved, as at the farm of Pikermi in Attica, by having been swept into the flood-deposits of streams; but whole vertebrate skeletons, other than those of fishes, are rarely found. The story, often repeated, of Cuvier reconstructing an extinct mammal from a single bone is, of course, a somewhat thoughtless exaggeration; yet both Georges Cuvier and Richard Owen, with their wide knowledge of comparative anatomy, made wonderful predictions as to the nature of certain fossils from very scanty relics.

These predictions from European specimens have in many cases been confirmed by the discovery of almost complete skeletons, or of mingled material from which a typical skeleton can be assembled, in the dry deposits of the Central United States. The work of Cope, Marsh, and their successors has led to the erection in American museums of representations of the gigantic reptiles of the Mesozoic era, in which only a few ribs, digits, or vertebrae have been filled in by artificial modelling. Prior to these reconstructions, almost the only large vertebrate skeletons that might be styled perfect were those of the marine reptiles, the enaliosauria which are so well represented in the Liassic shales of England.

At Solnhofen and Eichstätt, in Bavaria, a flaggy limestone of very delicate grain, the famous lithographic stone, has preserved a number of fossils that serve to show how imperfect the palaeontological record is under more ordinary rock-conditions. The earliest known bird occurs in these strata, which are of Upper Jurassic Age, the impressions of its feathers being well exhibited. The forms of soft-bodied animals, such as jelly-fish, and the membrane of the wings of flying reptiles are similarly recorded



Fossil Fern in Under-clay

in these limestones, and in Wurttemberg the whole form of Ichthyosaurus, showing unexpected fins, has been preserved as a mould around the skeleton.

In many other strata, creatures like worms are known by their tracks and borings, and regularly disposed impressions have been attributed to the movements of molluscs or crustaceans over the sea-floor; but it is obvious that many animals have been altogether incapable of appearing as fossils in the rocks. Curiously enough, those organisms that form their hard parts of opaline silica, the diatoms, the radiolarians and a large group of sponges, have been far less frequently preserved than their calcareous associates.

William Smith, Cuvier and Brongniart showed how strata of successive ages were characterized by the fossils that they contained, and henceforward fossils were utilized in assigning beds to their places in the long history of life upon the globe. A crowning interest

was given to fossils when the doctrine of descent allowed zoologists and botanists to trace, from horizon to horizon, the chains of organisms that connect the extinct creatures of the earliest periods with the present faunas and floras of the globe. For Bibliography *see* GEOLOGY.

FOSSOMBRO'NE, a town of Central Italy, 38 miles W.N.W. of Ancona, on the Metauro, with a fine cathedral. Pop. 9,700.

FOSTER, Sir George Eulas, G.C.M.G., Canadian statesman, born at New Brunswick, 3rd Sept., 1847. He studied at the New Brunswick, Edinburgh, and Heidelberg Universities, and was appointed professor of classics and history at the University of New Brunswick in 1872, resigning his professorship in 1879. Elected to the Canadian Parliament in 1882, he was Minister of Marine and Fisheries in 1885, and Minister of Finance in 1888. In 1894 he visited England in connection with Dominion finances and negotiated an important loan. A convinced Imperialist, he joined Sir Robert Borden's Cabinet in 1911 as Minister of Commerce. He was made G.C.M.G. in 1918, represented Canada at the Paris Peace Conference (1919), and was Canadian delegate to the League of Nations at Geneva in 1920 and 1926. He died in 1931.

FOSTER, Myles Birket, an English artist, born at North Shields in 1825, died in 1899. He learned wood-engraving under Landells, and in early life became a draughtsman. He soon achieved a high reputation as an illustrator of books and periodicals, and illustrated the works of Goldsmith, Scott, Longfellow, Beattie, &c. His landscape drawings on wood are of considerable merit. He afterwards devoted himself to water-colour painting of landscapes and rustic subjects, marked by over-elaboration, but delicate and sincere. In 1862 he was elected a full member of the Royal Society of Water-Colour Painters.

FOTHERINGHAY, a village of England, 27 miles north-east of Northampton. In its castle Mary Queen of Scots was beheaded in 1587. The building, once a royal residence, has disappeared.

FOUCAULT (fō-kō), **Jean Bernard Leon**, a French physicist, born 1819, died 1868. His name is especially connected with a celebrated pendulum experiment employed as a method of showing the rotation of the earth on its axis, by observing a vibrating pendulum. He also rendered services to optics, electric lighting, and photography.

FOUCHÉ (fö-shā), Joseph, Duke of Otranto, a minister of Napoleon I, was born in 1763, died 25th Dec., 1820. He was at first educated for the Church, but having adopted the principles of the Revolution, he became an advocate and was elected a member of the National Convention in 1792. Here he voted for the death of the king, and was implicated, at least nominally, in the atrocities of the period.

On the fall of Robespierre (1794), Fouché, who had for some time tended towards the Moderate party, managed to make friends with Barras, and was rewarded for his betrayal by the ambassadorship to Milan. He was afterwards appointed Ambassador to Holland, but ultimately recalled to Paris and made Minister of Police. Here his peculiar talents had full scope; and although he was twice dismissed by Napoleon, who did not altogether trust him, he always recovered his post, was loaded with riches, and made Duke of Otranto. He was Minister of Police at Napoleon's final abdication, and played an important part in the arrangements. He remained in office under Louis XVIII for a time, but the dislike of the Royalist party very soon forced him to resign (1815). He went as Ambassador to Dresden, but afterwards retired to Prague, and subsequently to Trieste, where he died.—Cf. L. Madelin, *Fouché*.

FOUGASSE (fö-gȧs) is a form of land-mine which may be used with considerable effect against troops attacking on a narrow front. It consists of an excavation in the form of an inverted cone, at the bottom of which is placed a charge of powder; over the charge is placed a heavy wooden shield, and over this again a load of stones or bricks of the appropriate weight for the charge. A fougasse may be arranged to be fired either automatically by the approach of the enemy, or, after observation, by the defenders.

FOUGÈRES (fö-zhār), a town of N.E. France, department of Ille-et-Vilaine, on a height 28 miles N.E. of Rennes. It was once fortified, so as to be considered one of the keys of Brittany, but is now open, well built, and has manufactures of flannels, sailcloth, and sacking. Pop. 23,500.

FOUILLÉE, Alfred Jules Émile, French philosopher, born at La Pouëze, Maine-et-Loire, 18th Oct., 1838, died at Lyons 16th July, 1912. Educated at the lyceum of Laval, he was professor of philosophy at the lycées of Douai and Montpellier, and was subsequently appointed professor of philosophy at the University of Bordeaux. In 1872 he was called to the École Normale in Paris, but had to resign his post on account of ill-health and failing sight.

At first a follower of Plato, Fouillée afterwards adopted the theory of empiricism, and endeavoured to connect Plato's idealism with the English doctrine of evolution. The synthesis of these doctrines he termed "the evolution of the ideal forces" (motor-ideas, or *idées-forces*). In 1867 he published *Mémoires sur la philosophie de Platon*, and *Mémoires sur la philosophie de Socrate*, which were crowned by the French Academy.

His other works include: *La Liberté et le déterminisme* (1873); *Histoire de la philosophie* (1875); *La Science sociale contemporaine* (1880); *Critiques des systèmes de morale contemporaine* (1883); *La Morale, l'art, et la religion d'après Guyau* (1889); *La Psychologie des idées forces* (1893); *Psychologie du peuple francais* (1898); *Nietzsche et l'immoralisme* (1902); *La Morale des idées forces* (1907); *Le Socialisme et la sociologie réformiste* (1909); *Esquisse d'une interprétation du monde* (1912).

FOULA, an island belonging to the Shetland group, but lying solitary some 20 miles to the west. It rises from the sea in lofty cliffs which swarm with sea-fowl. Pop. 239.

FOULIS (fou'lis), **Robert and Andrew,** two eminent printers of Glasgow, were born there—the former in 1707, the latter in 1712. Both were well educated at Glasgow University. In 1739 Robert commenced business as a bookseller, and, having obtained the appointment of printer to the University, began to issue editions of the ancient classics, which became famous for their accuracy and beauty. After some years Andrew entered into partnership with his brother, but outside speculations involved the firm in embarrassments. Andrew died in 1775, and Robert in 1776; the business was carried on by Robert's son, Andrew, who died in 1829.

FOUNDATION, in engineering and architecture, is the formation upon which a building or structure is reared. In erecting a building, for instance, the surface earth is removed, and the building begins when the natural formation of the place is reached. The nature of this formation depends entirely on the locality of the structure. In one place it may be clay, which, when level, forms a very good foundation; in another, running sand, which forms an exceedingly bad one. It is essential that the foundation should not move, and, consequently, clay on a hillside, for instance, is to be avoided if possible, as clay so situated is apt to slip. Running sand is out of the question, unless specially treated.

The permanence of the foundation being assured, its merit from one point of view is measured by the load it can carry per square foot. The following table gives the usual permissible loads (Colonel Seddon):—

Material.	*Tons per sq. ft.*
Hard rock	9.
Rock, of strength of good concrete	3.
Very soft rock	1·8.
Firm earth and hard clay	1 to 1·5.
Clean dry gravel and clean sharp sand, prevented from spreading sideways	1 to 1·5.

In places where running sand, or an unreliable formation, is encountered, piling is often used. Wooden piles, which may be anything up to 100 feet long, are driven downwards into the ground, sometimes two or three being driven one above the other, so that the deepest one may go down some 300 feet. The piles may be wooden beams or they may be made of concrete. They are driven into the ground by a pile-driver. On the top of these piles a concrete raft is usually formed, which consists of a flat layer of concrete from, say, 3 inches to 5 feet thick. This concrete platform or raft is allowed to set, and upon it the building is erected.

Submerged foundations are another important class which requires special treatment. This class includes the foundations of breakwaters, bridges, &c. It is usual to form such foundations with Portland cement, which is thrown, in sacks, into the sea or river, where the foundation is required. In course of time these sacks of cement form a solid mass. Upon this artificial 'bed of rock' the structure is raised. In bridge-work every effort is made to find natural and firm foundations for the piers, but it may be necessary to reinforce these with concrete in the artificial way described above. Each of the columns of the Tower Bridge in London is raised on a bed of granite lying on the natural clay bed of the river.—BIBLIOGRAPHY: W. M. Patton, *A Practical Treatise on Foundations;* C. E. Fowler, *Ordinary Foundations, including the Coffer-dam Process for Piers.*

FOUNDING is the manufacture of metal castings by pouring the molten metal into suitably prepared moulds, and that part of works devoted to the production of castings is known as the foundry. The castings thus produced may generally be made at lower cost than wrought or forged objects of similar design, and in many cases of intricate design casting (q.v.) is the only method of production possible.

The moulds used in the production of castings are commonly made of sand, and of these there are three classes, viz. green sand, dry sand, and

loam. Green sand moulds are made of sand in the natural state (sufficiently wetted with water to make it adherent), which is packed by ramming around a pattern usually of wood, having the shape of the casting required. After thus shaping the mould, the pattern is removed and the space thus formed is filled with molten metal. Dry-sand moulds, after being prepared, are thoroughly dried in suitable ovens before the metal is poured in. In loam moulding a sand rich in clay is used and the mould is built up on a case of bricks and shaped by hand. This type of moulding is used for large objects.

Machine moulding is largely used for small and medium-sized repetition castings, and is most economical when it is possible to mount and mould several patterns at the same time, and especially when the machine and pattern details are simplified to such an extent that skilled labour may be replaced by unskilled labour. Chill moulds contain metal portions inserted in order to abstract the heat rapidly and thus cause local rapid solidification and cooling, which increases the hardness of the parts thus treated.

For metals other than iron, steel or iron moulds are commonly used, and are known as permanent moulds; these are also used for the production of pressure castings which are made with the metal under pressure. After the preparation of the moulds, the molten metal from crucibles, cupolas, &c., is poured or teemed into them. The metal may be poured directly into the top from some sort of ladle, but in the case of sand moulds the metal is generally run in at the side or bottom by means of a separate channel known as a runner. After the castings have been removed from the moulds, a certain amount of dressing is required for the removal of adherent sand, fins of metal, &c. In most cases the castings should be submitted to an annealing operation to remove stresses induced by unequal cooling and to reduce brittleness.

FOUNDLING HOSPITALS, institutions for receiving children abandoned by their parents and found by strangers. Among such institutions are that of Paris (instituted in 1670), which grew out of a home established by St. Vincent de Paul in the reign of Louis XIII, and that of London, instituted in 1739. The latter, established by Thomas Coram (1668–1751,) a sailor, was originally a hospital for all exposed children; but the enormous increase in abandonments caused the hospital to be changed in 1760 to one for poor illegitimate children whose mothers are known. There were over 700 inmates in 1921. In 1926 the hospital was removed to Reigate, pending the erection of a permanent home for the foundlings on an estate near Berkhampstead. A fund was raised to preserve the site in Guilford Street, the former home of the hospital, as a public recreation ground, and in 1932 the required sum was obtained.—Cf. Sir John E. Gorst, *Children of the Nation.*

FOUNDRY, building where the casting or founding of metals is carried on. The art of casting reached a high stage of development among many of the ancient nations. The furnaces in use range from small gas furnaces to large blast and electric furnaces, and different forms of moulds are used for solid and hollow castings.

FOUNT, or **FONT** among printers, a quantity of types, in proportions sorted for use, that includes ordinary letters, large and small capitals, single letters, double letters, points, commas, lines, and numerals; as a fount of Pica or Bourgeois. A fount of 100,000 characters, which is a common fount, would contain 5,000 types of *a*, 3,000 of *c*, 11,000 of *e*, 6,000 of *i*, 3,000 of *m*, and about 30 or 40 of *k*, *x*, *y*, and *z*. But this is only to be understood of the ordinary types, capitals having other proportions.

FOUNTAIN, a contrivance by which water is made to spout from an artificial channel, and often to rise up to a great height in a jet or jets. There are various kinds of artificial fountains, but in those of an ornamental character the water is usually made to rise in a jet by the pressure or weight of a head of water situated some distance above the orifice of issue, in which case the water will rise nearly to the same height as the head. In some cities the public fountains form a feature on the streets. Rome, in particular, is noted for its fountains. At Paris, also, the fountains of the Place de la Concorde and of the Tuileries, and those at Versailles, are splendid structures.

FOUNTAINS ABBEY, ruined abbey in Yorkshire. It is 3 miles from Ripon near the River Skell in the grounds of Studley Royal. The ruins, perhaps the most beautiful in England, include parts of the church, chapter house and cloisters, as well as remains of other apartments. The abbey was a Cistercian house founded about 1130. Near is Fountains Hall, a fine house built early in the 17th century.

FOUQUÉ (fō-kā), **Friedrich Heinrich Karl,** Baron de la Motte, a German poet and novelist, born in 1777, died at Berlin in 1843. He was the grandson of General Fouqué, served as lieutenant of the Prussian Guards in the campaign of 1792, thereafter lived quietly in the country, but again re-

turned to the army, and was present at the most important battles in the campaign of 1813. As a writer his work is marked by fantastic unreality and extravagance of conception. Several of his tales, *Der Zauberring* (Magic Ring), *Undine*, and *Aslauga's Ritter* (Aslauga's Knight), have been very popular. A translation of the last was made by Carlyle.

FOUQUÉ, Heinrich August, Baron de la Motte, a distinguished Prussian general in the Seven Years' War, born in 1698, died in 1774. He was descended from an old Norman family which had fled on account of religious persecutions to the Hague. Fouqué's *Mémoires*, containing his correspondence with Frederick the Great, are highly interesting.

FOUQUET (fu-kē'), **Nicolas,** French politician. Born in Paris in 1615, he entered the public service at an early age, and in 1650 was made Procurator-General. In 1653 he was made Superintendent of the National Finances, and in that position amassed great wealth which he spent in regal style. This lasted until 1661 when he was arrested and tried. The sentence was imprisonment for life, and he was still a captive at Pignerol when he died 23rd March, 1680.

FOUQUIER-TINVILLE (fō-ki-ă-tan-vēl), **Antoine Quentin,** notorious for his ferocious cruelty in the first French revolution, was born in 1747. He was an attorney by profession, and, having attracted the attention of Robespierre, was appointed Public Accuser before the Revolutionary tribunal. His thirst for blood seems to have been increased by gratification, until it became a real insanity. He proposed the execution of Robespierre and all the members of the Revolutionary tribunal in 1794, but was himself arrested, and died under the guillotine, in a cowardly manner, in 1795.—Cf. Dunoyer, *Fouquier-Tinville, accusateur public du tribunal revolutionnaire.*

FOURCHAMBAULT (fōr-shăn-bō), a town of France, department of Nièvre, on the Loire. It has extensive iron-smelting furnaces and forges. Pop. 1,936.

FOURCROY (fōr-krwa), **Antoine François de,** a French Chemist, born in 1755, died in 1809. Having adopted the profession of medicine, he applied himself closely to the sciences connected with it, and especially to chemistry. In 1784 he was made professor of chemistry at the Jardin du Roi; and the next year he was chosen a member of the Academy of Sciences. At this period he became associated with Lavoisier, Guyton-Morveau, and Berthollet in researches which led to vast improvements and discoveries in chemistry.

When the Revolution took place, he was chosen a Deputy from Paris to the National Convention, but did not take his seat in that assembly till after the fall of Robespierre. In Sept., 1794, he became a member of the Committee of Public Safety. In Dec., 1799, Bonaparte gave him a place in the Council of State, in the section of the Interior, in which place he drew up a plan for a system of public instruction, which, with some alteration, was adopted. His works are numerous. We may mention his *Système des connaissances chimiques* and *Philosophie chimique.*

FOURIER (fo-ri-ā), **François Marie Charles,** a French Socialist and founder of the system named after him, was born 7th April, 1772, at Besançon, died 10th Oct., 1837. He studied in the college of his native town, and subsequently at Rouen and Lyons occupied subordinate situations in mercantile houses. In the last-mentioned town he entered into business on his own account, but lost all his money owing to the outbreak of war, and was forced to enlist in the Revolutionary army. Discharged in 1795 on account of ill-health, he returned to commerce, filling quite subordinate situations, till he died.

He wrote his books in his leisure hours, and published them out of his scanty savings. His first book, *Théorie des quatre mouvements et des destinées générales*, was published in 1808; the *Traité de l'Association Domestique Agricole*, his most important work, in 1822; but it was not till the last years of his life that they attracted any notice.

In his social system Fourier holds that the operations of industry should be carried on by *Phalansteries*, or associations of 1,800 members combining their labour on a district of about a square league in extent, under the control of governors elected by each community. In the distribution a certain minimum is first assigned for the subsistence of every member of the society, whether capable or not of labour. The remainder of the produce is shared in certain proportions to be previously determined among the three elements, labour, capital and talent.

The capital of the community may be owned in unequal shares by different members, who would in that case receive, as in any other joint-stock concern, proportional dividends. The claim of each person on the share of the produce apportioned to talent is estimated by the grade which the individual occupies in the several groups of labourers to which he or she belongs, these grades being in every case conferred by the voice of his or her com-

panions. The remuneration received would not of necessity be expended in common. Separate rooms or sets of rooms would be set aside for those who applied for them, no other system of living together being contemplated than such as would effect a saving of labour in building and the processes of domestic life, and reducing the enormous portion of the produce of industry at present carried off by middlemen and distributing traders to the narrowest possible margin. *See* COMMUNISM; SOCIALISM; BROOK FARM.—BIBLIOGRAPHY: Ch. Pellarin, *Ch. Fourier: sa vie et sa théorie*; E. Fournière, *Les Théories socialistes au XIX^ème siècle*; *Encyclopédie Socialiste*; Sambuc, *Le Socialisme de Fourier*; C. Gide, *Charles Fourier* (Petite Bibliothèque Économique).

FOURIER, Jean Baptiste Joseph, a French mathematician, born at Auxerre 1768, died in 1830. He was educated in the military school of his native town, and after holding an appointment for a short time in the Polytechnic School, followed Bonaparte to Egypt. Here he performed important political service, and was likewise secretary of the Institute of Egypt. After his return he was, in 1802, appointed Prefect of the department of Isère.

On Napoleon's return from Elba, Fourier issued a royalist proclamation, but was nevertheless appointed Prefect of the Rhône, though soon after deprived of the office. He now established his residence in Paris, devoting himself entirely to study, and was in 1815 admitted a member of the Academy of Sciences, and at a later period appointed secretary for life.

In the opinion of Sir William Rowan Hamilton, Fourier was the greatest of the brilliant group of French mathematicians who flourished at the beginning of the nineteenth century, a group which included Laplace, Lagrange, Cauchy, and Poisson. Amongst his principal works are the *Théorie analytique de la chaleur* (1822), and *Analyse des equations determinées*, published in 1831 after his death.

FOURIER SERIES, infinite series involving cosines and sines of the successive multiples of a variable, i.e. series of the type.

$$a_0 + a_1\cos\theta + a_2\cos 2\theta + a_3\cos 3\theta + \ldots + b_1\sin\theta + b_2\sin 2\theta + b_3\sin 3\theta + \ldots$$

A function of θ represented by a convergent series of this type is *periodic*, the period being 2π; for every term has the same value for $\theta + 2k\pi$ as for θ, where k is any integer. The corresponding form for a periodic function of period a instead of 2π can be written down from the above form by merely changing θ into $2\pi x/a$, the variable now being x. Any finite periodic function, subject to certain limitations of little practical moment, can be expressed by means of a Fourier series. This very important result is known as *Fourier's Theorem*. It was proved and applied to problems of heat conduction by Fourier in his beautiful work mentioned in the preceding article. The theorem has an application to functions which are not periodic. In fact, if we are given the values of a function of x for all values of x between two end values $x=0$ and $x=a$ say, we may regard these data as defining one wave of a periodic function of x, the period of which is a; in other words, we can define a periodic function so that one wave of it may have any assigned form. Hence any ordinary function whatever can be represented by a Fourier series for all values of x between two assigned end values. This remarkable property was a great stumbling-block to early investigators who looked on such an equation as $\frac{1}{4}x = \sin x - \frac{1}{2}\sin 2x + \frac{1}{3}\sin 3x - \frac{1}{4}\sin 4x + \ldots$ as obviously erroneous, the right hand member being periodic, while the left is not. The result, however, is quite correct for values of x between $-\pi$ and π, exclusive of these end values.

A rigorous proof, or even statement, of Fourier's theorem in all its possible generality is not easy, the difficulty being chiefly due to the very great complexity of the modern conception of a function. On the other hand, if the theorem is assumed to be true, it is usually an easy matter to determine the coefficients in the expansion of a given function. Suppose, e.g., we require a series equivalent to the function x between $x=-\pi$ and $x=\pi$. We put

$$x = a_0 + a_1\cos x + a_2\cos 2x + \ldots + b_1\sin x + b_2\sin 2x + \ldots$$

To find b_n, multiply both sides by $\sin nx$, and then integrate from $x=-\pi$ to $x=\pi$, assuming this to be allowable. We get

$$\int_0^\pi x\sin nx\,dx = b_n\int_0^\pi \sin^2 nx\,dx;$$

for all the other integrals on the right are easily proved to disappear. Thus $b_n = -2\cos n\pi/n$; similarly $a_n = 0$, and the series is found in the form already written down above.

In almost every branch of applied mathematics, Fourier series are indispensable. As an example of their use, we may take the problem of a vibrating string, in the treatment of which by Daniel Bernouilli the series first made their appearance in analysis. It is known from the dynamics of the problem that a string held in the form $y=\sin nx$ (where y is the displacement of a particle at distance x from one

end), and let go at the time $t=0$, subject to the end points $x=0$ and $x=\pi$ remaining fixed, will vibrate so that the displacement at time t is

$$y=\sin nx\ \cos nVt,$$

V being a constant depending on the tension and density of the string. Now take the corresponding problem for a string with the same fixed ends, but with *any* initial form. We can expand the value of y for this initial form in the series $y=a_1\sin x+a_2\sin 2x+\ldots$. The value of y at any time t is then

$$y=a_1\sin x\cos Vt+a_2\sin 2x\cos_2 Vt+\ldots$$

The purely mathematical resolution of the original displacement into sinusoidal components $a_1\sin x$, $a_2\sin 2x$, &c., thus corresponds closely to that physical resolution of the vibration into harmonic components, which seems to be carried out by the ear in the process of hearing.—BIBLIOGRAPHY: H. S. Carslaw, *Fourier Series and Integrals*; W. E. Byerly, *Fourier's Series and Spherical Harmonics*; E. W. Hobson, *Functions of a Real Variable and Fourier's Series*; papers by G. A. Gibson, Proceedings of the Edinburgh Mathematical Society, vols. 11 and 12.

FOURMIES (for-mē), a town of Northern France, department of Nord, an important centre of industry before the European War, during which it was occupied by the Germans. Pop. 14,140.

FOURNET, d'Artigue du, French admiral, born in 1856. He saw service in the Tongking War of 1883, the Chinese War of 1885, and the Siam War of 1893, and commanded the French squadron during the Balkan War. Raised to the rank of vice-admiral, he commanded the Dardanelles fleet during the European War. Commander-in-chief of the French navy in 1915, he had the supreme command over the Allied fleets in the Mediterranean, and obtained, in Oct., 1916, the surrender of the Greek navy.

FOURTEEN POINTS, THE, statement of Allied war aims presented by President Wilson (q.v.) to Congress on 8th Jan., 1918. The points were (1) open covenants of peace without secret diplomacy; (2) freedom of navigation outside territorial waters; (3) removal of economic barriers; (4) reduction of armaments; (5) impartial adjustment of all colonial claims; (6)-(13) dealt respectively with Russia, Belgium, Alsace-Lorraine, Italy, Austria-Hungary, Balkan States, the Ottoman Empire and Poland; (14) a general association of nations (the League of Nations) to be formed under specific covenants.

FOURTH, in music, a distance comprising three diatonic intervals, or two tones and a half. Three full tones compose a tritone or fourth redundant. The diminished fourth consists of a whole tone and two semi-tones.

FOURTH DIMENSION, term denoting a hypothetical extension over and above the three-dimensional world of length, breadth and thickness in our normal experience. Just as the geometrical forms of lines, planes and solids are expressible algebraically by a, a^2 and a^3 respectively, so a four-dimensional world is expressible by a^4. Although fourth-dimensional relations are mathematically soluble, the notion of a super-solid state is outside our comprehension. Einstein's theory of relativity studies three-dimensional space in relation to time as a fourth dimension.

FOURTH ESTATE, term used for the Press. Constitutionally there are in Great Britain three estates of the realm, Lords Spiritual, Lords Temporal and Commons. The phrase, Fourth Estate, is believed to have originated with Burke, and is, of course, a reference to the power of the Press in the State.

FOUVEAUX STRAIT (fō'vō), the strait between the South Island of New Zealand and Stewart's Island.

FOWEY (foy), a municipal borough and seaport of England, in Cornwall, on the River Fowey, formerly one of the chief seaports of England. In 1396 the town sent ships to the siege of Calais. There is a good harbour, a little shipping, and some fishing. It carries on an extensive export of china clay. The town is the Troy town of Sir A. Quiller-Couch's novels. Place House is a fifteenth century mansion and there are ruins of a castle. Pop. 1931), 2,382.

FOWL, a word originally synonymous with *bird*, now used, except in compound words such as 'wild-fowl,' in a stricter sense to designate the birds of the genus Gallus, of which the common domestic fowl (cock and hen) is a familiar example. The general form and characters of the bill, feet, &c., agree with those of the pheasants, but the crown of the head is generally naked and furnished with a fleshy comb, the base of the lower mandible also bearing fleshy lobes or wattles—characters which are most conspicuous in the males. The legs of the male are furnished with spurs, which are much used in conflict, the cocks being very pugnacious and unable to suffer the presence of a rival. In the centre of the cock's tail are two long feathers, which fall backwards in a graceful arch and add great beauty to the whole aspect of the fowl. Except in the pure white breeds the plumage of

the cock is always more splendid than that of the hen.

There are four species, all native to South and South-East Asia. One of these, the *Red Jungle Fowl* (*Gallus bankiva* or *ferrugineus*), is most probably the original stock of the domesticated poultry. It ranges from North India to Cochin-China and the Malay regions, extending as far as the Philippines. Amongst well-known breeds are; *Game*, *Indian Game*, and *Dorking* (table varieties); *Andalusian*, *Leghorn*, and *Minorca* (laying varieties); *Orpington*, *Plymouth Rock*, *Rhode Island Red*, and *Wyandotte* (utility); *Bantam* and *Silky* (fancy).— Cf. article in *Standard Encyclopædia of Agriculture*.

FOWLER, Sir John, civil engineer, was born near Sheffield in 1817, died in 1898. Originally a pupil of the engineer of the Sheffield waterworks, he was subsequently engaged on the London and Brighton Railway, and



Desert Fox

in 1842 returned to the north and became resident engineer of the Stockton and Hartlepool line. In 1844 he set up in London as consulting engineer, and was connected with various important undertakings. He was for many years engineering adviser to the Khedive of Egypt, and with Sir Benjamin Baker was chiefly responsible for the design of the Forth Bridge, opened in 1890. Greatly interested in railway improvements and dock-construction, he was president of the Council of the Institution of Civil Engineers in 1866, was created a K.C.M.G. in 1885, and a baronet in 1890.

FOWLER, Rev. Thomas, D.D., English philosophical writer, was born in 1832, and died in 1904. He studied at Merton College, Oxford, and graduated with first-class honours in both classics and mathematics in 1854, soon after becoming fellow and tutor of Lincoln College. From 1873 to 1889 he was professor of logic in the university, and in 1881 was elected president of Corpus Christi College, retaining the post until his death. He was also vice-chancellor of the university from 1899 to 1901. His published works include two volumes on Logic, *Deductive Logic* (1867), and *Inductive Logic* (1870) reproductions, in the main, for Oxford use, of J. S. Mill's logical system; editions of Bacon's *Novum Organum*, with introduction and notes, and Locke's *Conduct of the Understanding*; *Progressive Morality, an Essay in Ethics*; *Principles of Morals*; and monographs on Locke, Bacon, Shaftesbury, and Hutcheson.

FOX, an animal of the genus Canis, closely allied to the dog, with a straight bushy tail, elongated pupils, and erect ears. Foxes are natives of almost every quarter of the globe, and are everywhere among the most sagacious and wily of all beasts of prey, very voracious, devouring birds and small quadrupeds, and committing ravages not only on animals, but on fruits, honey, and eggs.

The common fox of Europe (*Canis vulpes*) and Asia is well known. Among other species there are the Arctic fox (*C. lagōpus*), celebrated for its glossy white winter fur; the *silver* or *black fox* (*C. argentātus*), similar to the common fox, but distinguishable by its rich, shining black fur, a native of the northern parts of Asia and America; the *grey fox* (*C. virginianus*) has a thick tail containing at its tip a tuft of stiff hairs, common through the northern parts of America; the *red fox* of America (*Vulpes fulvus*), generally of a pale-yellow hue; the *cross fox* (*C. pennsylvanicus* or *decussātus*), fur a sort of grey, muzzle and lower parts of body black, a dark cross on the shoulders; the *kit fox* (*C. velox*), an inhabitant of the plains which lie at the base of the Rocky Mountains. The little *desert fox* (*C. leucopus*) of South-West Asia, and its ally the *corsac fox* (*C. corsac*) from Central Asia, are also deserving of notice.

FOX, strait off the north coast of N. America. It divides Baffin Island from Melville Peninsula, and is connected by other arms of the sea with both the Atlantic and the Arctic Oceans. To the south is Fox basin which connects it with Hudson Strait and between the two is the projection of Baffin Island called Fox Land. The strait is named after a sailor, Luke Fox, who explored these regions early in the 17th century.

Two rivers in Wisconsin, U.S.A., are named the Fox, and Fox Islands is another name for the Aleutian Islands.

FOX, Charles James, an eminent English statesman, the second son of Henry, first Lord Holland, was born 24th Jan., 1749, died 1806. He was sent to Eton, whence he removed to Hertford College, Oxford. His father procured him a seat for the borough of Midhurst in 1768, before he was of legal age, and in 1770 he was appointed one of the Lords of the Admiralty,

which situation he resigned in 1772, and was appointed a Commissioner of the Treasury. After being a supporter of the administration for six years, a quarrel with Lord North threw Fox into the ranks of the Whig opposition, where, along with Burke and others, he steadily assailed the Government, especially on the score of their American policy.

In 1780 he was elected member for Westminster, and on the defeat of the administration of Lord North, and the accession of that of the Marquess of Rockingham, he obtained the office of Secretary of State for Foreign Affairs (1782). But the death of the Marquess of Rockingham suddenly divided the party; and when the Earl of Shelburne became First Lord of the Treasury, Fox retired.

Soon after a union took place between his friends and those of Lord North known as *the coalition ministry*, which was overthrown by Fox's famous East India Bill (1783). At the ensuing election nearly seventy of his friends lost their seats; but though Pitt had a decided majority, Fox still headed a very strong opposition, and for some years political questions were contested on both sides of the House with a great display of talent. He took an active part against Warren Hastings, supported the efforts of Wilberforce against the slave trade, and moved the repeal of the Test and Corporation Acts.

He welcomed the breaking out of the French Revolution, and his views on this subject led to a memorable break between him and his old friend Burke. Fox firmly opposed the principle on which the war against France was begun, and strenuously argued for peace on every occasion; but eventually, on becoming Secretary for Foreign Affairs in 1806, acquiesced in its propriety. His health, which had been impaired by his loose manner of living, now began rapidly to decline, and he died the same year, a few months after the death of Pitt, his great rival.

As a powerful and purely argumentative orator he was of the very first class; although as to eloquence and brilliancy he perhaps yielded to Pitt, Burke, and Sheridan; nor were his voice and manner prepossessing, although highly forcible. He was of an amiable nature, and a sincere friend to all broad and liberal principles of government. His *History of the Early Part of the Reign of James II* was published posthumously.—BIBLIOGRAPHY: Lord John Russell, *The Life of C. J. Fox*; Sir G. O. Trevelyan, *Early History of C. J. Fox*; J. L. Le. B. Hammond, *Charles James Fox: a Political Study*; W. E. H. Lecky, *History of England in the Eighteenth Century*.

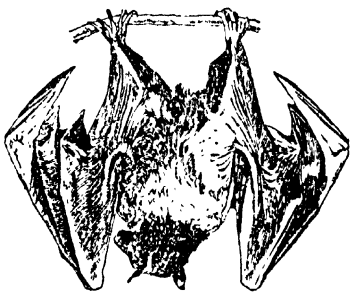
FOX, George, the founder of the Society of Friends, or Quakers, was born at Drayton, in Leicestershire, in 1624, his father being a weaver, and died in 1691. He was educated religiously, and at the age of nineteen persuaded himself that he had received a divine command to forsake everything else and devote himself wholly to religion. He accordingly forsook his relations, equipped himself in a leathern doublet, and wandered from place to place, supporting himself as he could. During this itinerant life he fasted much, sometimes sitting the whole day in a retired spot reading the Bible.



Charles Fox

In 1648 he commenced to preach publicly at Manchester, about which time he also adopted the peculiar language and manners of Quakerism. At Derby his followers were first denominated *Quakers*, in consequence of their trembling mode of delivery, and calls on the magistracy to tremble before the Lord. In 1655 he was sent a prisoner to Cromwell, who, having ascertained the pacific tendency of his doctrines, had him set at liberty. He was, however, treated with great severity by the country magistracy and the sterner Puritans, who disliked the mysticism and want of firm doctrines in his preaching. In 1666 he set about forming the people who had followed his doctrines into a formal and united society. In 1669 he married the widow of Judge Fell, and soon after went to America, where he remained two years, which he employed in making proselytes. On his return he was thrown into Worcester jail, where he remained for over a year.

On his release he went to Holland. He soon after returned, and was cast in a suit for tithes, which he deemed it unlawful to pay. In 1684 he again visited the Continent. At the time of his death the Society of Friends (q.v.) had acquired considerable importance. The writings of Fox have been collected into three volumes.—Cf. Bickley, *George Fox and the Early Quakers*.



FOX-BATS, or FLYING-FOXES, a name given to the fruit-eating bats of the family Pteropodidæ, including some of the largest of the bat tribe, one species, the *Pteropus edulis* or kalong, attaining a length of from 4 to 5 feet from the tip of one wing to the tip of the other. They inhabit Australia, Java, Sumatra, and Borneo, as well as the continents of Asia and Africa.

FOXE, John, an English Church historian, born in 1517, died in 1587. He studied at Oxford, and was elected a fellow of Magdalen in 1543, from which he was expelled two years later on a charge of heresy. In the reign of Edward VI he was restored to his fellowship, but during Mary's reign again went abroad, to Basel. On the accession of Elizabeth he returned to his native country, and was received in the most friendly manner by his former pupil, the Duke of Norfolk, who settled a pension on him. Secretary Cecil also obtained for him a prebend in the church of Salisbury; and he might have received much higher preferment if he would have subscribed to the articles enforced by the ecclesiastical commissioners. His principal work is the *History of the Acts and Monuments of the Church*, commonly called Foxe's *Book of Martyrs*, first printed in 1563, in one volume folio. An edition of this work, by Stoughton, appeared in 1877.

FOX'GLOVE, a common British plant, *Digitālis purpurea*, nat. ord. Scrophulariaceæ. It grows on banks, pastures, &c., in hilly and especially subalpine and rocky countries in Europe. Its flowers are campanulate, and somewhat resembling the finger of a glove. It is one of the most stately and beautiful of the British herbaceous plants, and one that has great reputation as a medicinal plant, being employed as a sedative, narcotic, and diuretic in diseases of the heart and in dropsy. Its medicinal properties are due to the poisonous substance known as *digitalin* (q.v.). A decoction or infusion of the leaves is what is generally used. The flowers are usually purple, but sometimes white. Several species are grown in gardens, such as *D. grandiflōra* and *D. lutea*, with yellow flowers, and *D. ferruginea* with brown.

FOXHOUND, a hound for hunting foxes, a variety of hound in which are combined, in the highest degree of excellence, fleetness, strength, spirit, fine scent, perseverance, and subordination. The foxhound is smaller than the staghound, its average height being from 20 to 22 inches. It is supposed to be a mixed breed between the staghound or the bloodhound and the greyhound. It is commonly of a white colour with patches of black and tan.

FOX-HUNTING, a favourite English sport much practised during the autumnal and winter months. A *pack* of foxhounds consists of from 20 to 60 couples of hounds, according to the frequency of the hunting days. These dogs are carefully bred and trained, and are under the superintendence of one experienced gentleman called the *master*, who has the general control of the whole 'field.' Under him is the *huntsman*, whose duty it is to look after the hounds in their kennels and



Foxhound.

direct them in the field. He is directly responsible for their condition and training. Next him are the *whippers-in*, whose main duty is that of assisting generally the huntsman both in the kennels and in the field. A less important function of the whipper-in is that of urging on lagging hounds.

The person who first sees the fox

leave the covert, *break cover* as it is called, gives the *view-halloo* after it has got some little distance, upon which the huntsman collects his hounds and sets off in a chase followed by the entire field. The foxhounds follow almost entirely by scent, the fox being itself perhaps far ahead and out of sight. Wherever, therefore, the scent fails the hounds are *at fault*, and there is a *check* till the scent is recovered. When the scent is good, most of the hounds *own* it by giving tongue, and they are then said to be in *full cry*. The rider who is first in at *the death* lashes the hounds off and secures the head, feet or *pads*, and tail or *brush* of the fox. The midland counties of England, Leicester, Warwick, Yorkshire, &c., are the most celebrated for fox-hunting. The most famous hunts are the Quorn, Pytchley, Cottesmore, Belvoir and others in the Midlands. Fox-hunting is carried on in Ireland and in Scotland, but not to any great extent elsewhere. There are about 200 packs of hounds in Great Britain and nearly 100 in Ireland.

The **fox-hunting season** lasts from November to April. It is preceded by a period of cub hunting, really a trial for the hounds and young foxes.

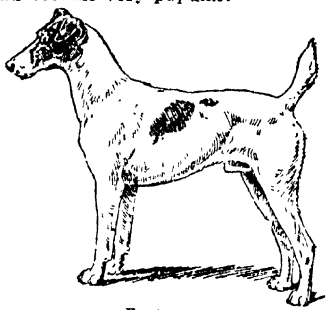
FOX INDIANS, a tribe of North American Indians belonging to the Algonquin family, now few in numbers and scattered over the Indian territories, Iowa, Kansas, and Nebraska.

FOX RIVER, a river of Wisconsin, United States, which enters Green Bay, an arm of Lake Michigan, after passing through Lake Winnebago. It is connected by canal with the River Mississippi, and thus furnishes water communication between that river and the Atlantic.

FOX-TERRIER, a favourite breed of dog, white, with black or tan markings (like a fox-hound), coat rough or smooth, hard and dense, ears drooping, legs straight, weight not more than 17 lb.; strong, active, and courageous, intelligent, and useful against vermin, keen in driving foxes from their lurking-places.

FOY (fwâ), **Maximilian Sebastian,** a French general, born in 1775, died at Paris 28th Nov., 1825. He was educated in the military school at La Fère, and served with distinction under Dumouriez, Moreau, and Masséna. In 1803 he received the command of the floating batteries intended for the defence of the coasts of the Channel, and in 1805 commanded the artillery of the second division in the Austrian campaign. In 1807 he took part in the preparations for the defence of Constantinople against the British. From 1808 to 1812 he was general of division of the army in Portugal.

In 1812, after the defeat of the French at Salamanca, he succeeded Marmont as commander-in-chief, and showed much talent in his conduct of the operations on the Douro. He was present in all the battles of the Pyrenees, until he was dangerously wounded at Orthez in 1814. In 1815 he commanded a division at Waterloo, where he was wounded for the fifteenth time. In 1819 he was appointed division-inspector of infantry, and the same year was elected Deputy by the department of the Aisne. He at once distinguished himself as one of the leading orators of the Liberal party, and became very popular.



Fox terrier

FOYERS, FALLS OF, two striking cataracts near the mouth of the little River Foyers, Inverness-shire, which falls into Loch Ness. The upper fall is about 30 feet in height, the lower, 'the most magnificent in Great Britain,' is about 165 feet. It now generates electricity for important aluminium works.

FOYLE, a river of Ireland, which flows north-east through Tyrone, Donegal, and Londonderry till it falls into Lough Foyle 4 miles below the city of Londonderry. It is navigable up to Londonderry for vessels of 800 tons.

FOYLE, LOUGH, the estuary of the River Foyle, on the north coast of Ireland, between the counties of Derry and Donegal. It is 16 miles long from north-east to south-west, 1 mile wide at its entrance, and 9 miles broad in the interior. A great part is dry at low water.

FRA BARTOLOMMEO. *See* BARTOLOMMEO.

FRACTION, in arithmetic and algebra, a combination of numbers representing one or more parts of a unit or integer: thus, four-fifths (⅘) is a fraction formed by dividing a unit into five equal parts, and taking one part four times. Fractions are of two

kinds, *vulgar and decimal*. Vulgar fractions are expressed by two numbers, one above another, with a line between them. The lower, the *denominator*, indicates into how many equal parts the unit is divided; and the number above the line, called the *numerator*, indicates how many of such parts are taken. The *solidus* notation is now frequently used, chiefly for the purpose of avoiding the troublesome process of 'justification' in printing. In this notation the result of dividing *a* by *b* is denoted by *a*/*b*.

A *proper fraction* is one whose numerator is less than its denominator. An *improper fraction* is one whose numerator is not less than its denominator, as $\frac{8}{5}$, $\frac{5}{5}$. A *simple fraction* expresses one or more of the equal parts into which the unit is divided, without reference to any other fraction. A *compound fraction* expresses one or more of the equal parts into which another fraction or a mixed number is divided. Compound fractions have the word *of* interposed between the simple fractions of which they are composed: thus, $\frac{1}{2}$ *of* $\frac{1}{3}$ *of* $1\frac{1}{2}$ is a compound fraction. A *complex fraction* is one which has a fraction either in its numerator or denominator, or in each of them; thus, $\frac{5\frac{1}{2}}{9}$, $\frac{8}{9\frac{1}{3}}$, $\frac{5\frac{1}{2}}{6\frac{2}{3}}$ are complex fractions. *See* DECIMALS.

FRACTURE, in mineralogy, is the manner in which a mineral breaks so that its texture is displayed. The fracture is *even* when it shows a level face or plane of some extent; *uneven*, when the surface is rough and broken; *conchoidal*, when one side is convex and the other concave, as in a molluscous shell; *fibrous*, when the separated edges have the appearance of torn filaments; *hackly*, when there are many fine sharp points or inequalities.

The same term is used in connection with metals and alloys, and the nature of the fracture of these is found to be intimately connected with the crystalline form, and often gives a useful indication of the purity or otherwise of the substance. The fracture of metals is usually described as crystalline, granular, fibrous, silky, columnar, conchoidal, or laminated, according to its general appearance.

FRACTURE, in surgery, is the breaking of a bone. It is simple when the bone only is divided; compound when there is also a wound of the soft parts leading down to the fracture. A fracture is termed *transverse*, *longitudinal*, or *oblique* according to its direction in regard to the axis of the bone. It is called *complicated* if accompanied with dislocation, severe contusions, wounded blood-vessels, or any disease which prevents the union of the bones and causes them to be very easily broken. A *comminuted* fracture is one in which the bone is broken into several small pieces at the point of rupture. An *incomplete* fracture is one in which only a portion of the fibres is broken. A *stellate* fracture is a series of fractures radiating from a centre.

When a fracture takes place, there is a pouring out of fluid—lymph—and cells from the blood contained in the vessels of the lining membrane of the bone as well as from the vessels of the soft parts which have also suffered injury. This material surrounds the broken ends of the bone, becoming firm and consolidated. A formation of bone then takes place round the seat of fracture, and in about three weeks is hard enough to keep the broken ends in position. This is called 'provisional callus,' because, when the process of repair is completed and true bone has formed to unite the break, it is reabsorbed and gradually disappears. Meanwhile a process of repair goes on between the broken ends, uniting them by the formation of true bone or 'definitive callus.' The more quickly and accurately the broken ends are brought together after the break, the more rapid will be the reunion.

The treatment of a simple fractured bone is to bring the portions into their natural position and to keep them permanently thus, by splints of some kind, pasteboard splints, for instance, dipped in warm water, with wooden ones exterior to them; or a mass of plaster of Paris may be used for the same purpose.

FRA DIAV'OLO, a celebrated Neapolitan brigand, whose real name was Michele Pezza. He was born in Calabria in 1760, quitted the trade of stocking-weaving for the army, and served for a time in the Papal Legion. He afterwards became a monk, but was expelled on account of misconduct. He then joined a troop of brigands, of which he became in a short time the leader. The Government set a price upon his head; but later, having need of Fra Diavolo's service against the French, they pardoned him and gave him a colonel's commission. At the head of his band he harassed the French, took refuge in Calabria after the conquest of Naples by Bonaparte, and incited the people against the French. He fell at last into their hands in 1806, and was executed as a robber and incendiary. Aubers opera *Fra Diavolo* has little or nothing in common with the rival Fra Diavolo.

FRAGA, a town of N.E. Spain, province of Huesca, on the Cinca, with a Moorish castle. It is supposed to be the Gallica Flavia of the Roman Empire. Pop. 7,418.

FRAGONARD, Jean Honore, French painter and engraver, born at Grasse, in Provence, in 1732, died in 1806. He studied under Chardin and Boucher, won the Prix de Rome, and then went to Italy, where he was influenced by the work of Tiepolo. Fragonard was one of the most distinguished painters of the Rococo period in France, depicting the charm, frivolity, and gaiety of the old régime. *The Bathers, The Sleeping Bacchante, The Shepherd's Hour, The Music Lesson,* and *The Storm* are in the Louvre; *The Swing, The Fair-haired Child, The School-mistress,* and *Le Chiffre d'amour* are in the Wallace collection.

FRAM, vessel famous in polar exploration. A three-masted schooner with auxiliary steam engines, she measured 117 ft. and weighed 402 tons. Nansen used her for a northward drift, followed by travel with sledges to 86° 13½′ N., in 1893–7. Sverdrup used her for exploring Jones Sound in 1899. Amundsen used her for reaching King Edward VII Land, whence he marched to the South Pole, in 1910–12. In 1931 a fund was raised for preserving the *Fram.*

FRAMBŒ'SIA. *See* TROPICAL DISEASES.

FRAMLINGHAM, a market-town of England, Suffolk, 18 miles north-east by north of Ipswich, with extensive remains of a castle, which can be traced back to the time of Henry I. In St. Michael's Church members of the Howard family are buried. There are considerable remains of one of their castles. The Albert Memorial College was opened in 1865. Framlingham College founded in 1876 as a school for boys, occupies a fine block of buildings. The town has an agricultural trade. Pop. 2,397.

FRANC, a modern French silver coin, but the name was given to two ancient coins in France, one of gold and the other of silver. The value of the gold franc was about half a guinea. The silver franc was in value a third of the gold one. The name was given from the device *Francorum Rex,* King of the French, on the coin, when first struck by King John II in 1360. These coins, called *francs à cheval,* disappeared during the latter half of the fifteenth century. The silver franc, or *franc d'argent,* was worth twenty *sous,* and equivalent to the *livre tournois,* and hence the use without distinction of the terms *livre* and *francs.*

The modern French franc is a silver coin and money of account which since 1795 has formed the unit of the French monetary system, and has also been adopted as the unit of currency by Switzerland and Belgium. It is of the value of a little over 9½*d.* English, and is divided into 100 centimes. In 1920 and 1921, in consequence of the fluctuations of the rate of exchange, the value of the franc was about 4*d.* English, and in 1928 it was stabilized at 124 21 to the £, or rather less than 2*d.* in English money.

In Belgium the franc has been stabilized at 175 to the £ sterling; in Switzerland it retains its original value.

FRANCAVILLA, several places in Southern Italy. The most important is in the province of Lecce, 14 miles W.S.W. of Brindisi. Pop. 17,759 (town); 20,510 (commune).

FRANCE (anciently **GALLIA**), a maritime country in the west of Europe, forming one of its most extensive, most populous, and most influential states. It is situated between lat. 42° 20′ and 51° 5′ N.; and long. 4° 42′ W. and 7° 39′ E., and is bounded north by the Straits of Dover and the English Channel: west by the Atlantic (Bay of Biscay); south by Spain and the Mediterranean Sea; east and north-east by Italy, Switzerland, Germany, and Belgium. Its greatest length from north to south is 600 m.l., and its greatest breadth 560 miles. The coast-line on the whole is considerably diversified by bays, estuaries, and indentations of various kinds, and presents numerous good harbours and roadsteads. It is studded by a number of islands, especially in the north-west and west, the largest being Oleron, Ré, and Belle Isle. The total area (including Alsace-Lorraine) is 212,659 sq. miles. The capital is Paris (Pop. 2,891,020); other towns and their populations (1931) are: Marseilles (800,881), Lyons (579,763) Bordeaux (262,990), Nice (219,549), Lille (201,568), Toulouse (194,564), St. Étienne (191,088), Nantes (187,343), Strasbourg (181,465), Le Hâvre (165,076), Toulon (133,263), and Rouen (122,957).

Mountains. The interior is traversed from south-west to north-east by successive chains of mountains, commencing with the Pyrennees and including the Cevennes, the Côte d'Or, the Vosges, and others, forming the watershed, on one side of which the rivers flow west and north into the Atlantic and the English Channel, on the other side east and south into the Mediterranean. At its north-eastern extremity this system is met by the Alps and the Jura.

A considerable portion of the Western Alps belongs to South-Eastern France. Mt. Blanc itself (15,781 feet) is mostly within the French boundary-line. Some lofty Pyrenean peaks are also within

French territory, the highest being Vignemale (10,792 feet). Near the centre of France, and separate from the great watershed of the country, are several groups of volcanic mountains known by the general name of the Mountains of Auvergne, the chief peaks of which are the Plomb du Cantal (5,983 feet), the Puy de Sancy (6,188 feet), and the Puy de Dôme.

Rivers. The spurs thrown off by the great watershed divide France into seven principal river basins, six of which are on the north-western slope and one on the south-eastern. These are: (1) The basin of the Garonne and its affluents (the Ariége, Tarn, Lot, and Dordogne on the right, and the Gers on the left), with the two secondary basins of the Charente on the north, and the Adour on the south.



France—the River Loire

(2) The basin of the Loire and its tributaries (Nièvre and Maine on the right, the Allier, Loiret, Cher, Indre, Vienne, and Sèvre Nantaise on the left). (3) The basin of the Seine and its tributaries (the Aube, Marne, and Oise on the right, the Yonne and Eure on the left). To the north is the secondary basin of the Somme. (4) The basin of the Meuse with its affluent the Sambre. (5) The basin of the Escaut or Scheldt with its affluent the Scarpe. Only the southern portion of these two basins is included within the political boundaries of France. (6) The basin which pours a number of tributaries, the principal of which is the Moselle, into the Rhine. Only a comparatively small portion of this basin also is included within the political boundaries of France. (7) The basin of the Rhône, occupying the whole of the territory which lies to the south-east of the great watershed, the tributaries being the Ain, the Saône, Ardèche, and Gard on the right, and the Isère, Drôme, and Durance on the left. The secondary basins are those of the Var and the Aude.

The four great rivers of France are the Loire, Seine, Rhône, and Garonne. France has in all more than 200 navigable streams, with a total navigation of 6,160 miles. Lakes are few, and individually very limited in extent.

Geology. Among geological formations granite holds a chief place as forming the nucleus of the mountains generally, and being the prevailing rock in the Alps, the Pyrenees, the Cevennes, and in the north-west peninsular portion of the country (Brittany). The other crystalline rocks, consisting chiefly of trachytes and basalts, have received a magnificent development in Auvergne, where whole mountains are composed of them, and where the effects of remote volcanic agency are still visible in extinct craters and lava streams.

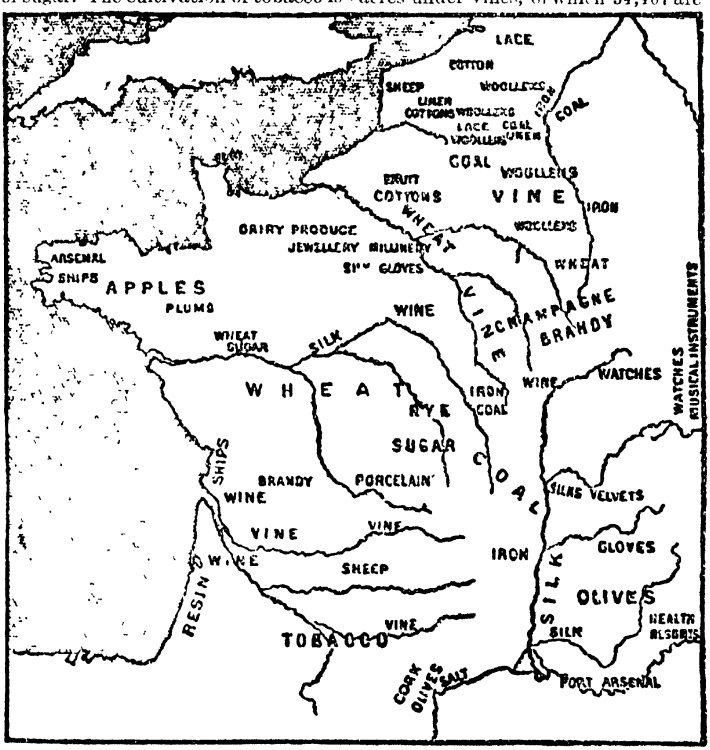
In the Jura limestone occurs in such enormous masses as to have given its name to a peculiar formation (the Jurassic). The granite is overlaid by gneiss, micaceous and argillaceous slates, succeeded, particularly in the Pyrenees, by mountain limestone. The secondary formation, commencing with this limestone, is largely developed in many parts, and furnishes a considerable number of coal- and mineral-fields. The tertiary formation covers a vast extent of surface, particularly in the south-west and around Paris.

Climate. Lying almost wholly within the more moderate portion of the temperate zone, between the isothermal lines of 50° and 60°, France has a climate not inferior to that of any country in Europe. In the south, and particularly the south-east, which is the warmest, the olive is successfully cultivated. Farther north to a limit determined by a line drawn diagonally in an east-north-east direction from the department of Gironde to that of the Vosges, the cultivation of maize or Indian corn extends. More northward still, a line drawn from the mouth of the Loire to Mezières in the Ardennes department marks the extreme limit of the profitable culture of the vine. Beyond this line is the fourth and coldest region. All these regions, notwithstanding their diversities of temperature, are generally healthy, and have an atmosphere remarkable for salubrity, serenity, and brightness.

Agriculture, &c. About nine-tenths

of the soil of France is productive, and about one-half of the whole is under the plough. The cereals forming the great bulk of the cultivated crops are wheat, oats, rye, and barley. The crops next in importance to these are meslin or mixed corn, potatoes, hemp, rape, maize, buckwheat, flax, and beet. Beet is cultivated extensively in some departments, especially in that of Nord, for the manufacture of sugar. The cultivation of tobacco is extensive demand for horses for the army, considerable pains are taken in the Government studs to improve the breeds.

France has a very large number of vineyards. The cultivation of the vine is one of the most important branches of French agriculture, the total quantity of land in vineyards being, since 1913, about 3 per cent of the whole surface. In 1931 there were 3,827,388 acres under vines, of which 34,107 are



Products of France

monopolized by the Government, and is confined to certain departments, 29 of which were authorized in 1913 to cultivate the plant.

In France the grass is on a much more limited scale than the arable husbandry, and the breeding of cattle is indifferently practised. The rearing of sheep is more successful, much of the wool being scarcely inferior to merino-wool. Excellent horses are bred in the north, and as there is an

in Alsace-Lorraine, and the total wine industry yields a net yearly total of over 2,000 million francs. In everything relating to this branch of culture the French are unsurpassed, the various first-class wines which they produce under the names of Champagne, Burgundy, Bordeaux, &c., being universally known. It is estimated that in good years France produces about one-third of the whole wine production of the world. Since

about 1870 the vineyards have frequently suffered from the devastations of the Phylloxera.

Among the most important fruit-trees cultivated in France are the apple, from the fruit of which much cider is made, especially in Normandy; the chestnut, which in some of the central districts of France is a staple food among the poorer classes; the mulberry tree, cultivated in the south-east both for its fruit and its leaves, the latter furnishing the food of the silk-worms so largely reared there; the olive also in the south-east; the pear, plum, peach, orange, citron, fig, &c. The forests occupy about 18 per cent of the whole territory.

Minerals. Coal-fields are numerous, but only two are really of importance—that of Valenciennes in the north-east, forming the western extremity of the great Belgian coal-field, and that of St. Étienne in the south-east, to which the manufactures of that town, Lyons, and the surrounding districts, are much indebted. Before the European War France ranked fifth among the principal coal-producing nations, the four first being the United States, Great Britain, Germany, and Austria. The war, of course, seriously interfered with the coal-supply, and the second half of 1914 only yielded under 10,000,000 tons. The annual output, which was about 40,000,000 metric tons in 1913, and only 26,322,000 metric tons in 1918, 53,885,000 in 1930, and estimated at 50,023,000 in 1931, falls so far short of the consumption that a large import takes place from England and Belgium, and wood continues to be the common fuel throughout France, at least for domestic purposes.

The coal-fields contain seams of iron, which are extensively worked, and furnish ore to a great number of blast-furnaces; but of the total amount of ore smelted in the country a considerable proportion is imported. Other metals, such as lead, zinc, manganese, copper, &c., are obtained to some extent. Common salt is obtained from mines of rock-salt, from salt-springs, and in still greater quantity from lagoons and salt-marshes on the coast.

Manufactures. The most important of the textile manufactures is that of silk goods. This industry has been centred at Lyons and the surrounding districts since the Italian wars, and especially since the discovery of the Jacquard loom. In 1914 there were 386 silk manufactures in the seven departments of the Lyonnais region. It employs about two millions of persons, and furnishes about 27 per cent in value of the whole of the manufactured products of France. The exports of silks rose from 310,059,000 francs in 1914, to 3,233,000,000 francs in 1927, and in 1932 were 897,800,000 francs. The principal purchaser is Great Britain, the value of French silk manufactured goods exported to the United Kingdom in 1918 amounting to 294 million francs, and in 1931 to £3,509,308. During the European War the French silk industry provided the military authorities with cartridge and aeroplane silk to the value of 5 million francs in 1915, 28 millions in 1916, and 50 millions in 1917.

After silk goods, though at a considerable distance, follow cotton stuffs and woollens, made largely at Rheims, Amiens, and Beauvais; carpets at Abbeville; tapestry at Paris and Beauvais; linens, including fine muslin, gauze, and lace, at St. Quentin, &c.; cutlery, porcelain, stone-ware, and common pottery, beet-root sugar, leather, paper, hats, hosiery, steel, iron, brass, and zinc ware, plate and flint glass, &c., besides many ornamental and artistic articles; jewellery, clocks, surgical instruments, types, engravings, &c., which have their common seat in the capital. The invasion of Nord and the eastern departments of France in 1914 brusquely deprived the country of its most important provinces from the industrial point of view, and its most active from the commercial. The two most vital industries of modern life, the metallurgical and textile industries, were reduced to less than half. Nevertheless, though hampered by lack of labour, raw material, and transport facilities, French industry not only kept alive during the war, but has made rapid progress since its conclusion.

The fisheries of France are important. Amongst the principal is that of sardines on the coast of the Bay of Biscay; that of herring, mackerel, turbot, salmon, &c., in the English Channel and the North Sea; that of tunnies and anchovies on the coasts of the Mediterranean. Oyster-breeding is largely engaged in, the most extensive oyster-beds being those of the basin of Arcachon in the department of the Gironde. Cod-fishing is carried on actively near the Newfoundland banks by French fishermen and also near Iceland.

Commerce. The principal towns from which the internal commerce emanates are Paris, Lyons, Rouen, Lille, St. Étienne, Toulouse, Nîmes, Nancy, Perpignan, &c. Before the outbreak of the European War French commerce, which had been rather behindhand at the close of the nineteenth century, had made rapid progress and was only inferior to that of

the United States, Great Britain, and Germany.

Generally speaking, France imported more than she exported. In 1913 the total foreign commerce of France amounted to 15,301 million francs. In 1932 she imported goods to the value of 42,199,302,000 francs, and exported goods to the value of 30,421,327,000 francs. The foreign commerce is chiefly with Britain, Belgium, Germany, and Italy. Britain is far ahead of the others, its imports from France being £40,922,000 in 1931; exports to France, £22,552,000; in 1932 they were £19,023,000 and £18,460,000 respectively, the former are chiefly silks, woollens, cottons, butter, wine and brandy, sugar; the latter chiefly wool and woollens, cottons and cotton yarn coal, machinery, and metals.

The shipping of France is much below what might be expected from the development of its foreign commerce. During the year 1932 the number of French and foreign vessels entering her ports was 8,045 and 19,430 respectively; and the tonnage amounted to 13,245,531 tons and 39,396,106 tons respectively. The chief seaports are Marseilles, Le Hâvre, Bordeaux, Rouen, Nantes (including St. Nazaire), Dunkirk, Calais, Boulogne, and Dieppe.

Canals, Railways, &c. The canals are numerous. The Canal du Midi, or, as it is sometimes called, the Canal of Languedoc, starting from a point in the Garonne a little below Toulouse, is continued in an east-south-east direction into the lagoon of Thau, and thereby gives a continuous navigable communication between the Atlantic and the Mediterranean, in the line of the important towns of Bordeaux, Agen, Toulouse, Carcassonne, and Narbonne. In like manner three separate canals cut across the basin of the Rhône; the Canal du Centre, or of Charollais, connecting the Saône and the Loire; the Rhône and Rhine Canal, so called from uniting these two rivers, partly by the intervention of the Doubs; and the Canal of Bourgogne, connecting the Saône, Yonne, and Seine. In all, France possesses about 3,291 miles of canals in addition to about 4,222 miles of navigable rivers, but a programme has been adopted for the improvement and extension of the canal system.

The railways in France partly belong to the State, and partly have been granted to private companies for a limited period, at the end of which they become State property. There were altogether 25,964 miles of railway in operation in 1931; 1,043 miles were electrified. The total length of telegraph lines in 1930 was 223,121 miles.

Education and Religion. In France the superintendence of education in all its branches is expressly committed to a high functionary, who takes the name of Minister of Public Instruction and Fine Arts and is assisted by an educational council. For a good part of the eighteenth century France had only one university, the University of France, embracing a series of 'faculties' (*facultés*), which were a sort of university colleges, each specially devoted to literature, law, medicine, theology, &c.

After 1896 a number of local universities were formed from these institutions, and university education is now in a flourishing state. Paris has again a university of her own, besides the Collège de France, École Polytechnique, École Normale Supérieure, École des Langues Orientales, &c. There are sixteen other universities in the following towns: Aix-Marseille, Besançon, Bordeaux, Caen, Clermont-Ferrand, Dijon, Grenoble, Lille, Lyons, Montpellier, Nancy, Poitiers, Rennes, Toulouse, Algiers, and Strasbourg.

Secondary instruction, either classical or commercial and industrial, is given by the State in the lyceums, by the communes in the communal colleges, or in certain other seminaries. There are about 104 lyceums, generally situated in the capitals of the departments, and about 211 colleges. Primary instruction is given in the communal schools, being compulsory and free.

Religion, in like manner, was long under the cognizance of the State, falling within the province of the Minister of Justice and Religion. The State declared Roman Catholicism to be the religion of the majority, but did not establish it; on the contrary, it placed all forms of religion with more than 100,000 adherents on an equal footing, and dealt impartially with all by paying salaries to their ministers. In 1905 this arrangement came to an end, however, by the separation of Church and State. In the Roman Catholic Church are 17 archbishops and 68 bishops, not including those of Alsace-Lorraine.

Army and Navy. Military service is obligatory upon every Frenchman who is over twenty years of age, and not pronounced unfit for military service. They have to serve first in the regular army (*armée active*), then in the reserve of the regular army for eleven years, next in the territorial army for six years, and finally in the reserve of the territorial army for six years. Before 1913 the term spent with the active army was two years, but in view of Germany's military preparations it was raised to three. In 1920 the term to be spent with the active army was reduced to eighteen

months. France now has an army of 420,000 men, on a peace footing, which can be raised to a war footing of 1,300,000 men. In 1918 the French army had risen to 5,000,000 men and 128,000 officers. During the European War France had altogether mobilized 7,935,000 white troops, besides 475,000 native troops.

The French navy is manned partly by conscription and partly by voluntary enrolment. The effective war navy of France is of considerable strength. There is a reserve of 114,000 men, of whom about 25,500 are serving with the fleet.

Finance. Before the outbreak of the European War France was a large creditor of many foreign countries, and held some 40,000 million francs worth of foreign securities. During the war she was compelled to import merchandise of all sorts, with practically no export trade to balance matters. The result was that French stocks of foreign shares fell enormously, and France became the debtor to other lands, especially the United States and Great Britain. Before the European War her national debt amounted to £1,367,000,000; in 1920 it was £9,538,000,000. Her revenue estimate for 1932 was 41,100,883,494 francs, and for 1933 43,880,000,000 francs. Her revenue in 1913 was about £189,555,297, the expenditure somewhat less. Revenue is raised by indirect and direct taxes, income tax, State monopolies, &c.

Constitution. France has been a republic since the overthrow of the Second Empire by a Paris mob on the 4th of Sept., 1870. The details of the Constitution were fixed by a law passed by a National Assembly which met in 1871. The constitutional law, confirming the republican Government, was passed in 1875, and modified in 1879, 1884, 1885, and 1889. This law places the legislative authority in the hands of an Assembly composed of two chambers, the Chamber of Deputies and the Senate.

The Chamber of Deputies is elected by universal suffrage, each arrondissement forming an electoral district. Proportional representation was adopted in 1919. The total number of Deputies is now 610. The Deputies are elected for four years. The Senate consists of 314 members (22 for Alsace-Lorraine), of whom 75 were originally elected for life; but in 1884 it was enacted that vacancies among the life senatorships should be filled up as they arose by the election of ordinary nine-year Senators. Both Senators and Deputies are paid 15,000 francs per annum, and travel free on all railways by means of a small annual payment.

The head of the State is a President, elected for seven years by a majority of votes of the members of the two chambers sitting as one. The President is assisted by a body of ministers appointed by him. He has the appointment to all civil and military posts.

Weights, Measures, and Money. The unit of the French monetary system is the franc (the value of which at par is about 9½d.), which is divided decimally. The system of weights and measures is also decimal, the units with their English equivalents being as follows: the mètre = 39·37 inches or 3·28 feet; the kilomètre, or 1,000 mètres = 1093·6 yards or ·621 of a mile; the are, the square of 10 mètres = 1076·411 sq. feet; the hectare, or 100 ares = 2·47 acres; the square kilomètre = ·386 of a sq. mile; the stère or cubic mètre = 35·317 cubic feet; the litre = 1·76 pints; the hectolitre, or 100 litres = 22·0097 gallons; the gramme = 15·4323 grains; the kilogramme or 1,000 grammes = 2·205 lb.

Political Divisions and Extent of Empire. Before the Revolution of 1789 France was divided into general governments or provinces, the number of which varied at different epochs. Under Francis I, by whom they were instituted, there were nine, namely, Normandie, Guyenne, Languedoc, Provence, Dauphiné, Bourgogne, Champagne-et-Brie, Picardie, Ile de France. Under Henry III there were twelve, formed by the addition of Bretagne, Orléanais, and Lyonnais. Under Louis XIV the number was fixed at thirty-two, to which a thirty-third was added by the acquisition of Corsica under Louis XV. At the Revolution the whole of France, including Corsica, was parcelled out into departments, and each department subdivided successively into arrondissements, cantons, and communes. This division, carried out in 1790, has since maintained its ground.

The number of departments was originally eighty-three, but it has been at different times increased and decreased. There are now ninety departments, including the three departments of Alsace-Lorraine transferred to France by the Peace Treaty of 28th June, 1919. These three departments are; Bas-Rhin Alsace, Haut-Rhin, and Moselle. The average area of each is about 2,300 sq. miles (more than one-third that of Wales). The total area added to France as a result of the European War was 5,605 sq. miles.

In addition to the territory it occupies in Europe, France possesses (either absolutely or as protectorates) Algeria, Tunis, Senegambia, Ivory Coast, Dahomey, &c., parts of the Sahara, Sudan, and of the Congo region, Réunion, Madagascar, and

other East African islands; Cochin-China, Tongking, Annam, and other possessions in Asia; French Guiana, in South America, with the Islands of Guadeloupe, Martinique, &c. New Caledonia, Tahiti, &c., in the Pacific. The total area of France and her dominions is therefore as follows; France (including Alsace-Lorraine) 212,659 sq. miles; pop. (1931), 41,834,923; colonies and dependencies, 4,265,188 sq. miles; pop. 63,374,000.

History. France or Gaul, at the earliest period of which anything is known with regard to it, was inhabited by a number of independent tribes, who appear to have been mainly Celtic in race. In the latter half of the second century B.C. the Romans conquered a portion of the south-east, and under Julius Cæsar the conquest of all Gaul was completed between 53 and 51 B.C. (*See* GAUL.) Subsequently the country became completely Romanized in language, civilization, and religion, and many flourishing towns sprang up.

In the decline of the Roman Empire German tribes began to make settlements in Gaul, and it was from a body of these, known as *Franks*, that the name France arose. Towards the end of the fifth century Clovis, chief of the Salian Franks, made himself master not only of almost all France (or Gaul), but also of a considerable territory east of the Rhine. The dynasty which he founded was called the Merovingian from his grandfather Merovæus. Clovis died in 511, leaving his kingdom to be divided amongst his four sons, as subsequent rulers often did. The Frankish dominions were thus differently divided at different times; but two divisions, a western and an eastern, or Neustria and Austrasia, became the most important.

A large part of the history of the Franks under the Merovingian kings is the history of the contests between these two states. Afterwards Pippin or Pépin d'Héristal, mayor of the palace of the Austrasian king, conquered Neustria and made his sway supreme throughout the kingdom of the Franks. This date may be regarded as that of the real termination of the Merovingian line, for although kings belonging to this family continued to be crowned till 752, they were mere puppets, *rois fainéants* as they are generally called; the real power was in the hands of the mayors of the palace. Pépin died in 714.

He was succeeded, after a brief period of anarchy, by his son Charles Martel, or Charles the Hammer—a title he earned by the courage and strength he displayed in battle. During his tenure of power all Europe was threatened by the Saracens, who, after occupying Spain, had penetrated into France, and were met by Charles Martel on a plain between Tours and Poitiers, and totally defeated (732). Charles Martel died in 741, leaving Austrasia and the countries beyond the Rhine to his son Carloman, and Neustria and Burgundy to his son Pépin the Short.

On his brother's death Pépin seized his heritage, and in 752, thinking it time to have done with the system of *rois fainéants*, had himself crowned King of the Franks. In 768 he died, and was succeeded by his sons Charles, afterwards known as Charlemagne (Charles the Great), and Carloman. The latter dying in 771, Charlemagne then became sole ruler, and conquered and organized an empire which extended from the Atlantic on the west to the Elbe, the Saale, and the Bohemian Mountains on the east, and embraced also three-fourths of Italy, and Spain as far as the Ebro. By Pope Leo III on Christmas Day in the year 800 he was crowned in the name of the Roman people as Emperor of the West. There was as yet, strictly speaking, no kingdom of France, and Charlemagne was a German, and his empire (the *Holy Roman Empire*) a German one.

To Charlemagne succeeded in 814 his youngest son Louis *the Pious*. At the death of the latter the empire, after many disputes, was eventually divided by the Treaty of Verdun in 843 amongst his sons, the portion nearly corresponding to modern France falling to Charles the Bald. From this time the separate history of France properly begins, the history of the French language being also traced to the same period, while the eastern portion of the old Frankish territory remained German. After Charles the Bald, the first of the Carolingian kings, had been succeeded in 877 by Louis II, and Louis II by Louis III (879–882) and Carloman (879–884), Charles the Fat, king of the eastern Frankish territory, became ruler of the western also till 887, when he was deposed.

After a brief usurpation by Eudes, Count of Paris, Charles III, the brother of Louis III, was recognized as king. But his kingship was little more than nominal, France being divided into a number of great fiefs, the possessors of which, though acknowledging the feudal supremacy of Charles, were practically independent. In these circumstances Charles, unable to offer any adequate resistance to the Norman pirates who were devastating the coast and making incursions into French territory, surrendered to them, in 912, the province which took from them the name of Normandy.

Towards the end of his reign Hugh of Paris, as he is generally called, Duke of France, was really the most powerful person in the kingdom, and throughout the reigns of Louis IV, Lothaire, and Louis V, he and his son Hugh Capet held the real power. On the death of Louis V without children in 987 Hugh Capet mounted the throne himself, and thus became the founder of the Capetian dynasty. The great fiefs of Paris and Orleans were thus added to the Crown, and Paris became the centre of the new monarchy.

The first task of the Capetian line was to reconquer the royal prerogatives from the great vassals, but for two centuries they had little success. Hugh Capet died in 996, and his first three successors, Robert (died 1031), Henry I (died 1060), and Philip I (died 1106), effected nothing whatever towards the establishment of the royal authority. Louis VI was more successful, being greatly helped by the fact that the nobility had been much weakened by the Crusades. The growth of the towns also, which ultimately became the allies of the kings, was a powerful check on the nobles.

Louis VI died in 1137, and was succeeded by his son Louis VII, who reigned till 1180. During his reign the stability of the French throne was endangered by the influence acquired in France by Henry II of England, who possessed, either by inheritance or by his marriage with Eleanor of Aquitaine, the whole of the west of France except Brittany. Louis was succeeded by his son Philip Augustus (Philip II), who did much to strengthen the throne, depriving John, King of England, of Normandy, Maine, and Anjou.

His son Louis VIII, who succeeded in 1223, carried on the work by the conquest of Poitou, and a religious war being proclaimed against the Counts of Toulouse, who protected the Albigenses, that House was extinguished, and their domains passed to the royal family. Louis VIII died in 1226, and under the wise rule of Louis IX (St. Louis) the influence of the Crown went on increasing, as it did also under Philip (III) the Bold (died 1285), Philip (IV) the Fair (died 1314), Louis X (died 1316), John I (died 1316, after a reign of five days), Philip V (died 1322), and Charles IV (died 1328), by the acquisition of fresh domains and other means until the outbreak of the wars with England.

The first branch of the Capetian line of kings became extinct on the death of Charles IV, the last of the sons of Philip the Fair, the Salic law excluding the female succession. The crown thus fell to Philip of Valois, a cousin, who became king as Philip VI. His claim was disputed by Edward III of England, and the dispute led to a series of wars which were not terminated for more than 120 years. During this period France was reduced to a state of great misery. While Edward, victorious over Philip VI, and after his death over John (II) the Good, who was taken prisoner at Poitiers in 1356, compelled the surrender to England of some of the finest provinces of France by the Treaty of Brétigny in 1360, the country was plundered by *banditti*, and the *Jacquerie*, a mass of furious peasants (about 1358), satiated their spirit of vengeance with the blood of the nobility. Charles (V) the Wise, who succeeded John the Good in 1364, and his constable, Du Guesclin, were able to restore order only for a short time, although during this reign the English were driven out of most of their possessions in France.

Then came the long and unhappy reign of the imbecile Charles VI (1380–1422), during which Henry V of England, reviving the claim of Edward III to the French crown, invaded France, won the field of Agincourt, and obtained a treaty (Treaty of Troyes) which secured the right of succession to the French crown for himself and his descendants. Charles VI died in 1422, a few weeks after Henry V, whose son, Henry VI, a minor, was acknowledged as king by the greater part of France.

But between 1429 and 1431 the peasant girl *Joan of Arc* animated the French in the cause of the dauphin, who was crowned as Charles VII at Rheims in 1429, and in 1451 the English had lost all their possessions in France, except Calais. The shrewdness and perfidy of Louis XI (1461–83) completed the subjugation of the great barons, and laid the foundation of absolute monarchy. Maine, Anjou, and Provence were left to him by the will of the last count, and a large part of the possessions of the Duke of Burgundy, including Picardy, Artois, the duchy of Burgundy proper, and Franche Comté, all came into his hands not long after the death of Charles the Bold, in 1477. His son and successor, Charles VIII (1483–98), also united Brittany to the Crown by his marriage with Anne, the heiress of the fief, and effected a conquest of Naples, which lasted but a short time.

Charles was the last king of the direct line of Valois, which was succeeded by the collateral branch of Valois-Orleans (1498), in the person of Louis XII, who was descended from Louis of Valois, Duke of Orleans, brother of Charles VI. In order to keep Brittany attached to the Crown he married the widow of his predeces-

sor. On his death the crown reverted to another branch of the House of Valois, that of Angoulême, Francis I (1515–47) being the grandson of John, Count of Angoulême, uncle of Louis XII. Francis I still continuing the attempts at conquest in Italy, was brought into conflict with Charles V of Germany, who also claimed Milan as an imperial fief. The result was five wars between France and Germany, in the first of which Francis had to retreat across the Alps; in the second he was taken prisoner at Pavia; in the third he seized Savoy and Piedmont, which the Peace of Crespy (1544), made at the conclusion of the fourth war, allowed him to keep.

Francis I died in 1547, and his son, Henry II (1547–59), pursuing the same policy, renewed the war for the fifth time with the House of Habsburg. In the Peace of Cateau-Cambrésis (1559), with which it ended, Henry had to surrender Savoy and Piedmont, but remained in possession of the German bishoprics of Metz, Toul, and Verdun. The year before, Calais, the last English possession in France, had been captured by Francis, Duke of Guise.

Francis II, the husband of Mary Queen of Scots, succeeded his father Henry, but reigned little more than a year (1559–60). The foundation of the national debt, the weight of which broke down the throne 250 years later, was laid in this period. Intrigue and corruption gave to women a dangerous influence at court and in public affairs. Under the administration of Charles IX (conducted during his minority by the queen-mother, Catherine de' Medici) France was inundated with the blood of Frenchmen, shed in the religious wars from 1562. (*See* BARTHOLOMEW, MASSACRE OF ST.) These continued throughout the reign of Charles IX and his successor, Henry III (1574–89), and were only terminated when Henry IV, originally King of Navarre, and since the death of Henry III King of France, went over to the Catholic Church (1593), having hitherto been the leader of the Huguenots.

Henry IV was the first French sovereign of the House of Bourbon, which inherited its right to the throne from a son of Louis IX. He united to the Crown of France the kingdom of Navarre, which he had inherited from his mother, Jeanne d'Albert. In his government of France Henry showed all the qualities of a great prince and a great statesman, establishing religious toleration (Edict of Nantes, 1598), and labouring diligently for the welfare of the State. He was cut off prematurely by the dagger of the fanatic Ravaillac (1610). During the minority of Henry's son, Louis XIII, the French policy was at first wavering, until the Prime Minister, Cardinal Richelieu, gave it a steady direction He restored the French influence in Italy and the Netherlands, humbled Austria and Spain, and created that domestic government which rendered the Government completely absolute.

Louis XIII died in 1643, the year after his great minister, and was succeeded by Louis XIV, 'le Grand Monarque.' The policy of Richelieu was carried on by Mazarin during the regency of Anne of Austria, while Louis was still a minor, and also for some years after Louis was declared of



Louis XIV.—From a print.

age. During his ministry France obtained by the Peace of Westphalia (1648) the German province of Alsace, and by the Peace of the Pyrenees (1659) parts of Flanders, Hainault, Luxembourg, &c.

After the death of Mazarin, in 1661, Louis XIV took the government into his own hands, and ruled with an absolute sway. The period which immediately followed was the most brilliant in French history. His ministers, especially Colbert, and his generals, Turenne, Condé, Luxembourg, and the military engineer Vauban, were alike the greatest of their time; the writers of the period were also among the greatest in French literature. An unsuccessful attempt was made on the Spanish Netherlands; a war was undertaken against Holland, Spain, and Germany, which ended in France receiving Franche Comté and other places from Spain, and Freiburg from Germany. In 1681 Strasbourg was

seized from the empire in a time of peace.

The last war of Louis was the War of the Spanish Succession (1701–14), which resulted unfortunately for France. During this reign great injury was done to French industry by the revocation of the Edict of Nantes in 1685. Louis XIV died in 1715, leaving the finances in disorder, and a national debt amounting to no less than 4,500,000,000 livres.

Louis XV, the great-grandson of Louis XIV, succeeded at the age of five years. During his minority the regent, the Duke of Orleans, squandered the revenues in the most reckless manner, and matters went from bad to worse. In 1723 Louis was declared of age, but he sank under the pernicious influences of mistresses like Pompadour and Du Barry into extravagance and licence, entering into useless and costly wars (War of Austrian Succession, 1740–8; Seven Years' War, 1756–63), and contracting enormous debts. During this reign two important acquisitions were made by France, namely, Lorraine and Corsica.

With the reign of Louis XVI began the period of expiation for the misdeeds of the French monarchy and aristocracy, which had culminated in the preceding reign. The king himself was amiable, but the whole administration was rotten, and the court, the nobility, and the clergy formed only one privileged class united to oppress the people. The good intentions of Louis were neutralized by a total lack of energy and firmness. The first difficulty of his Government, and the rock on which it split, was the hopeless condition of the public finances, with which Turgot, Necker, Calonne, Brienne, and again Necker tried in vain successively to grapple. Finding all ordinary measures unavailing, Necker demanded the convocation of the States General, which had not met since 1614.

They met on 5th May, 1789, but as the nobles and clergy refused to give the Third Estate its due weight in the conduct of business, the Deputies of this body assumed the title of the National Constituent Assembly, and resolved not to separate till they had given a Constitution to France. The clergy and nobles then yielded, and the fusion of the three orders was effected on 27th June. Foreign troops, however, were brought to Paris to overawe the Assembly. The people now demanded arms, which the municipality of Paris supplied; and on 14th July the Bastille was captured and destroyed. Lafayette was made commander of the newly established National Guard.

On the 4th Aug., a decisive step was taken by the abolition of all feudal rights and privileges. On 5th Oct., Versailles was attacked by the mob, and the royal family, virtually prisoners, were taken to Paris by Lafayette. The king tried to obtain the aid of some of the foreign powers against his subjects, and made his escape from Paris (20th June, 1791); but he was recognized, arrested at Varennes, and brought back to Paris.

On 30th Sept., 1791, the Assembly brought its work to a finish by producing a new Constitution, which was sworn to by the king on 14th Sept., and he was then reinstated in his functions. This Constitution deprived the king of arbitrary powers, provided liberty of worship and freedom of the press, of commerce, of industry; abolished the laws of primogeniture and entail as well as titles; all France was redivided into eighty-three departments, nearly equal in extent.

The Constituent Assembly was, according to the Constitution, immediately followed by the Legislative Assembly, which met on 1st Oct., 1791, and in which there were two parties of political importance, the Girondists, moderate republicans, so named because their leaders came from the department of the Gironde, who led it, and the Montagnards, extreme radicals, known collectively as the Mountain, because their seats were the highest on the left side of the hall, who subsequently became all-powerful in the Convention. The constitutionalists and monarchists were already powerless.

The declaration of Pilnitz by the Emperor of Germany and the King of Prussia, threatening an armed intervention on behalf of the king, compelled the Assembly to take a decisive course, and on 20th April, 1792, war was declared against Austria and Prussia. Reverses to the French troops caused a popular rising, and the Tuileries, after a sanguinary combat, were taken and sacked. The king took refuge with his family in the Assembly, which was invaded and compelled to submit to the dictation of the victors by assenting to the suspension of the king and the convocation of a National Convention in place of the Assembly.

The first act of the Convention was to proclaim a republic. On 3rd Dec., the king was cited to appear before it. On 20th Jan., 1793, he was sentenced to death within twenty-four hours, and on the 21st the sentence was executed. This violent inauguration of the republic shocked public opinion throughout Europe, and armed the neutral states against France. England, Holland, and Spain joined the coalition. The extremists in France only grew more violent, a Committee

of Public Safety, with sovereign authority, was appointed 6th April, and the Reign of Terror began. The struggle between the Girondists and the Montagnards or Jacobins terminated in favour of the latter.

A new Constitution was adopted by the Convention on 23rd June, called the Constitution of the Year I, the Republican Calendar being adopted on 5th Oct., 1793, the year 1 beginning on the 22nd of Sept., 1792. Christianity was formally abolished. Risings against the Government were put down with frightful bloodshed. Both in Paris and the provinces executions and massacres of persons alleged to be disaffected to the party in power followed each other daily. The queen was executed on 16th Oct., 1793, the Girondists on 31st Oct., and others followed, Robespierre being foremost in the bloody work. At length the Reign of Terror came to an end by the execution of Robespierre and his associates on 27th and 28th July, 1794. Danton and Hébert, his old allies, he had already brought to the scaffold. Marat, another man of blood, had perished by assassination.

The campaigns of 1793 and 1794 resulted favourably to the French arms, which were carried beyond the French frontier, Belgium and Holland being occupied, Spain being invaded, and the Allies being driven across the Rhine. These successes induced Prussia and Spain to sign the Treaties of Basel (1795), recognizing the French Republic. In 1795 the Convention gave the republic a new Constitution, a chamber of *Five Hundred* to propose the laws, a chamber of *Ancients* to approve them, and an executive of five members, one elected annually, called the *Directory*. The Convention was dissolved on 26th Oct.

Napoleon Bonaparte now began to be the most prominent figure in French affairs; and after his brilliant successes against the Austrians both north and south of the Alps, and his empty conquest of Egypt, it was not difficult for him to overthrow the government of the *Directory*. This was accomplished in the revolution of 18th and 19th Brumaire (9th–10th Nov., 1799), the Directory being succeeded by the Consulate, Bonaparte himself being appointed *First Consul* for ten years. The other two Consuls, Cambacérès and Lebrun, were to have consultative voices only.

The new Constitution (Constitution of the year VIII, originally devised by Siéyès) was proclaimed on 15th Dec. Under the appearance of a republic it really established a military monarchy. The history of France for the next sixteen years is virtually the history of Napoleon (q.v.). In 1802 the Constitution was amended, Napoleon being made Consul for life, with the right of appointing his successor. In 1804 he was proclaimed Emperor, this being confirmed by a popular vote of 3,572,329 against 2,569. The emperor was consecrated at Paris by Pius VII, and in 1805 he was also crowned King of Italy.

For years the continental powers, whether singly or in coalitions, were unable to stand against him, though at sea France was powerless after the great victory by Nelson over the French and Spanish fleets at Trafalgar (1805). The Austrians and Russians were decisively defeated at the great battle of Austerlitz (1805); the King of Naples was dethroned, and Napoleon's brother Joseph put in his place; another brother, Louis, was made King of Holland; while for a third, Jerome, the Kingdom of Westphalia was erected (1807). Prussia was conquered, and compelled to accede to humiliating terms.

Napoleon was at the height of his power in 1810 and 1811, his empire then extending from Denmark to Naples, with capitals at Paris, Rome, and Amsterdam. By this time, however, the Peninsular War (q.v.) had broken out, which was one immediate cause of his downfall, the disastrous Russian campaign of 1812 being another. The latter cost the French the loss of at least 360,000 men.

A new coalition was now formed against Napoleon, and in 1813 he was disastrously defeated by the Allies at the great battle of Leipzig. By this time the Peninsular War was drawing to a close, and Southern France was actually invaded by Wellington. The Allies entered Paris on 31st March, 1814. Napoleon abdicated, and received the Island of Elba as a sovereign principality. Louis XVIII was proclaimed King of France, and concluded the Peace of Paris (30th May, 1814).

A congress of the Great Powers had assembled at Vienna to adjust European affairs, when it was announced that Napoleon had left Elba, returned to Paris 20th March, 1815, and been reinstated without resistance in his former authority. The allied sovereigns proclaimed him an outlaw, and renewed their alliance against him. Napoleon, anticipating the attack, crossed the Sambre with 130,000 men, defeated Blücher in the battle of Ligny, and marched against the British, who had taken position at Waterloo. Here on the 18th was fought the decisive battle which resulted in his final overthrow. On the 7th July the Allies entered Paris for the second time. Napoleon surrendered to the British, and was sent to St. Helena as a prisoner.

Louis XVIII at first governed with the support of a moderate Liberal party, but the reactionary spirit of the aristocrats and returned émigrés soon got the upper hand; the country, however, was prosperous. Louis having died 16th Sept., 1824, his brother, Charles X, succeeded.

On 26th July, 1830, the Polignac ministry, strongly reactionary in its tendencies, published ordinances suppressing the liberty of the Press and creating a new system of elections. The result was an insurrection during the three days 27th–29th July, by which Charles X was overthrown and Louis Philippe of Orleans proclaimed king 9th Aug., 1830. During the last days of Charles X's reign a French expedition had captured the city of Algiers and laid the foundation of the French colony there. During the eighteen years of Louis Philippe's reign the chief events were the taking of the Citadel of Antwerp, the temporary occupation of Ancona, both in 1832, and in 1835 the completion of the conquest of Algeria. But afterwards, under the ministry of Guizot, a policy of resistance to all constitutional changes was adopted, and a strong opposition having been formed, on 24th Feb., 1848, another revolution drove Louis Philippe into exile.

A republic was proclaimed, and on the 10th Dec., 1848, Louis Napoleon, nephew of the great Napoleon, was elected President for four years. The President, having gained the favour of the army, dissolved the Legislative Assembly on 2nd Dec., 1851, put down all resistance in blood, and by this *coup d'état* established himself as President for the further term of ten years. A plebiscite of 7,839,216 votes confirmed the appointment.

On 2nd Dec., 1852, the President was declared emperor under the title of Napoleon III (a son of the great Napoleon being counted as Napoleon II); and a plebiscite of 7,824,129 votes was again got to confirm the appointment. The Crimean War (1854–6) and the war against Austria on behalf of Italy (1859) distinguished the early part of his reign. The latter greatly aided in the foundation of a United Italy, and gave France the territories of Savoie and Nice (1860).

In 1870 the uneasiness of Napoleon and the French at the steady aggrandizement of Prussia broke out into flame at the offer of the Spanish crown to a prince of the House of Hohenzollern. France, not satisfied with the renunciation of the German prince, demanded a guarantee from the King of Prussia that the candidature should never be resumed. This being refused, France declared war. (*See* FRANCO-GERMAN WAR.) One French army was driven back by the Germans and cooped up in Metz, another was pushed northwards to Sedan, and so hemmed in that it had to surrender with the emperor at its head. On the news of this disaster reaching Paris the Republic was proclaimed. After an almost uninterrupted series of victories the Germans became masters of the French capital (28th Jan., 1871), and the war ended in France giving up to Germany Alsace and a part of Lorraine, and paying a war indemnity of five milliards of francs (£200,000,000).

Meanwhile civil war had broken out in Paris, which was suppressed with great difficulty. (*See* COMMUNE OF PARIS.) The Assembly elected in 1871 for the ratification of peace with Germany found it expedient to continue their functions, Thiers being the head of the administration. In 1873 the Thiers administration was overthrown and replaced by one under Marshal MacMahon. In 1875 a republican Constitution was drawn up. In 1879 MacMahon resigned his presidentship before its legal expiry, being succeeded by Jules Grevy, who was followed by Carnot (assassinated), Casimir-Perier, Faure, Loubet, Falliéres, Poincare, Deschanel, and Millerand. In 1881 France occupied Tunis as a protectorate; in 1883–4 she extended her influence over Tonquin and Annam; in 1895 she reduced Madagascar to submission.

Since the establishment of the republic the reactionary and royalist parties have never disarmed, but all their endeavours to overthrow the republic have failed. One of the principal crises which threatened France in modern times was that of Boulangism. General Boulanger had become so popular that for a moment it was thought he would form a new Government. The parliamentary republic, however, triumphed. This happened in 1889, and ten years later the Dreyfus Affair once more divided France into two camps. Dreyfus, however, was at last proved to be innocent, and the reactionary party was weakened. Many reforms, social and religious, were the result of the activity of the Republican Government, one of the chief being the separation of Church and State in 1905.

Abroad France steadily pursued her policy of colonial expansion. In 1891 France concluded an alliance with Russia, which was strengthened between 1899 and 1906 when Delcassé was Minister for Foreign Affairs. Cordial relations were also established with Italy, thus weakening the Triple Alliance. In 1904 an Anglo-French agreement was concluded, and France obtained territorial concessions in West Africa, and the right to main-

tain order in Morocco. The Algeciras Conference of 1906 decided that France should be given certain customs rights on the Algerian frontier. Germany protested in 1908 and in 1911 against the extension of the French sphere of influence, and the Kaiser sent a warship to Agadir to protect German interests. France, however, emerged triumphant, and in 1912 she secured a practical protectorate over Morocco.

In 1913 Raymond Poincaré was elected President of the Republic, and a firm foreign policy was inaugurated. The three years' service Bill was passed, but France did not seek war, and showed no enthusiasm for it. When the European War at last broke out it found France unprepared. (*See* EUROPEAN WAR.) There were moments when the country seemed to be on the verge of ruin, and more than once it seemed as if France would once more be vanquished by a ruthless foe. The situation, however, was saved by Clemenceau, who became Premier in Nov., 1917, and by Marshal Foch.

As a result of the European War France retrieved her lost provinces, Alsace and Lorraine, and when the new French Chamber met on 8th Dec., 1919, the Deputies from Alsace-Lorraine took their seats in the French Parliament for the first time since the Franco-Prussian War. In 1921 diplomatic relations between France and the Vatican were again resumed. The year 1925 saw the completion of the military evacuation of the Ruhr, which the French had occupied since 1923, when the Germans failed to pay the money agreed upon as reparations. In the same year the Locarno treaties were concluded by which the existing frontiers of France were guaranteed. In 1928, during the premiership of M. Poincaré, the Kellogg Pact, a multilateral treaty for the outlawry of war as an instrument of national policy, was concluded.

In May 1932 M Doumer, who had been President of the Republic for a year, having defeated M. Briand in 1931, was shot by a foreigner and died a few hours later. He was succeeded by M. Le Brun.

As a member of the League of Nations France has taken a leading part in various European Conferences, including the one in London in July 1931 and that at Lausanne in July 1932.—BIBLIOGRAPHY: V. Duruy, *Histoire de France*; F. P. G. Guizot, *Histoire de France*; Lavisse and Rambaud, *Histoire générale*; G. Hanotaux, *Histoire de la France contemporaine*; J. H. MacCarthy, *The French Revolution*; R. Parisot, *Histoire de Lorraine*; C. Seignobos, *Histoire politique de l'Europe contemporaine*; R. Poincaré, *How France is Governed*; A. Hassall, *The French People*; C. Dawbarn, *France and the French*; L. Jerrold, *France Today*; M. Betham Edwards, *Twentieth Century France*; F. Funck-Brentano (editor), *The National History of France*; C. Headlam, *France* (The Making of the Nations Series); Fustel de Coulanges, *Histoire des institutions politiques de l'ancienne France*; A. L. Guérard, *French Civilization in the Nineteenth Century*; E. A. Vizetelly, *Republican France: her Presidents, Statesmen, and Policy*. *See also* A. S. Rappoport (editor), *French Year-Book* for 1919.

French Language. At the time of the conquest of Gaul by Julius Cæsar, the principal dialects spoken by the inhabitants were Celtic. After the conquest of Gaul by the Romans all these dialects were gradually supplanted by Latin except in Brittany, where a Celtic dialect still holds its ground. The popular Latin of Gaul, of course, exhibited considerable differences from the written and classic Latin, and by the seventh or eighth century the literary and the popular languages had come to be quite clearly distinguished as the *Latina* and the *Romana* respectively.

Besides the Celtic words, not very numerous, which were imported into the new speech, it was considerably modified by Celtic habits of speech, new sounds being introduced. It was still further modified by the influences introduced with the Teutonic invasions. The half-barbarous conquerors, incapable of mastering the intricacy of Latin inflections, mostly neglected them, using only the simpler forms. They enlarged the vocabulary also by a number of words, mostly terms of war, hunting, &c.

After the Franks in Gaul had abandoned their native language and adopted this new Romanic or Romance tongue, it became known as the *Francisca*, later *Francois*, from which the modern term *French* is derived. The oldest known monument of the new dialect is the oath of Louis the German, taken at Strasbourg in 842. In the ninth and tenth centuries two main branches or groups of dialects came to be recognized, the *Langue d'Oc*, spoken in the districts south of the Loire, and the *Langue d'Oil*, spoken in a variety of dialects in the provinces of the north and the east. The former may be said to have reached its height in the Provençal poetry and dialect, known especially in connection with the Troubadours. In the thirteenth century the political superiority of the north threw the Langue d'Oc into the shade, and a dialect of the Langue d'Oil spoken in

the central province of Île de France, where the capital, Paris, was, came to be regarded as the classical language of the country, all other dialects sinking into the condition of *patois*.

At the beginning of the sixteenth century Francis I prohibited the use of Latin at court and in the public tribunals, and formally recognized the French as the national language. As one of the Romance languages it is a sister tongue of Italian, Spanish, and Portuguese.—BIBLIOGRAPHY: A. Brachet, *Historical Grammar of the French Tongue*; L. Petit de Julleville, *Histoire de la langue et de la littérature fran aise*; Brunot, *Histoire de la langue française des origines*; Remy de Gourmont, *L'Esthétique de la langue fran aise*; Nicholson, *Practical Introduction to French Phonetics*.

Literature. French literature proper begins in the eleventh century with the epic of narrative poems known as *chansons de geste*, and produced by the class of poets known as *Trouvères*. These poems belong to Northern France and are very numerous. They are usually divided into three heads: poems relating to French history, in particular to the deeds of Charlemagne, his descendants and vassals; poems relating to Alexander the Great and to ancient history; and poems of the Arthurian cycle, or relating to King Arthur. They are generally written in verses of ten or twelve syllables, and are of a length varying from 1,000 to 20,000 lines.

One of the oldest and best examples of the first class is the *Chanson de Roland* (Song of Roland). Of the Arthurian cycle, the *Roman de Rou* and *Roman de Brut*; and of the Alexandrine cycle, the *Alexandre* by Lambert li Cors, and *La Guerre de Troie* (War of Troy) by Benoît de St. More, are examples. Out of the *chansons de geste* grew the *romans d'aventures*, fictitious poems which are not connected with any of the well-defined topics of the *chansons de geste*. Distinct from these are the fabliaux, metrical tales of a witty, sarcastic kind, belonging mostly to the twelfth or thirteenth centuries. Allied to these is the *Roman de Renard* (History of Reynard the Fox), a poem, or rather series of poems, written between the end of the twelfth and the middle of the fourteenth century, and forming a satirical picture of all the classes and institutions of the time.

Side by side with these epics, romances, and tales, an abundant lyric poetry flourished from the eleventh century. This song literature is mainly of a sentimental character, and is usually divided into two classes, *romances* and *pastourelles*. It is in general remarkable for its lyric grace and skilful melody. Amongst the principal of the early lyrists are Thibaut de Champagne (1201–53) and Charles of Orleans (1391–1465). The latter, a graceful writer of ballades and rondels, was amongst the last of the real Trouvères. Rutebeuf (born 1230), also a writer of fabliaux, is the first of a series of poets, culminating in François Villon, who passed their life in a Bohemian alternation of gaiety and misery, celebrating each phase with equal vigour in verse.

The *Roman de la Rose*, the work, in its earlier part, of Guillaume de Lorris, who lived in the first half of the thirteenth century, in the later, of Jean de Meung (died 1320), is one of the most notable productions of the time. It consists of more than 22,000 verses, and is a curious combination of a love poem and a satire. Olivier Basselin (who died about 1418) wrote songs celebrating the praises of wine. François Villon (1431–1500), the greatest of French poets before the Renaissance, wrote two compositions known as the *Great* and the *Little Testament*, interspersed with lyrical compositions of great poetic merit.

In prose literature the first important work is the *Histoire de la conquête de Constantinople* by Villehardouin (1167–1213). The *Mémoires* of the Sieur de Joinville (1223–1317) delineates the life of St. Louis and the exploits of the last Crusade. Froissart (1337–1410), the 'Herodotus of his age,' gives a vivid picture of the chivalry of the fourteenth century. With Philippe de Commines (1445–1509) we are introduced to Louis XI and his contemporaries in a style of history which, if less naive and charming, shows a deeper and more philosophical sense of things. In lighter prose the *Cent Nouvelles Nouvelles* already shows the power of the French language for the short, witty tale.

The revival of classical learning and the reformation of religion exercised a powerful influence on the French literature of the sixteenth century. Rabelais (1483–1553), a profound but often gross humorist, and Montaigne (1533–92), an interesting and instructive, though somewhat sceptical essayist, hold the first rank. Calvin (1509–64) did much by his great theological work, *Institution de la religion Chrétienne*, to mould French prose in the direction of strength and gravity.

Amongst the other works which indicate the rapid development of French prose in this century are Brantôme's *Mémoires*, the *Heptaméron* of Queen Margaret of Navarre (1492–1549), the translations of Amyot (1513–93) of Plutarch and other classic writers, and the celebrated political pamphlet, *Satire Ménippée*. In poetry

Clement Marot (1497–1544) gave a new elegance to the language in his epistles and epigrams. Pierre de Ronsard (1524–85) and the other members of the celebrated *Pléiade*, Jodelle, Belleau, Du Bellay, and others, sought to enrich their native tongue by the introduction of classic words, constructions, and forms of verse. Du Bartas (1544–90) and D'Aubigné (1550–1630) carried on the work of Ronsard. Mathurin Régnier (1573–1613) may be said to close this school of poetry. He unites in himself the lighter qualities of the style of Villon and Marot, with the erudition and command of language characteristic of the Ronsardists.

Malherbe (1556–1628), the creator of a new taste in literature, opposed with success the tendency of the Ronsard school, and, falling into the opposite excess, sacrificed everything to correctness. It was his school that set the example of the smooth but monotonous Alexandrine. With the Renaissance translations of the classic dramas appeared, and a member of the *Pléiade*, Jodelle (1532–1573), wrote the first regular tragedy (*Cléopâtre*) and comedy (*Eugène*).

The seventeenth century opened with Alexandre Hardy (1560–1631), Rotrou (1609–50), Tristan (1601–55), Mairet (1601–88), Du Ryer (1605–48), and a host of other dramatists, for nearly a hundred can be enumerated in the first quarter of the century. At length Pierre Corneille (1606–84), with his *Cid*, *Cinna*, *Horace*, and *Polyeucte*, brought French tragedy to a degree of grandeur which it has never surpassed. Of seventeenth century prose writers Pascal (1628–62) is vigorous and satirical in his *Lettres Provinciales*; profound, if sometimes mystica, in his *Pensées*.

The letters of Balzac (1594–1654) and Voiture (1598–1648), though rhetorical, are good examples of polished prose. Descartes (1596–1650) showed in his *Discours sur la méthode* that the language was now equal to the highest philosophical subjects, and the great work of his disciple, Malebranche, *Recherche de la vérité*, is equally admirable for its elegance of style and its subtlety of thought.

The age of Louis XIV is known as the golden age of French literature. Besides Corneille, Racine (1639–99) represented the tragic drama, and Molière (1622–73) brought his great masterpieces of comedy on the stage. The 'inimitable' La Fontaine (1621–95) produced his *Contes* and the most charming collection of fables. For his critical influence, if not for his poetry, Boileau (1636–1711) holds a prominent place. In eloquence the sermons and funeral orations of Bossuet, Bourdaloue, and Massillon take the first rank. Bossuet is also celebrated as a controversialist and theological historian.

Very important, too, are the memoir and maxim writers of this time. Amongst the former are the Cardinal de Retz, Madame de Motteville, Madame de Sévigné (1627–96), and others; amongst the latter are La Rochefoucauld (1613–80), St. Evremond (1613–1703), La Bruyère (1639–99). In fiction Le Sage, who also wrote comedies, produced his immortal *Gil Blas* and the *Diable Boiteux*; and the versatile Fontenelle wrote his *Dialogues des morts*.

Amongst the writers of the eighteenth century Voltaire holds the first place. He claims notice as an epic, lyrical, and comic poet, as a tragic and comic dramatist, historian, novelist, and philosopher, and he remained at the head of the republic of letters for more than half a century. Next to him in immediate influence on the age stands Jean Jacques Rousseau (1712–78), a writer of an eloquent sentimental vein, well represented by his *Nouvelle Héloïse* and his famous *Confessions*. His new theories of politics and education are embodied in his *Contrat Social* and *Émile*. Buffon (1707–88) devoted himself to the production of his immense natural history. Montesquieu (1689–1755), commencing with the *Lettres Persanes*, a satire on French manners and government, followed with an historical masterpiece, *Considérations sur la grandeur et la décadence des Romains*, and finally with his great work, the *Esprit des Lois*.

Diderot (1713–83), a powerful and suggestive writer in many departments, and D'Alembert (1717–83), a great geometrician, founded the *Encyclopédie*, a vast review of human knowledge, often hostile to social order and always to religion. Amongst the philosophers Helvetius, D'Holbach, and La Mettrie represent the extreme materialistic and anti-Christian school. Condillac and Condorcet kept most on the side of moderation. Among the writers of fiction Bernardin de St. Pierre (1737–1814), author of *Paul et Virginie*, and Prévost (1697–1763), author of *Manon Lescaut*, are particularly worthy of mention; while dramatic literature was enriched by the *Barbier de Séville* and the *Mariage de Figaro* of Beaumarchais (1732–99).

The age was not poetical; poetry had degenerated into imitations of foreign descriptive poets, such as Thomson. The most successful writer of this stamp was Delille (1738–1813). André Chénier (1762–94), the most promising of all, fell beneath the guillotine just after completing his *Jeune Captive*.

Neither the Revolution nor the First Empire was favourable to literature. Chateaubriand (1768–1848) and Madame de Staël (1766–1817) gave a new turn to the taste and sentiment of the time, the former in his *Génie du Christianisme* and his *Martyres*, clothing the history of Christianity in the romantic hues of his imagination, the latter in her *Corinne* and *De l'Allemagne* introducing the idealistic spirit and thought of the Germans to her countrymen. A purely reactionary school of thought was headed by Joseph de Maistre (1754–1821), the advocate of theocracy, with a vigorous despotism for its system of government.

Later on in the nineteenth century the influence of Goethe, Schiller, Shakespeare, Scott, and Byron began to be felt, and a new school, called the *Romantic*, as opposed to the old or *Classic*, sprang up, headed by Victor Hugo (1802–85), who promulgated the new theories in the preface to his drama of Cromwell, and carried them into practice in numerous poems. The most notable of his associates were Alfred de Vigny (1797–1863), author of a volume of *Poëmes*, and of a novel, *Cinq-Mars*; Sainte-Beuve (1804–69), who published several volumes of poetry in these early days, but became famous later on as a critic, perhaps the best France has ever possessed; and Alfred de Musset (1810–57), who produced some of the finest lyrics in the language. Charles Nodier, Gérard de Nerval, the two Deschamps, and, later, Théophile Gautier, with others, also belonged to the band of romanticists.

On the stage the dramas of Alexandre Dumas, the elder (1803–74), though melodramatic and of inferior literary value, served as rallying points for the new school. To English readers, however, he is best known by his novels. A reactionary movement was attempted, led by Ponsard (1814–67) and Émile Augier (1820–89). Casimir Delavigne (1793–1843) attempted to combine the Classic and Romantic schools; and Lamartine (1790–1869) is more than half a romanticist by sentiment and style.

Béranger (1780–1857), the greatest of French song-writers, may be considered as belonging to neither of the two schools, nor can the machine-made comedies and vaudevilles of Eugène Scribe be claimed by any of the rival parties.

Among novelists, Balzac (1799–1850) by his series of realistic novels, known by the comprehensive name of *La Comédie Humaine*, has established his claim to the first place. The novels of George Sand (Madame Dudevant, 1804–76), perhaps equally famous, have gained her the reputation of possessing the finest style of any contemporary writer. Low life in Paris was vividly depicted by Eugène Sue (1804–57) in the *Mystères de Paris*, &c.

Of a healthy tone are the novels of Frédéric Soulié, Émile Souvestre, and Edmond About (1828-85), and the stories of the two novelists, conjoined in work as in name, Erckmann-Chatrian. The younger Dumas, Victorien Sardou, Octave Feuillet, Ernest Feydeau, Henri Murger, Gustave Flaubert, developed a realistic style of novel in which social problems are treated with more candour than delicacy. During the second half of the nineteenth century a school of writers arose who strove to outdo the most realistic of their predecessors. The chiefs of this school were Émile Zola, Guy de Maupassant, Émile Gaboriau, Victor Cherbuliez, Alphonse Daudet, &c.

In works of history the eighteenth and nineteenth centuries were very prolific, the leading historians being Michaud (1767–1839), Sismondi (1773–1842), Guizot (1787–1874), Amédée Thierry (1787–1873), Augustin Thierry (1795–1856), Mignet (1796–1884), Thiers (1797–1877), Michelet (1798–1874), Henri Martin (1810–83), Victor Duruy (1811–94), Louis Blanc (1813–82). Literary historians are: Villemain (1790–1870), Vinet (1797–1847), J. J. Ampère (1800–64), Littré (1801–81), St. Marc-Girardin (1801–73), Sainte-Beuve (1804–69), Taine (1828–93), Demogeot, Fustel de Coulanges, Lavisse, and Sorel.

Philosophy is represented by Lamennais (1782–1854), Victor Cousin (1792–1867), Jouffroy (1796–1842), Rémusat (1797–1875), Auguste Comte (1798–1857), Quinet (1803–75), Montalembert (1810–70), Renan (1823–92), and in the twentieth century Fouillée, Bergson, and Boutroux. Among the writers on political economy and sociology are Bastiat (1801–50), Tocqueville (1805–59), Chevalier (1806–79), Proudhon (1809–65), Jules Simon (1814–96), Prévost-Paradol (1829–70), Letourneau, and Dürkheim.

Among scientific writers are Étienne Geoffroy St. Hilaire and his son Isidore, Cuvier, Jussieu, Duméril, in natural science; Gay-Lussac, Biehat, Corvisart, Magendie, Berthelot, and Le Chatelier in chemistry and medicine; and Lagrange, Laplace, Arago, and H. Poincaré in mathematics. Amongst Orientalists of note are Champollion, Burnouf, Silvestre de Sacy, Stanislas Julien, Sylvain Lévi, Maspero, Opert, &c. The essayists and literary and art critics are legion. We can only mention by name Théophile Gautier, Jules Janin, Philarète Chasles, Léon Gozlan,

Paul do St. Victor, Gustave Planche, and St. René Taillandier.

Among critics are Brunetière, Doumic, Faguet, Larroumet, and Lanson. Amongst poets who belong to a date posterior to the Romantic movement, to show different tendencies, may be mentioned Gautier, who inaugurated the Parnassian school of poetry and formulated the doctrine *l'art pour l'art*, and his disciples Banville and Baudelaire. Others were: Leconte de Lisle, François Coppée, Sully Prudhomme, Catulle Mendes, the modern Provençal poets, Frédéric Mistral and Théodore Aubanel. Paul Verlaine and Mallarmé, on the other hand, founded the Symbolist school of poetry. Symbolism, it may be pointed out, is individualism carried to its extreme. To the Symbolists belong the Belgians Maeterlinck, Verhaeren, and Rodenbach.

Among well-known novelists are: Bourget, Bazin, Bordeaux, Barbusse, Anatole France, Pierre Loti, Marcel Prévost, Pierre Benoît, &c. Among dramatists we may mention: Brieux, Donnay, Henri Bataille, Henri Bernstein, and last, but not least, Edmund Rostand, poet and dramatist. The novels of Marcel Proust (1862–1922) are representative of twentieth-century French literature. They are marked by egoism, disillusion and to a certain extent mysticism. This novelist did not become famous until after 1919. Other twentieth century novelists are André Gide, Georges Duhamel, Pierre Hamp, whose novels are about the world of labour, and Henri Barbusse, who was awarded the Goncourt Prize for his novel *Le Feu*.

Of poets Francis Jammes, and later, Charles Guérin, Charles Pegny, killed in 1914, and Paul Valéry, considered the greatest twentieth-century French poet, are prominent. Other names of importance in modern French literature are Abbé Henri Bremin, the historian, and André Maurois, the essayist.—BIBLIOGRAPHY: Petit de Julleville, *Histoire de la langue et de la littérature française des origines à* 1900; Nisard, *Histoire de la littérature française*; F. Brunetière, *Manual of the History of French Literature*; G. E. B. Saintsbury, *A Short History of French Literature*: E. Dowden, *A History of French Literature*; Kastner and Atkins, *A Short History of French Literature*; L. Claretie, *Histoire de la littérature française, les contemporains*, 1900–1910.

FRANCE, Anatole, assumed names of *Jacques Anatole Thibault*, French author, born in Paris 16th April, 1844. The son of a bookseller, he was brought up in a literary atmosphere, and educated at the Collège Stanislas, Paris. Devoting himself to literature, he made his entry into the world of letters in 1868 with his study on *Alfred de Vigny*. This essay was followed by many editorial prefaces to the works of French classics, by his *Poèmes dorés*, *Les Noces Corinthiennes*, and *Le Chat maigre*. He first attracted attention, however, in 1882, with his *Le Crime de Sylvestre Bonnard*, which was crowned by the Academy. This work placed the young author in the first rank of French novelists, and since then his success has continued. He was elected to the Académie Française in 1896, and was made an officer of the Legion of Honour.

Anatole France was not only a novelist, but at once a satirist and a critic, a philosopher and a theologian, a historian and a politician. His novels, simple and plotless, are veritable storehouses of a vast amount of erudition which the author has accumulated. As an Agnostic France is particularly interested in religious feelings and situations. A spiritual descendant of Renan, he is an implacable master of irony, but he has also affinities with Aristophanes and Epicurus, Voltaire and Heine. A sceptic, he has also the gift of pity, and whilst he criticizes, he also seeks to understand human stupidity and human failings, and "tout comprendre, c'est tout pardonner." A perfect stylist and a prince of humorists, France stands alone, in his ideas as well as in his style, and can scarcely be compared with any other contemporary French author. He shocks ordinary morality, ordinary faith and conduct, and condemns conventional practices in matters of right and justice.

Even those who dislike France's philosophy, however, are compelled to admire the artist in him. A fighter for freedom and justice, he was always ready to protest against the crimes of nations and governments, and to employ his pen and his eloquence in the service of the oppressed. He showed this attitude more than once, as during the Dreyfus affair, when he supported Zola, in the Armenian massacres, and the Russian pogroms. And yet, in spite of his radicalism, France is not a democrat; he is an aristocrat to the core, an aristocrat *à la* Renan and Flaubert, the forerunners and inspirers of Nietzsche.

It is this spirit of aristocracy which makes France's works breathe a spirit of hatred against the existing social order. His books are at once novels and works of criticism, revealing an author who is both a charming storyteller and a subtly reasoning philosopher. They are not only tales of romance and adventure, but essays on art, religion, and philosophy, full of original sayings, and discussions on

history and morality. Among his numerous works, the majority of which have appeared in English, are: *Le Livre de mon ami* (1885), *Thaïs* (1890), *La Rôtisserie de la Reine Pédauque* (1893), *M. Bergeret à Paris* (1901), *Crainquebille* (1902), *Histoire de Jeanne d'Arc* (1908), *L'Ile des Pingouins* (1908), *Les Dieux ont Soif* (1912), *La Révolte des Anges* (1914), &c. He was awarded the Nobel Prize for literature in 1921 and died in 1924. His last two works were *Le Petit Pierre* (1918) and *La Vie en Fleur* (1921).—BIBLIOGRAPHY: G. Brandes, *Anatole France*; W. L. George, *Anatole France*; J. Huneker, *Egoists*; A. S. Rappoport, *The Anatole France Calendar*.

FRANCE, ISLE OF (*Île-de-France*), an ancient province of France, so called because it was originally bounded by the Seine, Marne, Ourcq, Aisne, and Oise, and formed almost an island.

FRANCESCA DA RIMINI (frân-ches'kâ dâ rē-minē), an Italian lady, daughter of Guido da Polenta, Lord of Ravenna, lived in the latter part of the thirteenth century. She was married to Lanciotto, or Sciancato, the deformed son of the Lord of Rimini, who, discovering an intimacy between her and his brother Paolo, put them both to death. The story forms an episode in Dante's *Inferno*, and is alluded to by Petrarch; it is the subject of a poem by Leigh Hunt, of a tragedy by Silvio Pellico, a dramatic poem by Stephen Phillips, and a drama by D'Annunzio. There is also an opera *Françoise da Rimini*, by Ambroise Thomas, and a symphonic poem by Tschaikovsky. Pictures of Paolo and Francesca have been produced by Ingres (in the Chantilly Museum), Cabanel (in the Luxembourg), and Ary Scheffer (in the Wallace Collection).—Cf. Yriarte, *Françoise da Rimini dans la légende et dans l'histoire*.

FRANCESCO DI PAULA. *See* FRANCIS OF PAULA.

FRANCHE-COMTÉ (frânsh-kon-tā), an ancient province of France, forming at present the departments of Doubs, Haute-Saône, and Jura. It formed part of the Kingdom of Burgundy.

FRANCHET D'ESPEREY, Louis, French soldier, born at Mostaganem, Algeria, in 1856. Entering the army in 1876, he saw service in Tunis, Tongking, China, and Morocco, and commanded the French Fifth Army in Aug., 1914. In 1918 he became supreme commander of the Allied armies in the Orient, and obtained the surrender of Bulgaria. Until 1920 he commanded the Allied armies in European Turkey. He was created Marshal in Feb., 1921.

FRANCIA, Francesco. *See* RAIBOLINI.

FRANCIS I, King of France, was born 1494, died 1547. His father was Charles of Orleans, Count of Angoulême, and his mother Louise of Savoy, grand-daughter of Valentine, Duke of Milan. He ascended the throne in 1515, having succeeded his uncle, Louis XII. In prosecution of his claim to Milan he defeated the Swiss in the plains of Marignano, and forced the reigning duke, Maximilian Sforza, to relinquish the sovereignty. On the death of Maximilian (1519) Francis was one of the competitors for the empire; but the choice fell on Charles of Austria, the grandson of Maximilian, henceforth known as the Emperor Charles V.

From this period Francis and Charles were rivals, and were almost continually at war with one another. Both attempted to gain the alliance of England. With this view Francis invited Henry VIII of England to an interview, which took place near Calais, between Guînes and Ardres, in June, 1520. The magnificence of the two monarchs and their suites on this occasion has given to the meeting the name of the Field of the Cloth of Gold.

In 1521 war broke out between the rivals, and in 1525 Francis was defeated and taken prisoner at Pavia. He could recover his liberty only by renouncing his claims to Naples, Milan, Genoa, and Asti, the suzerainty of Flanders and Artois, and promising to cede the Duchy of Burgundy and some other French fiefs.

War was soon after renewed, an alliance, called the Holy League, having been formed between the Pope Clement VII, the King of France, the King of England, the Republic of Venice, the Duke of Milan, and other Italian powers, with the object of checking the advances of the emperor. In this war Rome was taken and sacked by the Constable of Bourbon (1527), and Italy was devastated, but Francis gained little either of fame or material advantage. Peace was concluded in 1529, but hostilities again broke out in 1535, when Francis possessed himself of Savoy. A hastily-made-up peace was soon broken, and Francis again found himself at war with the emperor and the King of England.

Fortunately for France the union of the Protestant princes of Germany against the emperor prevented him from following up his success, and inclined him to a peace, which was concluded at Crespy in 1544. Charles

resigned all his claims to Burgundy, and allowed Francis to retain Savoy. Two years after, peace was made with England. Francis I possessed a chivalric and enterprising spirit, and was a patron of learning.—BIBLIOGRAPHY: Capefigue, *François I et la Renaissance*; Julia Pardoe, *The Court and Reign of François I*; A. C. P. Haggard, *Two Great Rivals, François I and Charles V.*

FRANCIS II, King of France, son of Henry II and Catherine de' Medici, born at Fontainebleau in 1544, ascended the throne on the death of his father, 1559. The year previous he had married Mary Stuart, only child of James V, King of Scotland. The uncles of his wife, Francis, Duke of Guise, and the Cardinal of Lorraine, held the reins of government. Francis, who was of a feeble constitution, died in Dec., 1560.

FRANCIS I, Emperor of Germany, eldest son of Leopold, Duke of Lorraine, was born in 1708. In 1736 he married Maria Theresa, daughter of the Emperor Charles VI. After the death of Charles VI (1740), he was declared by his wife co-regent of all the hereditary states of Austria, but without being permitted to take any part in the administration. After the death of Charles VII, he was elected emperor in 1745. He died in 1765. *See* MARIA THERESA.

FRANCIS I, Emperor of Austria (previously Francis II, Holy Roman Emperor), was born 1768, died 1835. He was the son of the Emperor Leopold II and Maria Louisa, daughter of Charles III, King of Spain. He succeeded his father in 1792. France declared war against him in 1792, and hostilities continued till the Peace of Campo-Formio, 1797. In 1799 he entered into a new coalition with England and Russia against the French Republic; but in 1801 Russia and Austria were compelled to conclude the Peace of Lunéville. France having been declared an empire in 1804, he assumed the title of *hereditary Emperor of Austria*; and on the establishment of the Confederacy of the Rhine in 1806, he renounced the title of Emperor of Germany.

In 1805 war again broke out between Austria and France. But after the battle of Austerlitz (1805) the Peace of Presburg was signed. In 1809 he again took up arms against France, and in the Peace of Vienna was compelled to surrender 42,000 sq. miles of territory. The marriage of his daughter, Maria Louisa, with Napoleon promised to form a strong tie between the imperial Houses, but in 1813 he entered into an alliance with Russia and Prussia against France, and was present to the close of the contest.

FRANCIS OF ASSISI, ST., founder of the Order of the Franciscans, was born at Assisi, in Umbria, in 1182, where he died in 1226. In youth Francis did not refrain from the pleasures of the world; but after a serious illness he became enthusiastically devout, left the paternal roof, and in 1208 gave himself to a life of the most rigorous poverty. His followers were at first few, but when they reached the number of eleven he formed them into a new order, made a rule for them, and got it sanctioned, though at first only verbally, in 1210, by Pope Innocent III.

In 1212 he received from the Benedictines a church in the vicinity of Assisi, which now became the home of the order of the Franciscans or Minorites. Francis afterwards obtained a bull in confirmation of his order, from Pope Honorius III. After an unsuccessful attempt to convert the Sultan Meledin, he returned to Assisi, when the order of St. Clara was founded under his direction, and a third order, called the Tertiaries, designed for penitents of both sexes. He was canonized by Pope Gregory IX in 1228. His festival is on the 4th of Oct. *See* FRANCISCANS.—BIBLIOGRAPHY: Paul Sabatier, *Vie de St. François* (English translation by L. S. Houghton); A. Barine, *St. François d'Assise et la légende de ses trois compagnons*; Canon Knox-Little, *St. Francis of Assisi*; Stoddart, *Francis of Assisi*; Duff Gordon, *The Story of Assisi*; Father Cuthbert, *Life of St. Francis of Assisi*; J. Jörgensen, *St. Francis of Assisi: a Biography.*

FRANCIS OF PAOLA, or PAULA, ST., was born in 1416 in the city of Paula, in Calabria, died in France 1507. He was brought up in a Franciscan convent, and in 1436 founded a new order, which, when the statutes were confirmed by Alexander VI, received the name of the *Minims* (Lat. *minimi*, the least). To the three usual vows Francis added a fourth, that of keeping the Lenten fast during the whole year. The fame of his miraculous cures reached Louis XI of France, who invited him to France in the hope that Francis would be able to prolong his life. After the death of Louis, Charles VIII built him a monastery in the park of Plessis-les-Tours and also at Amboise, and loaded him with honour and tokens of veneration. Twelve years after his death he was canonized by Leo X, and his festival is on the 2nd of April. *See* MINIMS.

FRANCIS OF SALES. *See* SALES.

FRANCIS FERDINAND, Archduke

of Austria, born in 1863, assassinated at Serajevo in 1914. A nephew of the Emperor Francis Joseph and the son of Archduke Charles Louis, he became heir-presumptive to the crown of the Dual Monarchy after the death of Prince Rudolf of Austria in 1889. In 1900 he married morganatically the Countess Sophia Choteck, who was created Princess of Hohenberg. The archduke then renounced for his future children the right of succession to the thrones of Austria and Hungary. It was during his tour in Bosnia that he was assassinated at Serajevo on 28th June, 1914, an event which precipitated the European War.

FRANCIS JOSEPH I, Emperor of Austria and King of Hungary, born at Vienna 18th Aug., 1830, died at Schonbrunn 21st Nov., 1916. Revolts had forced his uncle, Ferdinand I, to abdicate, and when his father, Francis Charles, renounced his rights, Francis Joseph succeeded to the throne of the Dual Monarchy in 1848. His reign thus lasted sixty-eight years, exceeding that of Queen Victoria.

Francis Joseph was during his long reign above everything a Habsburg, and nearly all his acts were dictated by the interests of his House. Thus he not only refrained from establishing the Constitution which he had promised to his subjects in 1849, but refused to recognize the Constitution granted by his predecessor to Hungary. Nicholas I of Russia helped him to quell the Separatist movement in Hungary, whilst his general Radetzki brutally suppressed the attempt of the Lombardians to shake off the Austrian yoke. In 1854 he married Elizabeth, daughter of Duke Max of Bavaria.

During his long reign Francis Joseph not only saw the prestige of his House diminished, and Austria losing many of her possessions, but he also lived through a series of family tragedies. His only son, Prince Rudolf, met a violent death at Meyerling; his wife was assassinated at Geneva in 1897; his sister-in-law, the wife of Emperor Maximilian of Mexico, went mad after her husband's death. The climax came when, in June, 1914, the Archduke Francis Ferdinand, nephew of the emperor and heir to the throne, was murdered with his wife at Serajevo in Bosnia. The crime of Serajevo and the Austrian ultimatum to Serbia precipitated the crisis and led to the European War, which, in spite of the promise of politicians and littérateurs that it would be "the war which will end war," has, unfortunately, sown the germs of future conflicts.

Francis Joseph was to a great extent personally responsible for the European War, but he did not live to see the end and the downfall of the House of Habsburg. *See* AUSTRIA; EUROPEAN WAR.—BIBLIOGRAPHY: R. P. Mahaffy, *Francis Joseph: his Life and his Times*; H. de Weindel, *The Real Francis Joseph*; F. Gribble, *Life of the Emperor of Austria.*

FRANCIS, Philip, poet and dramatist, was born in Dublin 1700, died 1773. Educated at Dublin, he took orders, and kept an academy at Esher, Surrey, where Gibbon was one of his pupils. He was afterwards chaplain to Chelsea Hospital. He is best known from his translations of Horace and other classic authors.

FRANCIS, Sir Philip, one of the many political writers to whom the authorship of the *Letters of Junius* has been ascribed, was the son of the preceding, born in Ireland in 1740, died 1818. In 1773 he went to the East Indies, where he became a member of the Council of Bengal, and the constant opponent of Warren Hastings. In 1781 Francis returned to England, and shortly after was chosen member of Parliament for the borough of Yarmouth in the Isle of Wight. He took a prominent part in the impeachment of Hastings. He published several political pamphlets. Francis is generally considered to have been the author of the *Letters of Junius.* The majority of competent critics hold this opinion, which is supported by stronger evidence than the claims of other authors. The whole matter is still far from being decided. *See* JUNIUS.—Cf. article in *Dictionary of National Biography.*

FRANCIS'CANS, the members of the religious order established by St. Francis of Assisi about 1210. They are also called Minorites, or Fratres Minores ('lesser friars'), which was the name given them by their founder in token of humility, and sometimes Grey Friars, from the colour of their garment. The order was distinguished by vows of absolute poverty and a renunciation of the pleasures of the world, and was intended to serve the Church by its care of the religious state of the people. The rule of the order destined them to beg and to preach. The popes granted them extensive privileges, and they had an evil repute as spies, frequenting the courts of princes and the houses of noblemen, gentry, &c. They appeared in Great Britain in 1220.

Early in the fifteenth century the Franciscans split up into two branches, the Conventuals and the Observants or Sabotiers. The former went barefooted, wore a long grey cassock and cloak and hood of large dimensions, covering the breast and back, and a knotted girdle. The Observants wore wooden sandals, a cassock, a narrow

hood, a short cloak with a wooden clasp, and a brown robe.

In France the members of the order not belonging to any particular sect are called Cordeliers, from the cord which they tie about them. The Capuchins, so called from the peculiar kind of hood or cowl (*capuce*) which they wear, originated in a reform introduced among the Observantists by Matteo di Bassi in the early part of the sixteenth century. Although it received the approbation of different Popes within a short time after its foundation, it did not receive the right of electing a particular general and become an independent order till 1619.

St. Francis himself collected nuns in 1209. St. Clara was their prioress; hence they were called the *nuns of St. Clara*. The nuns were also divided into branches, according to the severity of their rules. The Urbanists were a branch founded by Pope Urban IV; they revered St. Isabelle, daughter of Louis VIII of France, as their mother. St. Francis also founded in 1221 a third order, of both sexes, for persons who did not wish to take the monastic vows, and yet desired to adopt a few of the easier observances. They are called Tertiarians or Tertiaries, and were very numerous in the thirteenth century. From them proceeded several heretical fraternities, as the Fraticelli and Beghards.

The whole number of Franciscans and Capuchins in the eighteenth century amounted to 115,000 monks, in 7,000 convents. At the dissolution of the monasteries in England there were sixty-five houses of the Franciscans. The order has given five Popes and more than fifty cardinals to the Church. There are now several houses in Great Britain and Ireland. Friar Roger Bacon, Duns Scotus, St. Bonaventure, Alexander of Hales, and William of Ockham were Franciscans. —BIBLIOGRAPHY: L. Wadding, *Annales Minorum Fratrum*; Brewer, *Monumenta Franciscana*; Cusack, *St. Francis and the Franciscans*; A. G. Little, *The Grey Friars in Oxford*; J. Sever, *The English Franciscans under Henry VIII.*

FRANCIS XAVIER, ST. *See* XAVIER.

FRANCKE (*fràn'kė*), **August Hermann,** German theologian and philanthropist, born at Lubeck 1663, died at Halle 1727. He was professor of Oriental literature and then of theology at Halle, but is chiefly known for his successful labours on behalf of poor orphans. In 1695 he founded the famous orphanage at Halle, still known by his name, which now includes, besides the orphan asylum, a great variety of schools, a printing and publishing establishment, chemical laboratory, &c. His *Manuductio* (1693) was translated into English under the title of *A Guide to the Reading and Study of the Holy Scriptures* (1813).

FRANCO-GERMAN WAR OF 1870-1. The immediate occasion of this was an offer made in June, 1870, by General Prim, then at the head of affairs in Spain, of the crown of that country to Leopold of Hohenzollern, a prince belonging to the reigning house of Prussia. The Government of Napoleon III demanded of the King of Prussia that he should forbid the



Franco-German—with and without cloak

candidature of the prince. Though the prince voluntarily withdrew it, the French Ambassador, Benedetti, demanded from King William at Ems a guarantee against any renewal of the candidature. A telegram from the king giving an account of this interview was published by Bismarck with certain omissions, and the state of public feeling in France was such that war was declared on Prussia on the 19th of July. The French were the first in getting their troops to the frontier; but it soon became manifest that instead of being in a complete state of readiness for war, as the Minister of War had declared, the French army was defective in almost everything essential to the equipment of an army.

In Germany everything formed a complete contrast to this state of

matters. Each section of the army was completely organized in the head-quarters of the district which it occupied in time of peace, and was sent to the frontiers only after being furnished with everything it required. In addition to this, Prussia, against which country alone the war had been declared was not only joined, according to treaty, by all the states of the North German Confederation, but also by those of the South, upon whose neutrality, perhaps even upon whose alliance, Napoleon and the French had counted.

The German forces were divided about the end of July into three armies, one of which, known as the First Army, had its head-quarters at Trèves under General Steinmetz; another of which, known as the Second Army, occupied the Bavarian Palatinate under Prince Frederick Charles; while the Third Army, under the Crown Prince of Prussia, was stationed in Northern Baden. The commander-in-chief of the whole forces was King William of Prussia, who was supported by a staff of general officers, with von Moltke at their head. The French army, under Napoleon himself, had its head-quarters at Metz, and two advanced divisions were stationed on the borders of France and Germany, the one in the north on the Saar, under General Frossard, the other farther south at Weissenburg, under General Douay.

The victories of the Third Army, under the Crown Prince, at Weissenburg (4th Aug.) and at Wörth (6th Aug.), and of the First and Second Armies at Forbach (6th Aug.), put the French army in retreat along its whole line, the southern half in the direction of Nancy, and the northern of Metz. The northern army, under Bazaine, was overtaken by those of Steinmetz and Frederick Charles on the 14th of Aug., when an engagement at Courcelles took place, in which the Germans were again victorious. This was followed by the battles of Vionville, or Mars-la-Tour, and Gravelotte, the result being that Bazaine withdrew his army under the protection of the fortifications of Metz, which was now surrounded by an army under the command of Prince Frederick Charles.

Meantime the Crown Prince of Prussia had advanced as far as Nancy, and was there awaiting the result of the battles around Metz. He had still the army of MacMahon to deal with, which had now reached Châlons, where it had been reorganized and strengthened to such a degree that the army of the Crown Prince was no longer able to cope with it unaided. Accordingly, out of three *corps d'armée* belonging to the Second Army, a new army was formed, which was afterwards called the Army of the Meuse, and was placed under the Crown Prince of Saxony.

About the 20th of Aug. these two armies set out on parallel routes in the direction of Châlons in order to engage the army of MacMahon, which it was expected would now retreat on Paris. Instead of this, however, Count Palikao, Minister of War at Paris issued an order to Marshal MacMahon to strike northwards to the Belgian frontier that he might thence make a descent upon Metz and relieve Bazaine. On the 27th of Aug., at Buzancy, an advanced detachment of cavalry belonging to the Army of the Meuse dispersed a body of French Chasseurs, and on the days immediately succeeding a number of engagements and strategic movements ensued, the result of which was that on the 1st of Sept. the army of MacMahon was surrounded at Sedan by a force of overwhelmingly greater numbers, and on the following day both army and fortress surrendered by capitulation.

On this occasion 50 generals, 5,000 other officers, and 84,000 private soldiers became prisoners of war. Among these was Napoleon III, who was unexpectedly found to have been present with the army of MacMahon. He had a personal interview on the day after the battle with King William of Prussia, who assigned to him Wilhelmshöhe, near Cassel, as his place of residence during his captivity.

One of the first consequences of this defeat was an outburst of rage on the part of the Parisians against the Napoleon dynasty. On the 4th of Sept. the Third Republic was proclaimed by Gambetta, Jules Favre, Crémieux, Ferry, and Jules Simon, members of the Corps Législatif, and the emperor was declared dethroned. A Government of National Defence was formed, at the head of which was placed General Trochu, military governor of Paris.

Meantime France had no available army which was strong enough to stand its ground for an instant before the German armies that were now enabled to continue their march upon Paris. The investment of the city was completed on the 19th of Sept. It was not till about the beginning of October that the French were able to organize a new army after the loss of that of MacMahon, and by the beginning of November the war in the open field had been resumed in different centres; but the capitulation of Metz with the army of Bazaine (28th Oct.), and that of Strasbourg (27th Sept.),

had set free for further operations large numbers of German troops, and the utmost efforts of the French could not relieve Paris.

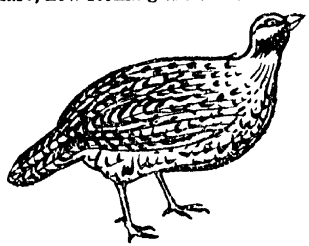
The city had held out for a much longer period than even the most sanguine on the side of the French had at first expected that it would be able to do. Sallies were made at intervals by the garrison (12th, 21st of Oct., 13th, 14th, 15th, and 19th of Jan.), but not sufficiently often or in sufficient strength to have an decisive effect. On the failure of the last sally, which took place on the west side from Mont Valérien on the 19th of Jan., it was seen that a capitulation was inevitable. On 21st Feb. M. Thiers, Head of the Executive, arrived at Versailles along with a diplomatic commission, and preliminaries of peace were signed at Versailles on the 26th of Feb., and accepted by the National Assembly at Bordeaux on the 1st of March, by a vote of 546 to 107.

Among those who voted against the preliminaries of peace was Clemenceau. The principal terms were the following: (1) That France should cede to Germany one-fifth part of Lorraine, including Metz, together with the whole of Alsace except Belfort and the surrounding district. (2) That France should pay to Germany a war indemnity of five milliards of francs (£200,000,000). (3) That certain departments of France should remain in the occupation of the Germans, and should not be fully evacuated until after the payment of the whole indemnity.

The definitive treaty of peace, which was signed at Frankfort on the 10th of May, 1871, and ratified on the 21st, confirmed in all essential particulars the preliminaries of Versailles. The last instalment of the war indemnity was paid on the 5th of Sept., 1873, and France completely evacuated by the Germans on the 13th of the same month.—BIBLIOGRAPHY: Von Moltke, *The Franco-German War* 1870–71; Chuquet, *La guerre de* 1870–71; *The Franco-German War* (in Cambridge Modern History); Major-General J. F. Maurice (editor and translator), *The Franco-German War*, 1870–71.

FRAN'COLIN, a genus of birds belonging to the same family as the partridge, which they resemble in many respects, though they usually have one or more strong and sharp horny spurs on the tarsi. The only European member of the genus is the *Francolinus vulgāris*, which is characterized by a red band round the neck, and red feet. It is found in the south of France, Sicily, Cyprus, and the southern part of Europe generally. It also ranges east to North India, where it is known as the 'black partridge.' The other species belong to Africa, Asia, and Oceania. The 'redwing' (*F. levaillanti*) of Cape Province is familiar to sportsmen.

FRANCO'NIA (in Ger. *Franken*, so called because early in the sixth century it was colonized by Franks), a district of Germany lying to the east of the Rhine, and traversed by the Main. After the dismemberment of the Carlovingian Empire, this district became attached to the German division, and ultimately formed one of the grand duchies of Germany. In 1806 it was partitioned among Wurttemberg, Baden, Hesse-Cassel, the Saxon duchies, and Bavaria. The last received the largest share, now forming the three divisions



Francolin

of Upper, Middle, and Lower Franconia; total area, 9,093 sq. miles. Pop. 2,518,645.

FRANC-TIREUR (frăn-tē-reur), literally a free shooter: an irregular sharp-shooter, one of a body of soldiers organized in France in the Franco-German War, and employed in guerrilla warfare for harassing the enemy and cutting off detachments. On the 22nd Jan., 1871, the franc-tireurs blew up the Moselle railway bridge at Fontenoy.

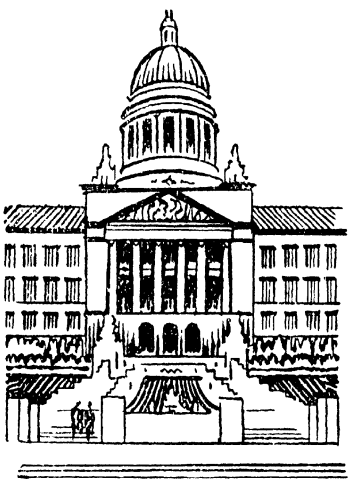
FRAN'EKER, a town in Holland, in the province of Friesland, on a canal communicating with the sea at Harlingen. It was long celebrated as a school of theology. Pop. 7,642.

FRANGIPANI (fran-ji-pā'nē), the name of an illustrious Roman family whose history dates from A.D. 1014. The name is said to have been derived from the generosity of the family, who distributed bread during a famine in Rome.—*Frangipani* is also the name of a perfume invented by the Marquis Frangipani, Maréchal des Armées of Louis XIII of France. It was a powder composed of every spice then known, with the addition of ground orris-root and musk. It is now a perfume prepared from, or imitating

the odour of, the flower of a West Indian tree, *Plumiera rubra*, or red jasmine.

FRAN'GULIN, a yellow crystallizable colouring matter contained in the bark of the berry-bearing alder (*Rhamnus Frangula*). It is a bright-yellow, silky, crystalline mass, without taste or smell, which fuses on heating, and can be sublimed in golden needles. It dyes silk, wool, and cotton.

FRANK'ENBERG, a German town, in Saxony, 40 miles S.E. of Leipzig.



State Building at Frankfort (Kentucky)

It is regularly built, and has extensive manufactures of woollens, cottons, and silks. Pop. 13,576.

FRANKENHAUSEN, a town of Germany, in the former principality of Schwarzburg-Rudolstadt, one of the Thuringian states, on an artificial arm of the River Wipper, 36 miles N.N.E. of Gotha. It has important rock-salt mines and salt-springs, also lignite and sandstone quarries. It was the scene of the defeat of Thomas Münzer and the Anabaptists in the Peasant's War in 1525. Pop. 7,000.

FRANKENSTEIN, the student hero of a tale by Mrs. Shelley. He constructed a monster from human fragments gathered in burial grounds and dissecting-rooms, and by galvanism succeeded in enduing it with life, though not with soul. Powerful for evil, it wrought a dreadful retribution upon its maker, who had usurped the prerogative of the Creator. References to this monster under the name of its maker, Frankenstein, are popular in metaphor.

FRANK'ENSTEIN, a town of Germany in the Prussian province of Silesia, 35 miles S.S.W. of Breslau. It has manufactures of cloth, and gunpowder and other mills. Pop. 10,000.

FRANK'ENTHAL (-tăl), a town in Bavaria, in the Palatinate, on a canal near the Rhine, 33 miles S.S.E. of Mainz. It has varied manufactures. Pop. 24,617.

FRANKFORT, the capital of Kentucky, United States, picturesquely situated on the Kentucky River, 25 miles W.N.W. of Lexington. It has a fine marble State house (capitol), an arsenal, saw-mills, shoe and furniture factories, &c. Pop. 11,626.—Another town of this name, in Indiana, 40 miles north-west of Indianapolis, is a railway centre. Pop. 12,196.

FRANKFURT-ON-MAIN (Ger. *Frankfurt am Main*), a city of Germany, in the Prussian province of Hesse-Nassau, 23 miles N.E. of Mayence (Mainz). It was formerly a free town of the empire, and down to 1866 one of the free towns of the German Confederation and the seat of the Diet. It is mainly situated on the right bank of the Main, but has the suburb of Sachsenhausen on the left bank, the river being crossed by seven bridges (two for railways). Both banks of the river are lined by spacious quays.

The older part of the town contains a number of ancient houses, and largely consists of narrow and unattractive streets, but the principal street, the Zeil, and those of the newer parts of the town, are spacious and have many handsome modern buildings. The older portion is surrounded by the *Anlagen* or promenades with gardens, on the site of the old fortifications. Fronting these promenades and in the districts outside of them are very many handsome, and some palatial, private residences with gardens. The Römerberg and the Ross-markt (horse-market) are the chief squares in the town.

The Römer or town house was erected about 1405, but has been greatly altered since, and modern structures have been added. In one of its halls the Electors of the empire met and made arrangements for electing the emperor, and in it the magistrates now sit. In another, the Kaisersaal, the emperor was banqueted after election, and waited on by kings and princes.

The most remarkable of the churches is the Dom or Cathedral of St. Bartholomew (Roman Catholic), in which the

German emperors after 1711 were crowned. It is a Gothic edifice, begun in 1238. The choir was built between 1315 and 1318. The building was seriously injured by fire in 1867, but has been completely restored, the tower left incomplete since 1514 being finished in accordance with the original plans.

Other buildings are the University founded in 1914, the new opera-house, one of the finest buildings of the kind; the courts of justice, of modern construction; the new exchange, a spacious and handsome edifice; the large palace of the Prince of Thurn and Taxis; the new railway station, a very fine building, which can be favourably compared with any similar structure; the archive building, post office, the house in which Luther dwelt, and that in which Goethe was born and lived till 1775.

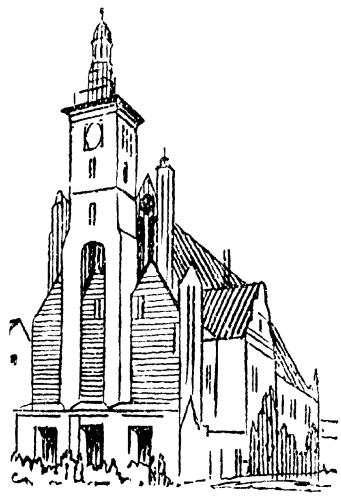
There are monuments to Gutenberg, Goethe, Schiller, and others. Frankfort is rich in collections connected



Goethe's statue in Frankfurt-on-Main

with literature and art, and in establishments intended to promote them. The chief of these are the Historical Museum (in the archive building), the Städel Art Institute (in Sachsenhausen), containing a fine gallery of pictures and other collections; the Senckenberg Museum of Natural History; the town library, possessing over 300,000 printed volumes. There is also a zoological garden and the Palm Garden, both favourite places of resort.

The manufactures comprise chemicals, ornamental articles of metal, sewing-machines, straw hats, soap,



Frankfurt-on-the-Oder 13th Century Church

perfumery, and beer. A great business is done in money and banking. The town is provided with tramways, is a great railway centre, and is now reached by the largest vessels navigating the Rhine.

History. Frankfort dates from the time of Charlemagne. It was made an imperial free city by a decree of the Emperor Louis V in 1329. Frederick Barbarossa had been elected emperor here in 1152, and in 1356 the right of being the place of election for all future emperors was granted to it by the Golden Bull.

Frankfort suffered severely in the Schmalkald War (1552), the Thirty Years' War (1635), the Seven Years' War (1762), and during the French Wars (1792, 1796, 1799, 1800, 1806). Under Napoleon it became the capital, first of a principality, and then, in 1806, of a grand duchy. From 1814 to 1866 it was one of the four free cities of the German Confederation, and in 1866 it was taken by the Prussians. The town was occupied by French troops on the 6th of April, 1920, pending the withdrawal of German troops from the Ruhr district. It was evacuated on 17th May, 1920. Pop. (1925), 540,115.

FRANKFURT - ON - THE - ODER (*Frankfurt an der Oder*), a town of Germany in the Prussian province of Brandenburg, on the Oder, 50 miles by rail E.S.E. of Berlin. It is built with considerable regularity, and was an important military centre until 1918. Many retired officers and Government officials take up their residence here. The manufactures consist of machinery and metal goods, chemicals, leather, earthenware, and spirits; and the trade is extensive both by land and water. Frankfurt was annexed to Brandenburg in 1250, and notwithstanding its repeated captures during



Benjamin Franklin

the Hussite, the Thirty Years', and the Seven Years' War, was always an important commercial place. Pop. 71,130.

FRANK'INCENSE, a name given to the oleo-resinous exudations from different species of conifers. American frankincense is got as a soft, yellow, resinous solid, with a characteristic turpentine odour, from *Pinus Taeda*. Another kind is exuded by the spruce fir, and forms a soft solid, the colour of which varies from white to violet-red. From this Burgundy pitch is prepared by melting in water and straining through a cloth.

The frankincense employed in religious ceremonies (called also *incense* and *olibānum*) is a gum-resin obtained from *Boswellia thurifĕra* (of *serrāta*), a tree somewhat resembling the sumach, belonging to the Amyridaceæ, and growing amongst the mountains of India. It comes to us in semi-transparent yellowish tears, or sometimes in masses, of specific gravity 1·22; it possesses a bitter and nauseous taste, and is capable of being pulverized. When burned, it exhales a strong aromatic odour, on which account it was much employed in the ancient temples, and still continues to be used in Catholic churches.

FRANKLAND, Sir Edward, English chemist and authority on sanitation, was born in 1825 at Churchtown, in Lancashire, died in Norway in 1899. He served an apprenticeship to a chemist in Lancaster, afterwards studying in London under Playfair, and at Marburg and Giessen under Bunsen and Liebig respectively. In 1851 he became professor at the newly founded Owens College in Manchester, and in 1852 suggested the conception of the valency of organic compounds. In 1853 he was elected F.R.S., and in 1857 received the society's gold medal. From 1863 to 1868 he was professor of chemistry in the Royal Institution, and held a similar post in the Royal School of Mines (afterwards merged in the Royal College of Science) from 1865 to 1885.

For many years he was Government water-analyst, and in 1868 was appointed a member of the second Royal Commission on river-pollution. He was a member of various foreign scientific academies, and was made K.C.B. in 1897. He and Sir Norman Lockyer were the original discoverers of helium (in 1868). In 1877 he published a volume of *Experimental Researches in Pure, Applied, and Physical Chemistry*, a work on *Inorganic Chemistry* (with F. R. Japp, 1884), besides many other works and papers.

FRANKLIN, formerly the designation for a free-holder, yeoman, or landowner, holding directly from the Crown and not of noble birth.

FRANKLIN, Benjamin, American writer and politician, born at Boston 17th Jan. 1706, died at Philadelphia 17th April, 1790. He was the fifteenth of seventeen children, and was at first intended for the ministry, but was placed instead with his brother, a printer, to serve an apprenticeship to that trade. His brother having started the *New England Courant*, Franklin secretly wrote some pieces for it, and had the satisfaction of finding them well received. But, on this coming to the knowledge of his brother, he was severely lectured for his presumption, and treated with great harshness.

Soon after he quitted his brother's employment, and at the age of seventeen started for Philadelphia, where he obtained employment as a compositor. Here he attracted the notice of Sir William Keith, the Governor of Pennsylvania, who induced him to go to England for the purpose of purchasing types to establish himself in

business. He got work in a printing-office, and after a residence of eighteen months in London returned to Philadelphia. Here he returned to his trade, and in a short time formed an establishment in connection with a person who supplied the necessary capital. They printed a newspaper, *The Pennsylvania Gazette*, which was managed with much ability, and acquired Franklin much reputation. By his exertions a public library, improved systems of education, a scheme of insurance, &c., were established in Philadelphia.

In 1732 he published his *Poor Richard's Almanack*, which continued to be issued till 1757. Being in Boston in 1746 he saw, for the first time, some experiments in electricity, which led him to begin those investigations which resulted in the identification of lightning and electricity, and the invention of the lightning conductor. As member of the Provincial Assembly of Pennsylvania he showed himself very active, and he was sent out (in 1757) to the mother country as the agent of the province. His reputation was now such, both at home and abroad, that he was appointed agent of the provinces of Massachusetts, Maryland, and Georgia. Oxford and Edinburgh conferred on him their highest academical degrees, and the Royal Society elected him a fellow.

In 1762 he returned to America; but was again appointed agent in 1764, and brought to England a remonstrance against the project of taxing the colonies. He opposed the Stamp Act, and in 1774 presented to the King the petition of the first American Congress. On his return he was elected member of the Congress, and exerted all his influence in favour of the Declaration of Independence. In 1776 he was sent to France as commissioner plenipotentiary, to obtain supplies from that court. After the surrender of Burgoyne, he concluded with France the first treaty of the new states with a foreign power (1778), and was subsequently named one of the commissioners for negotiating the peace with the mother country.

On his return to his native country he filled the office of President of Pennsylvania, and served as a delegate in the Federal Convention in 1787, and approved the Constitution then formed. His works include his unfinished *Autobiography* (edited by John Bigelow in 1868, and in 1888), and a great number of political, anti-slavery, financial, economic, and scientific papers. His complete works were edited by John Bigelow (1905), and by A. H. Smyth (1905–7).—BIBLIOGRAPHY: James Parton. *Life and Times of Benjamin Franklin*; P. L. Ford, *Franklin Bibliography*; J. B. McMaster, *Benjamin Franklin as a Man of Letters* (American Men of Letters Series).

FRANKLIN, Sir John, an English Arctic explorer, born in Lincolnshire in 1786, died near Lancaster Sound 1847. He entered the navy as a midshipman at the age of fourteen, and was present at the battle of Copenhagen in 1801. He afterwards accompanied Captain Flinders on his voyage to the coast of Australia (1801–3). Shortly after his return he was appointed to the *Bellerophon*, and had charge of her signals during the battle of Trafalgar. Two years later he joined the *Bedford*, which was employed successively in the blockade of Flushing, on the coast of Portugal, and on the coast of America. On the last station she took part in the attack on New Orleans in 1814, when Franklin was slightly wounded.

His Arctic work began in 1819, when he conducted an overland expedition for the exploration of the north coast of America from Hudson's Bay to the mouth of the Coppermine River. On his return to England he published a narrative of the expedition, was promoted to the rank of captain, and elected a F.R.S. In a second expedition he surveyed the coast from the mouth of the Coppermine west to Point Beechy, thus traversing in his two expeditions about a third of the distance between the Atlantic and the Pacific. On his return in 1827 he received the honour of knighthood.

After serving for some years in the Mediterranean, he held the post of Governor of Tasmania from 1836 to 1843. In 1845 he took command of the *Erebus* and *Terror* in what proved his last polar expedition. The problem was to find an Arctic water-way between the Atlantic and the Pacific. The expedition was seen in Melville Bay two months later, but from that time no direct tidings were received from it. Many expeditions were sent in search of him both from Britain and America, but with little success.

At last an expedition, sent out under M'Lintock, in 1857, discovered in 1859, at Point Victory, in King William's Land, a document which had been deposited in a cairn thirteen years before, and gave the latest details of the ill-fated expedition. This paper stated that Sir John died 11th June, 1847; that the ships were abandoned in April, 1848; and that the crews, 105 in number, had started for the Great Fish River. None survived, but many relics of the party have been recovered.

Between 1878 and 1880 Lieutenant

Schwatka, of the United States army, made a final search and found other remains of Sir John Franklin's men.—*Eleanor Pordon* (1795–1825), first wife of Sir John Franklin, published several volumes of verse.—His second wife, *Jane Griffin* (1802–75), was notable for her philanthropy and her persevering efforts to clear up the fate of her husband.—BIBLIOGRAPHY: S. Osborn, *The Career, Last Voyage, and Fate of Sir John Franklin*; H. D. Traill, *Life of Sir John Franklin*.

FRANKLIN, a name given (from Sir John Franklin, the Arctic explorer) to a district of Canada which includes the islands lying north of the mainland, with Melville Peninsula and Boothia Peninsula.

FRANKLIN, a town of the United States, Pennsylvania, Venango County, interested in the petroleum trade. Pop. 10,254. There are smaller towns of the same name in Massachusetts, New Hampshire, and Indiana respectively.

FRANKLINITE, a mineral composed of oxide of iron 64·5 to 66, oxide of zinc 21·8, and oxide of manganese 12·23 to 13·5 per cent, belonging to the group of minerals called *spinels*. It is found in New Jersey and named after the town there. It is used for the manufacture of spiegeleisen, an iron containing 12 to 20 per cent manganese, and the zinc is recovered from the furnace gases.

FRANK-PLEDGE, literally pledge or surety for a freeman. Frank-pledge was a law prevailing in England before the Norman Conquest, by which the members of each decennary or tithing, composed of ten households, were made responsible for each other, so that if one of them committed an offence the others were bound to make reparation.

FRANKS. *See* FRANCE.

FRANZENSBAD (fränts'ens-bät), a watering-place in Bohemia, Czechoslovakia, about 3 miles north of Eger. The mineral springs, mentioned as early as the sixteenth century, are alkaline, saline, and chalybeate, and are very efficacious, particularly in scrofulous and cutaneous affections. Pop. 3,000.

FRANZ-JOSEPH LAND, an island group in the Arctic Ocean, lying north of Novaya Zemlya, and consisting of two chief islands, much broken up by fiords, and a number of smaller ones.

FRANZOS, Karl Emil, German novelist and journalist of Jewish descent, born in Podolia in 1848, died 28th Jan., 1904. He studied law but entered journalism, lived at Vienna for some time, and then settled in Berlin where he founded in 1886 the *Deutsche Dichtung*, a fortnightly review. In 1876 he published *Aus Halb-Asien*, wherein he described life in Rumania, Galicia, and Southern Russia. This book was translated into several languages. Other works by Franzos are: *Vom Don zur Donau* (1878), *Die Juden von Barnow* (1877), *Ein Kampf ums Recht* (1882), *Die Wahrheitsucher* (1894), and *Mann und Weib* (1897).

FRASCA'TI, a town, Italy, 15 miles by rail S.E. of Rome, situated on the slopes of the Alban Hills, near the site of the ancient Tusculum. It is much resorted to by the people of Rome in summer-time. Charles Edward Stuart the Young Pretender, is buried in the Cathedral of S. Pietro. Pop. 11,000.

Frascati was also the name of an aristocratic gaming-house in Paris during the first quarter of the nineteenth century. It was suppressed by Louis Philippe.

FRASER, Alexander Campbell, Scottish philosophical writer, born 1819, died in 1914. He succeeded Sir William Hamilton in the professorship of logic and metaphysics at Edinburgh, in 1856, and retired in 1891. He edited the *North British Review*, and published *Essays in Philosophy*; *Bishop Berkeley's Works*, with *Life*, &c.; an edition of *Locke's Essay*; Monographs on Locke and Berkeley; *Biography of Thomas Reid*; *Philosophy of Theism*; *Biographia Philosophica*; *Our Final Venture*; and *Berkeley and Spiritual Realism*.

FRASER, or **FRAZER, Simon.** *See* LOVAT.

FRA'SERA, a genus of plants, nat. ord. Gentianaceæ, containing ten species of erect perennial herbs, natives of North America. *F. carolinensis* is indigenous in the swamps of the Carolinas. The root yields a powerful bitter, similar to gentian, and used as a tonic.

FRASERBURGH, a seaport of Scotland, in Aberdeenshire, 25¼ miles east of Banff. It is substantially built, has two harbours, a good trade, and is the chief seat of the Scottish herring-fishery. Pneumatic-tool works have been established there. Pop. (1931), 9,720.

FRASER RIVER, the principal river in British Columbia, rising in the Rocky Mountains. It first flows north-west for about 270 miles, then turns south, and after a total course of 470 miles falls into the Gulf of Georgia. Gold is found both on the Fraser and its affluents, and the salmon fisheries are important. Its principal affluents are the Thomson and Stuart Rivers. New Westminster, Hope, Yale (head of navigation), and Lytton are on its banks.

FRATER'NITY, an association of

men who unite to promote their common interest, business or pleasure. In this wide sense it includes all secret and benevolent societies, the monastic and sacerdotal congregations, the orders of knighthood, and also guilds, trades unions, and the like. In a limited sense it is applied to religious societies for pious practices and benevolent objects. These were often formed during the Middle Ages, from a desire of imitating the holy orders. Many of these societies, which did not obtain or did not seek the acknowledgment of the Church, had the appearance of separatist organizations, and incurred the charge of heresy.

The pious fraternities which were formed under the direction of the Church, or were acknowledged by it, were either required by their rules to afford assistance to travellers, to the unfortunate, the distressed, the sick, and the deserted, on account of the inefficiency of the police, and the want of institutions for the poor, or to perform certain acts of penitence and devotion. Of this description were the *Fratres Pontifices*, a brotherhood that originated in Tuscany in the twelfth century, where it maintained establishments on the banks of the Arno, to enable travellers to cross the river, and to succour them in case of distress A similar society was afterwards formed in France, where it built bridges and hospitals, maintained ferries, kept the roads in repair, and provided for the security of the highways.

Similar to these were the *Knights and Companions of the Santa Hermandad* (or *Holy Brotherhood*) in Spain; the *Familiars and Cross-bearers* in the service of the Spanish Inquisition; the *Calendar Brothers* in Germany; and the *Alexians* in Germany, Poland, and the Netherlands. The professed object of the Alexians, so called from Alexius their patron saint, was to visit the sick and imprisoned; to collect alms for distribution; to console criminals, and accompany them to the place of execution; to bury the dead, and to cause masses to be said for those who had been executed, or for persons found dead.

There were also *Grey Penitentas* (an old fraternity of an order existing as early as 1264 in Rome, and introduced into France under Henry III); the black fraternities of *Mercy* and of *Death*; the *Red*, the *Blue*, the *Green*, and the *Violet Penitents*, so called from the colour of their cowl; the divisions of each were known by the colours of the girdle or mantle. The fraternity of the *Holy Trinity* was founded at Rome in 1548 by Philip de' Neri for the relief of pilgrims and the cured dismissed from the hospitals. The *Brothers of Charity* are another fraternity whose hospitals are found in all the principal cities of Catholic Christendom.

FRAUD (Lat. *fraus*, deceit), an act or course of deception deliberately practised with the view of gaining an unlawful or unfair advantage, such as the obtaining of goods under false pretences, and the like. Fraud is a generic term comprising both crimes and torts. For criminal proceedings the various crimes involving frauds are punishable by statute. The civil remedy for fraud is a suit for damages or for avoidance of the transaction in which it is contained, and every species of fraud of which the law takes cognizance renders voidable every transaction into which it enters as the constituent material element.

Fraud may be committed in many ways, such as by false representation, concealment of material circumstances that ought to be revealed, underhand dealing, taking advantage of imbecility or intoxication, &c. The law will not impute fraud to one who has not actually been guilty of fraud, so there is no such thing as 'technical' or 'constructive' fraud. By statute, however, a director of a company which issues a fraudulent prospectus may be liable for it under certain conditions although he himself did not authorize its issue. Moreover a person may in certain circumstances obtain in equity the setting aside of a remedy, otherwise restricted to fraud, in a transaction which is not actually fraudulent.

The Statute of Frauds was the statute 29 Charles II. c. 3, passed 1677. Among its complex provisions it provided that various transactions should be in writing or evidenced by some memorandum in writing signed by the party who is sought to be made liable thereon; else they shall, for most or all purposes, be deemed unenforceable. This provision is re-enacted by section 40, The Law of Property Act, 1925.

FRAUNHOFER (froun'hō-fĕr), **Joseph von**, German optician, born 1787, died 1826. Apprenticed in 1799 to a glass-polisher in Munich, he ultimately became a partner in a manufactory of optical instruments there. His many improvements in glass-making, in optical instruments, and in the polishing of lenses, have been eclipsed by his investigation of the innumerable dark fixed lines in the solar spectrum, known as *Fraunhofer's Lines*. The importance of this discovery can scarcely be overestimated. It led to the invention and use of the spectroscope, to the science of spectroscopy, and to all our present knowledge of solar and stellar chemistry. *See* SPECTRUM; SPECTROSCOPE.

FRAXINELLA, a species of dittany.

FRAY BENTOS (fri), a small town of Uruguay, on the River Uruguay, about 170 miles north-west of Monte Video. It owes its existence to immense slaughter-houses and other establishments connected with the extract-of-meat trade. Pop. 7,000.

FRAZER, Sir James George, classical scholar and anthropologist, was born in Glasgow in 1854, studied at Trinity College, Cambridge, and graduated with high distinction in classics in 1878. He was called to the Bar at the Middle Temple in 1882. He is a Fellow of Trinity College, Cambridge, became professor of social anthropology at Liverpool in 1907, and has received honorary doctor's degrees from several universities. He was knighted in 1914, and received the Order of Merit in 1925.

His publications include: *Totemism* (1887); *The Golden Bough; a Study in Comparative Religion* (1890); *Pausanias' Description of Greece* (Translation and Commentary, 1898); *Pausanias and other Greek Sketches* (1900); *Lectures on the Early History of the Kingship* (1905); *The Scope of Social Anthropology* (1908); *Totemism and Exogamy* (1910); *Folklore in the Old Testament* (1918). In his chief work, *The Golden Bough*, there are brought together a mass of material and a number of ingenious theories and speculations bearing on the origin of religion and religious beliefs, the folklore of many peoples being brought under review.

FRECKLES, small yellow or greenish-yellow spots of a circular form, situated in the middle layer of the skin and underneath the cuticle. They only appear to any appreciable extent on those surfaces exposed to the action of the sun, as the neck, face, hands, and arms. This affection is most common in persons of fair complexion and hair; in some cases it is permanent, but in most it disappears with the warm season.

FREDERICIA, a seaport of Denmark, in Jutland, at the north entrance of the Little Belt. In 1849 the army of Schleswig-Holstein was defeated there by the Danes, and in 1864 the Danes were compelled to evacuate it before the superior Austro-Prussian forces. A bronze statue, *The Danish Soldier*, was erected here in commemoration of the victory of 1849. Pop. 19,389.

FREDERICK, a town in the United States, in Maryland, 41 miles N.W. of Baltimore. It has an extensive trade, chiefly in live stock, grain, flour, tobacco, and wool. During the Civil War it was occupied on different occasions by the opposing armies. Pop. 14,434.

FREDERICK, King of Bohemia. Born 26th Aug., 1596, he was a son of Frederick IV, elector palatine of the Rhine, and became elector as Frederick V in 1610. In 1613 he married Elizabeth, daughter of James I, and in 1619, being a Protestant, he was elected King of Bohemia. His enemies, however, were too strong for him. He was called derisively "the winter king," and driven from the land. His enemies also took from him his electorate, and although James sent help he could not recover it. From 1623 until his death, 29th Nov., 1632, Frederick was an exile. One of his children was Sophia, electress of Hanover; he was thus an ancestor of King George V. Prince Rupert was one of his sons.

FREDERICK I, Barbarossa (or, as the Germans call him, **Rothbart,** both surnames meaning 'Red-beard'), Roman emperor, son of Frederick, Duke of Suabia, was born 1121, drowned in 1190. He received the imperial crown in 1152 on the death of his uncle the Emperor Conrad III. His principal efforts were directed to the extension and confirmation of his power in Italy. In his first expedition to Italy in 1154 he subdued the towns of Northern Italy, and then got himself crowned at Pavia with the iron crown of Lombardy (April, 1155), and afterwards at Rome by Pope Adrian IV with the imperial crown (June, 1155).

Soon after his return to Germany the Lombard cities revolted, and Frederick led a second expedition into Italy (1158), took Brescia and Milan, and at the Diet of Roncaglia, at which all the cities and imperial vassals of Italy were represented, he assumed the sovereignty of the towns and received the homage of the lords. The rights assigned to the empire were so great that many of the cities refused to acknowledge them, and Milan especially prepared for resistance. Meantime Pope Adrian IV died (1159), and in electing a successor the cardinals were divided, one section choosing Victor IV and another Alexander III. Frederick supported Victor, and Alexander was compelled to flee from Italy and take refuge in France.

Other expeditions into Italy were made in 1161 and 1166, in the latter of which Frederick at first carried everything before him, and was even able to set up in Rome the Anti-Pope Paschalis III, whom he supported after the death of Victor IV. His successes were put an end to, however, by a terrible pestilence, which carried off a large part of his army, and compelled him hastily to return to Germany.

Scarcely had he settled the most pressing difficulties here when he undertook, in 1174, a fifth expedition into Italy; but he was totally defeated in the battle of Legnano on the 29th of May, 1176, in consequence of which nearly all that he had won in Italy was again lost, and he was compelled to acknowledge Alexander III as the true Pope. In 1188 he assumed the cross, and with an army of 150,000 men and several thousand volunteers set out for Palestine. After leading his army with success into Syria, he was drowned in crossing the River Kalykadnus (now Geuksu), 1190.—BIBLIOGRAPHY: J. Jastrow, *Deutsche Geschichte im Zeitalter der Hohenstaufen*; H. Prutz, *Kaiser Friedrich I.*

FREDERICK II, Hohenstaufen, grandson of the preceding, born 1194, died in 1250. He was the son of the Emperor Henry VI and of the Norman Princess Constance, heiress of the Two Sicilies. He remained under the guardianship of Innocent III till 1209, when he took upon himself the government of Lower Italy and Sicily. The imperial crown of Germany was now worn by a rival, Otho IV, whose defeat at the battle of Bouvines opened the way to Frederick, and in 1215, after pledging himself to undertake a crusade, he was crowned at Aix-la-Chapelle. He caused his eldest son Henry to be chosen King of Rome in 1220, and the same year received the imperial crown from the Pope.

His ambition aimed at the subjugation of Lombardy, the mastership of all Italy, and the reduction of the Popes to their old spiritual office as the leading bishops in Christendom. This led him into constant struggles in Germany and Italy. In 1227 he undertook a crusade; but when he did reach the Holy Land he was able to effect nothing permanent, although he had crowned himself at Jerusalem as King of Judea. On his return he had to suppress a revolt of his son Henry, whom he imprisoned for life.

In 1237 he broke the power of the Lombard League by a victory at Corte Nuova in Lombardy, and marched on Rome, but did not attack it. The remainder of his life was occupied with his troubles in Italy, and he died in the midst of his wars. He was one of the ablest and most accomplished of the long line of German emperors, and art, literature, commerce, and agriculture received every encouragement at his hands. He himself was a good linguist, was acquainted with natural history, was a minnesinger, and a writer on philosophy.—BIBLIOGRAPHY: J. Jastrow, *Deutsche Geschichte im Zeitalter der Hohenstaufen*; L. Allshorn, *Stupor Mundi: the Life and Times of Frederick II.*

FREDERICK I, King of Prussia, son of the great Elector, born 1657, died 1713. He succeeded his father as Elector of Brandenburg, in 1688, became King of Prussia in 1700, and was all his reign bitterly opposed to France.

FREDERICK II, King of Prussia, known as Frederick the Great, born 1712, died 1786. He was the son of Frederick William I and the Princess Sophia Dorothea of Hanover, sister of George II of England. Although he was instructed only in the details of military exercises and service, his taste for poetry and music was early developed. He was brutally treated by his father, and in 1733 was obliged to marry the Princess Elizabeth Christina, daughter of Ferdinand Albert, Duke of Brunswick-Bevern. Frederick William gave the castle of Schonhausen to her, and to the prince the county of Ruppin, and in 1734 the town of Rheinsberg, where he lived, devoting himself chiefly to literary pursuits, composing several works, and corresponding with foreign scholars, particularly with Voltaire, whom he greatly admired.

The death of his father raised him to the throne in 1740, and it was not long before he asserted the claims of the House of Brandenburg to a part of Silesia then held by Maria Theresa. But his proposals being rejected, he occupied Lower Silesia in Dec., 1740, defeated the Austrians near Mollwitz and at Czaslau (Chotusitz), and the first Silesian War was terminated by the peace signed at Berlin, 28th July, 1742, leaving Frederick in possession of Silesia. Soon the second Silesian War broke out, the result of which was equally favourable to Frederick. By the Peace of Dresden (15th Dec., 1745) he retained Silesia and acknowledged the husband of Maria Theresa, Francis I, as emperor.

During the eleven following years of peace Frederick devoted himself to the domestic administration, to the improvement of the army, and at the same time to the muses. He encouraged agriculture, the arts, manufactures, and commerce, reformed the laws, increased the revenues of the State, and perfected the organization of his army, which was increased to 160,000 men.

Secret information of an alliance between Austria, Russia, and Saxony gave him reason to fear an attack and the loss of Silesia. He hastened to anticipate his enemies by the invasion of Saxony (1756), with which the Seven Years' War, or third Silesian War, commenced. This was a far more severe struggle than either of the former. In it Frederick had against him Austria, Russia, France, Sweden, and the greater part of Germany,

though Britain and some of the German states were on his side. He gained victories at Prague, Rossbach, Leuthen, Zorndorf, Torgau, Freiberg, but suffered severe defeats in the battles of Kollin, Hochkirch, and Kunersdorf. (*See* SEVEN YEARS' WAR.) The Peace of Hubertsburg (1763) terminated this war, Frederick keeping Silesia and ceding nothing.

Frederick came out of the Seven Years' War with a reputation which promised him in the future a decisive influence in the affairs of Germany and Europe. His next care was the relief of his kingdom, drained and exhausted by the contest. This he prosecuted with great diligence and liberality. On the partition of Poland in 1772 Frederick received a large accession to his dominions. In 1778–9 he frustrated the designs of the Emperor Joseph II on Bavaria, and the war of the Bavarian Succession was terminated without a battle by the Peace of Teschen (13th May, 1779). Austria consented to the union of the principalities of Franconia with Prussia, and renounced the feudal claims of Bohemia to those countries.

In the evening of his active life Frederick concluded, in connection with Saxony and Hanover, the Confederation of the German princes, 23rd July, 1785. An incurable dropsy hastened the death of Frederick, who left to his nephew, Frederick William II a kingdom increased by 29,000 sq. miles, a well-filled treasury, an army of 200,000 men, great credit with all the European powers and a state distinguished for population, industry, wealth, and science. Frederick's works, relating chiefly to history, politics, military science, philosophy, and the belles-lettres, were all written in French, the language which he regularly used, as he despised German. He was a man of the highest abilities, but in some respects narrow and repellant. Among his closest friends was the Scottish exile Marshal Keith. Carlyle's *History of Frederick* is well known.—BIBLIOGRAPHY. E. Lavisse, *La jeunesse du grand Frédéric*; Lavisse and Rambaud, *Histoire Générale* (vol. ii); E. Daniels, *Frederick the Great and his Successor* (in Cambridge Modern History); F. T. Kugler, *Life of Frederick the Great*; Sir E. M. Satow, *The Silesian Loan and Frederick the Great.*

FREDERICK III, Emperor of Germany, born 1831; succeeded William I 9th March, 1888; died 15th June, 1888. In 1858 he married the Princess-Royal of Britain, eldest daughter of Queen Victoria. He commanded the army of the Oder in the war with Austria (1866), and in the Franco-German War he led the army which ultimately forced Napoleon III and his army to surrender at Sedan. He also took a prominent part in the siege of Paris. In 1887 he was attacked by a serious throat affection, which turned out to be cancer, and which after a series of relapses proved fatal. His renown as a military commander, his liberal views, his patience and fortitude under trouble, and his many lovable qualities made him extremely popular.

FREDERICK VII, King of Denmark, reigned from 1848 to 1863. He was the last king of the Oldenburg family. He died 1863.

FREDERICK VIII, King of Denmark, born in 1843, died suddenly at Hamburg on 14th May, 1912. He was the eldest son of Christian IX, married in 1869 Princess Louise of Sweden, a niece of King Oscar II, and succeeded to the throne of Denmark in 1906. His second son Charles became King of Norway in 1905, under the name of Haakon VII.

FREDERICK AUGUSTUS I and II, Electors of Saxony and Kings of Poland. *See* AUGUSTUS II and III.

FREDERICK CHARLES, Prince, known as the 'Red Prince,' born 1828, died 1885. He was nephew to the Emperor William I, and gained fame for his military exploits during the wars of 1866 and 1870. Sadowa, Thionville, Gravelotte, and St. Privat are among his chief achievements.

FREDERICKSBURG, a town, United States, Virginia, on the Rappahannock, 60 miles north by east of Richmond. Here the Federal forces under Burnside were defeated by the Confederates under Lee on the 13th Dec., 1862. Pop. 6,819.

FREDERICK WILLIAM, of Prussia, generally called the *Great Elector*, was born in 1620, died 1688. At the age of twenty he succeeded his father as Elector of Brandenburg. He must be considered as the founder of the Prussian greatness, and as the creator of a military spirit among his subjects. His reign began when the unhappy Thirty Years' War was still raging in Germany, and his conduct towards both parties was prudent. He succeeded in freeing Prussia from feudal subjection to Poland; and obtained possession of Pomerania in 1648. In 1672 he concluded a treaty with the Dutch Republic when that state was threatened by Louis XIV. In 1673 he concluded a treaty by which France promised to evacuate Westphalia, and to pay 800,000 livres to the Elector, who, in return, broke off his treaty with Holland, and promised not to render any aid to the enemies of France.

In 1674 the German Empire declared

war against France. The Elector marched 16,000 men into Alsace, but a Swedish army having been induced to invade Prussia, Frederick turned back and totally defeated them at Fehrbellin (1675). Some years after the Swedes again invaded his territories, but were driven back. France, however, demanded the restoration of all the conquered territories to Sweden. The Elector, having refused compliance, formed an alliance with Denmark, and waged a new war against Sweden, but was at last obliged to submit. He paid great attention to the promotion of agriculture and horticulture, and, by affording protection to the French refugees, gained 20,000 industrious manufacturers, who were of the greatest advantage to the north of Germany. Berlin was much improved during his reign. He left to his son a country much enlarged and improved, an army of 28,000 men, and a well-supplied treasury.—Cf. Sir A. W. Ward, *The Great Elector and the First Prussian King* (Cambridge Modern History).

FREDERICK WILLIAM I, King of Prussia, son of Fredrick I and father of Frederick the Great (II), was born in 1688, died 1740. While Crown Prince (1706) he married Sophia Dorothea, daughter of the Elector of Hanover, afterwards George I of England. On his accession to the throne, in 1713, he endeavoured to increase the army and reform the finances, and became the founder of the rigid discipline regarded as characteristic of Prussian troops. His ridiculous fondness for tall recruits is well known. He was very miserly, eccentric, and arbitrary. He opposed Charles XII, and was the protector of the neighbouring Protestant states. He left behind him an abundant treasury, and an army of about 70,000 men. His affairs were in the greatest order and regularity, and to his energy Prussia was much indebted for that prosperity and success which distinguished her till she was humbled by the power of Napoleon.

FREDERICK WILLIAM II, King of Prussia, born 1744, died 1797. He succeeded his uncle Frederick the Great in 1786, and shared in the second partition of Poland.

FREDERICK WILLIAM III, son of Frederick William II, born 1770, died 1810. During his reign Prussia suffered much at the hands of Napoleon, sustaining defeats at Jena, Eylau, and Friedland, and lost a large portion of territory, which, however, was recovered after the fall of Napoleon.

FREDERICK WILLIAM IV, King of Prussia, son of Frederick William III, was born 1795, died 1861. He was carefully trained by the best masters in all the leading branches of knowledge and art, civil and military. He took part, though without any active command, in the campaigns of 1813 and 1814. When he succeeded to the throne on the death of his father in 1840, his first proceedings were both of a popular and praiseworthy character. He soon, however, began to pursue a retrograde and absolutist policy.

The popular movement which followed the French revolution of 1848 was at first met by the king with firmness, but on the demand of the people that the troops should be withdrawn from the capital, backed by an attack on the arsenal, the king offered concessions, which, however, as soon as he felt himself strong enough to do so, he retracted. Afterwards his mind gave way, and he sank into a state of hopeless imbecility, which rendered it necessary to appoint his brother William regent of the kingdom. He died without issue, and was succeeded by his brother, who ten years later became emperor of united Germany.

FREDERICTON, the capital of New Brunswick, Dominion of Canada, on the River St. John, about 84 miles from its mouth, and 54 miles N.N.W. of the town of St. John. It is well laid out, and has handsome public buildings, including the Government house, the provincial buildings, court-house, town hall, cathedral, and university. The trade is extensive and increasing, the river being navigable for large steamers. Pop. 1931, (8,828) 8,114.

FREDERIKSBORG, palace of Denmark. It stands on some islands in a lake in Zeeland, about 21 miles from Copenhagen. The early kings had a castle here, but the present building, which stands in a large park, was erected by Christian IV. about 1620. In 1859 it was largely rebuilt and is now a national museum.

Fredericksborg must be distinguished from **Frederiksberg.** The latter is a western suburb of Copenhagen, where there is also a palace now used for public purposes. It stands in extensive grounds, part of which are used as a zoological garden.

FRED'ERIKSHALD, or **FREDERIKSHALL,** a seaport, Norway, at the mouth of the Tistedal in the Iddefiord, 35 miles by rail S.S.E. of Oslo. Immediately to the south stands the fortress of Frederiksteen, at the siege of which Charles XII of Sweden was killed, 30th Nov., 1718. An obelisk marks the spot. Pop. 11,992.

FREDERIKSHAVN, a seaport of Denmark, in Jutland, on the Kattegat, with a large export of agricultural

produce, its harbour being much resorted to for shelter. Pop. 9,882.

FREDERIKSTAD, a seaport of Norway, at the mouth of the Glommen, 48 miles S.E. of Christiania. Formerly strongly fortified; it has an arsenal; manufactures hardware, pottery, &c., and has some shipping and general trade. Pop. 14,101.

FREE-BENCH, in law, the right which a widow has, in some parts of England, in her husband's copyhold lands, corresponding to dower in the case of freeholds.

FREEBOARD, in a vessel the distance between the upper or main deck and the load-water line. It should provide an amount of reserve buoyancy that will keep a ship afloat if two of its compartments have been holed.

FREE CHURCH OF ENGLAND, an Episcopal body separate from the Established Church of England, founded in 1844 as a counteracting influence to the tractarian movement. The churches belonging to it, though not numerous, are widely spread. The service is practically identical with that of the Evangelical party of the National Church. The Church is governed by two bishops, and has about 30 churches.

FREE CHURCH OF SCOTLAND, a Presbyterian Church organized as a separate body from the Established Church in May, 1843. The Queen Anne Act of 1712, which restored patronage in Scotland, was for long the chronic cause of schism and discontent in the Scottish Church, unwelcome clergymen being often under it appointed to church livings. In 1834 the General Assembly passed a *veto act*, which declared that no minister should be intruded into a parish church against the will of the people, and that a majority of male heads of families, full members of the church, should be able to bar an obnoxious presentee. This act before long created litigation, and the ecclesiastical and civil powers came into conflict. The struggle was brought to an issue by the judgment of the House of Lords in 1842, affirming a decree of the Court of Session, which required the Presbytery of Auchterarder to induct the presentee to Auchterarder parish without regard to the dissent of the parishioners.

In May, 1843, the members of the General Assembly had been elected and were convened at Edinburgh, when the Rev. Dr. David Welsh, who had been Moderator of the last Assembly, instead of constituting the meeting in the ordinary manner, rose and read a protest, pointing out that the civil courts had undue powers of interference with the Established Church, and concluding by asserting the right of the protesters, in the circumstances, to withdraw to a separate place of meeting for the purpose of taking steps on behalf of themselves and their adherents for separating in an orderly way from the Establishment, but still maintaining the Confession of Faith and Standards of the Church of Scotland as heretofore understood. After reading this document the Moderator and other members of Assembly, together with those adhering to them, withdrew to another place of meeting (the Tanfield Hall, Canonmills), and constituted themselves the Free Church of Scotland. They elected Dr. Chalmers as their Moderator, and proceeded with the business before them.

Although thus denuded of the temporal benefits of an establishment, they declared themselves to be the true National Church of the Reformation, and did not object to the endowment and establishment of religion by the State. In late years, however, a decided majority of the Free Church clergy gave up the doctrine of the lawfulness of the establishment of the Church by the State, and became converts of the 'voluntary principle.' The deed of demission, or resignation of livings, was signed by 474 ministers and professors. A sustentation fund was instituted for the maintenance of the ministers, to be supplied by the voluntary offerings of the people. In the first year after the disruption the sum of £366,719 was contributed for the erection of churches, between 700 and 800 of which had to be provided for congregations which left the Establishment with their ministers. Colleges for the theological training of the ministry were subsequently erected in Edinburgh, Glasgow, and Aberdeen. Schools were added to the churches in town and country, and normal schools for the training of teachers were instituted.

In 1900 the Free Church joined the United Presbyterian Church (established in 1847 on the voluntary principle), to form the United Free Church of Scotland. A small minority of Free Church ministers and members, who were nicknamed the 'Wee Frees,' refused to accept the union and claimed to be the true Free Church of Scotland, a claim which the law decided in their favour, the Church property passing in accordance with the decision. The inability of the (new) Free Church to make full use of the churches and other property thus assigned led to legislative interference and to a Royal Commission of Inquiry. In 1905, following on the

Commissioners' report, an Act of Parliament, The Churches (Scotland) Act, was passed, under which an Executive Commission was set up for the purpose of allocating the property in proportion to the number of the adherents. The Free Church consists of 5 synods, 12 presbyteries, and foreign missions. In 1919 there were 150 congregations and 89 ministers. From 1909 the General Assemblies of the Church of Scotland and the United Free Church were moving towards reunion. The negotiations were interrupted by the War, but were later resumed. In May 1929 the two bodies resolved on an incorporating union of the two Churches. The Union was consummated on 2nd October, 1929. Just before the union the Free Church had a membership of over 500,000—

BIBLIOGRAPHY: R. H. Story, *The Church of Scotland*; W. Stephen, *History of the Scottish Church*; A. M. Stewart, *Origins of the United Free Church in Scotland*; Peter Bayne, *The Free Church of Scotland*.

FREE CITIES, cities having an independent government of their own, and virtually forming states by themselves; a name given to certain cities of Germany which were members of the German Confederation, and exercised sovereign jurisdiction within their own boundaries. At the time of the French Revolution the free or 'imperial' cities numbered no fewer than fifty-one; but all except Hamburg, Lübeck, and Bremen have been deprived of their special privileges.

FREE COMPANIES, or **FREE LANCES,** names given to the bodies of private adventurers who, in the Middle Ages, organized themselves into bands of mercenary soldiers, and let out their services to the highest bidder. They played their most conspicuous part in Italy, where they were called *Condottieri*.

FREEDMEN (*liberti*, *libertini*) was the name applied by the Romans to those persons who had been released from a state of servitude. The freedman wore a cap or hat as a sign of freedom (hence the origin of the cap of liberty), assumed the name of his master, and received from him a white garment and a ring. With his freedom he obtained the rights and privileges of a Roman citizen of the plebeian rank, but could not be raised to any office of honour.

FREEDOM OF THE SEAS. This phrase has two meanings. It may signify the right of any nation to use the seas for commercial purposes in time of peace, and may thus be connected with early protests against the claims of certain countries to exclude foreign ships from portions of the ocean. In the Middle Ages, Venice asserted a sovereignty over the whole of the Adriatic Sea and levied tributes from foreign vessels, and, after the discovery of the New World, Spain claimed exclusive rights in the Western Atlantic, in the Gulf of Mexico, and in the Pacific, and Portugal had similar pretensions in the Indian Ocean. These controversies have long been settled by the universal recognition of the freedom of the seas in this sense, and the claims of natives to control tracts of sea near their own coasts have been abandoned in favour of the adoption of an international admission of a three (or sometimes four) mile limit of territorial sovereignty over the seas adjacent to any country.

The use of the open sea by any nation in time of peace is now taken for granted, and the phrase 'freedom of the seas' in modern conversational usage is always understood to refer to time of war. Under conditions of war, a belligerent Power not only attempts to close the seas against its enemies, but also, for certain purposes, against neutrals. All enemy shipping is recognized by international custom to be liable to destruction or seizure, and no distinction is drawn between purely commercial shipping and ships of war, or between cargoes useful for military purposes and other classes of goods; the only limits to belligerent action in this respect are those imposed by considerations of humanity.

In regard to neutrals, a belligerent Power claims the right to stop neutral vessels to search them, to confiscate goods likely to assist the military purposes of the enemy (contraband of war), and even to confiscate vessels which can be proved to be employed in the enemy's behalf, provided that the lives of crews and passengers are preserved. The position of Great Britain as a maritime Power has rendered it necessary, from time to time, to insist upon the legality of these principles, and the assertion of them has sometimes brought about the conversion of neutrals into enemies.

In the War of American Independence (1776–83), a rival theory was propounded, to the effect that 'free ships make free goods,' and that anything might be carried under a neutral flag. After the French entered into the war, they recognized this principle on condition that the neutral Powers should compel Great Britain to follow the French example, and it was in this connection that the phrase 'the freedom of the seas' first became a technical term.

In 1780 Russia, Denmark, Sweden, Prussia, and Austria formed an 'Armed Neutrality' against Great Britain in order to establish a rule

that "a Power at war has no right to interrupt the commerce of the subjects of a neutral Power." Holland, which also joined the Neutrality League, soon entered into the war against Great Britain. The League promised to prohibit their own nationals from carrying contraband of war, but such a promise was obviously worthless, and to the end of the struggle Great Britain maintained her attitude.

The question again became important in the course of the great French war, and in 1800 Russia, Sweden, Denmark, and Prussia formed the second Armed Neutrality, which aimed at compelling Great Britain to recognize 'the freedom of the seas'; but the murder of the Czar Paul and the battle of Copenhagen put an end to the League. In the later stages of the war, Napoleon justified the prohibition of trade with Great Britain by his Berlin and Milan decrees as a policy of retaliation against British interference with the freedom of the seas, and the enforcement of the blockade by the British Orders in Council led to the war of 1812–4 with the United States. The attitude neither of France nor of the Powers of the Armed Neutrality had been consistent throughout the period 1780–1815. All of them had shown that they advocated their principle of the 'freedom of the seas' only when it suited them, and that they were ready to abandon it when it became inconvenient.

In the course of the nineteenth century, the general principles of the right of search by belligerent Powers and of the seizure of contraband goods came to be accepted as a rule of international law. In the European War of 1914–8, the Germans revived the cry of the 'freedom of the seas,' but with little attempt to disguise the fact that their real aim was to establish a German maritime predominance. In their conduct of the naval war, they deliberately violated international law in two respects. The destruction of enemy merchant vessels was admitted to be legitimate only if the safety of the crews and passengers was secured, and in former wars enemy merchant vessels were released if no provision could be made for those on board. The Germans, from an early stage in the war, sunk enemy merchant ships without warning, and without the possibility of preserving the lives of their victims. At a later stage in the war they broke the further rule that neutrals are immune from hostile attack, and that, although neutral vessels are liable to examination and in certain circumstances to seizure, the lives of neutral seamen and passengers are to be held inviolate.

The defeat of the Central Powers has disposed of the inhuman contentions of the former German Government, and the general question of the rights of belligerents at sea is one of the matters on which the League of Nations will have power to legislate. One of the 'fourteen points' which President Wilson described as essential for a permanent peace was "absolute freedom of navigation upon the seas, alike in peace and in war, except as the seas may be closed in whole or in part by international action for the enforcement of international covenants." This clause, which has no counterpart in the Peace Treaty, was interpreted as an attack upon British theory and practice, but provision is made for the British contention in the exception made for the closure of the seas by international agreement.

FREEHOLD, in law, an estate in real property, held either in fee-simple or fee-tail, in which case it is a freehold of inheritance, or for the term of the owner's life; also, the tenure by which such an estate is held. Freehold is to be distinguished from *copyhold* and *leasehold* (q.v.).

FREEMAN, one who is not a slave. In early society there was a sharp distinction between freemen and slaves, this being the case in Greece and Rome, as well as among the Anglo-Saxon and other Teutonic tribes, the freemen forming the fighting and governing class. Gradually, as slaves became free, the distinction disappeared. In England a serf or villein could, among other ways of winning it, obtain his freedom by residing for a year and a day in a chartered town. By the end of the 15th century serfdom had entirely disappeared in Britain, and the word freedom had lost its special meaning. In other European countries the same process took place, but at a slower rate.

The word freeman was then used in England for a man who had the right to take part in the government of the city or borough in which he lived. These privileges were greatly abused and in 1835 they were swept away, the municipal corporations being reformed. London, however, was an exception, and there freemen still remain and take part to a slight extent in the city's government. This freedom is usually obtained by heredity, or by apprenticeship, although the latter is only nominal, and all freemen are members of one or the other of the city companies.

A third kind of freeman came into existence in the 19th century. These are men of distinction, such as a Prime Minister or a leading soldier, who are given the honorary freedom of

a city or borough, now a popular way of recognising distinguished services to the state.

FREEMAN, Edward Augustus, English historian and archæologist, born 1823, educated at Trinity College, Oxford, of which he was scholar and fellow; died in 1892. He received various academical distinctions, and in 1884 became regius professor of modern history at Oxford.

His works, which are very voluminous, include: *History of Architecture* (1849), *History and Conquests of the Saracens* (1856), *History of Federal Government* (1863), *Old English History* (1869), *Growth of the English Constitution* (1872), *Historical Essays* (1872–9), *History of the Norman Conquest* (1867–76), *Historical Geography of Europe* (1881), *The Reign of William Rufus* (1882), and *History of Sicily* (unfinished, 1891–2).—Cf. W. R. W. Stephens, *Life and Letters of E. A. Freeman*,

FREEMASONRY, a term applied to the organization of a society calling themselves *free* and accepted *masons*, and all the mysteries therewith connected. This society, if we can reckon as one a number of societies, many of which are unconnected with each other, though they have the same origin and a great similarity in their constitution, extends over almost all parts of the globe, and is consequently of the greatest service to travellers who are members of the craft. According to its own peculiar language, it is founded on the practice of social and moral virtue. It claims the character of charity in the most extended sense; and brotherly love, relief, and truth are inculcated in it. It has been defined as "a peculiar system of morality, veiled in allegory and illustrated by symbols."

Fable and imagination have traced back the origin of freemasonry to the Crusaders and the Rosicrucians, to the Roman Empire, to the Pharaohs, the temple of Solomon, the Tower of Babel, and even to the building of Noah's ark. According to the legendary history contained in a number of MSS., known as the *Old Charges of British Freemasons*, masonry was originated in Egypt by Euclid and spread into various countries, reaching England in the time of St. Alban (A.D. 300).

In reality freemasonry took its rise in the Middle Ages along with other incorporated crafts. Skilled masons moved from place to place to assist in building the magnificent sacred structures—cathedrals, abbeys, and churches—which had their origin in these times, and it was essential for them to have some signs by which, on coming to a strange place, they could be recognized as real craftsmen and not impostors.

Freemasonry in its modified and more modern form dates only from the seventeenth century. In 1717 the First Grand Lodge was established in London. The modern ritual is said to have been partly borrowed from the Rosicrucians and knights templars, and partly devised by Elias Ashmole, the founder of the Ashmolean Museum. Freemasonry, thus modified, soon began to spread over the world. In 1725 it was introduced into France by Lord Derwentwater; and in 1733 the first American lodge was established. The United Grand Lodge of England recognizes only two species of Freemasonry —the *Craft* and the *Royal Arch*; Scottish, Irish, American, and Continental lodges acknowledge higher degrees; but these, with the exception of the *Mark Degree*, are not universal.

In ordinary freemasonry there are three grades—those of apprentice, fellow-craft, and master-mason—each of which has its peculiar initiatory ceremonies; the last of these grades, however, is necessary to the attainment of the full rights and privileges of brotherhood.—BIBLIOGRAPHY: R. F. Gould, *History of Freemasonry*, and *A Concise History of Freemasonry*; E. Conder, *Records of the Hole Crafte and Fellowship of Masons*.

FREE PORT (It. *Porto franco*), a harbour where ships of all nations may enter on payment of a moderate toll, and load or unload. Goods may be stored at first at free ports without paying any duty; the goods may then be either reshipped for export on paying a mere transit duty, or they may be admitted for home consumption on payment of the usual full customs of the country. Free ports have never existed in Great Britain.

FREEPORT, capital of Stephenson County, Illinois, 100 miles W. by N. of Chicago; the seat of a Presbyterian college; it manufactures machinery and carpets. Pop. (1930), 22,045.

FREE-THINKERS. *See* RATIONALISM.

FREETOWN, a seaport, West Africa, capital of the British West African colony of Sierra Leone, near the mouth of the estuary or river of Sierra Leone, in the vicinity of extensive swamps. Its principal streets are broad and straight and have a very attractive appearance. Among the public buildings are several churches, a governor's house, and barracks. It has a good harbour, and is a coaling-station. Pop. (1931), 55,359.

FREE-TRADE, the principle under which international commerce is freed from every form of Government manip-

ulation, such as tariffs, bounties, or restrictive legislation in the interest of particular classes of producers. In all countries it was long held to be of importance to encourage native production and manufactures by excluding from their own markets, and from the colonial markets over which they had control, the competing produce and manufactures of other countries.

The Physiocrats in France, and in this country Adam Smith, in *The Wealth of Nations*, had, however, already advocated the principle of free-trade in the eighteenth century, and beginnings of the movement towards free-trade were made by Pitt in 1786 and by Huskisson in 1823–5; but the great body of British commercial legislation was based until 1846 on the theory of protection. The battle for free-trade in the United Kingdom was fought over the Corn Laws of 1815, 1822, and 1828, and by the National Anti-Corn Law League (founded 1839) in which the moving spirits were before all Richard Cobden and John Bright. It was partly as a measure of retaliation against the Leaguers that the landed interest supported Sir Robert Peel in the removal or reduction of import duties on a large number of materials and manufactures in 1842 and 1845, but the effect was to strengthen the case for free-trade in grain very actively pressed by the League all over the country. In 1846 the fear of famine finally broke the resistance of the landlords to the repeal of the Corn Laws. The repeal of the Navigation Laws followed in 1849, and the last protective duties were removed by Gladstone in 1853 and 1860.

Britain remained until 1914 the chief centre of free-trade, but the doctrine did not remain unchallenged. In 1881 the Fair Trade League was founded to advocate the limitation of freedom of trade to those countries which would apply it reciprocally; later, in 1903, the Tariff Reform League was founded by Joseph Chamberlain. The last breach in Britain's seventy years' fidelity to free-trade was made in 1915, on the plea of discouraging 'luxury' imports during the European War. At the end of 1920 the Dyestuffs (Import Regulation) Act was passed prohibiting for ten years, except under licence from the Board of Trade, the import of synthetic organic dyestuffs and intermediate products used in their manufacture. In 1921 the Safeguarding of Industries Act was passed, under which all articles belonging to industries scheduled as 'key' industries were subjected to a duty. In 1931–2 Britain ceased to be a free-trade country and a general system of tariffs came into force. *See* IMPERIAL PREFERENCE.

Broadly, it may be said that a large State can afford to choose what commercial policy it will follow; thus, with inter-State free-trade over an area comparable with the whole of Western Europe, the United States can afford a protective policy in regard to external commerce. But small States dependent on external commerce, as are the European neutrals, Belgium and Holland, Norway and Denmark, are bound to follow a free-trade policy. Even here the gain is a negative one, viz. the removal of an obstacle. — BIBLIOGRAPHY: Adam Smith, *The Wealth of Nations*; Bastiat, *Economic Sophisms*; Mongredien, *History of the Free Trade Movement in England*; Morley, *Life of Richard Cobden*; C. F. Bastable, *The Theory of International Trade*; W. Smart, *The Return to Protection*; J. M. Robertson, *Free Trade*; J. H. Higginson, *Tariffs at Work*.

FREE TRADE (BALANCE OF). The provisional figures for 1932 were £703,132,725. £365,137,785 and £50,913,593 respectively.

FREE-WILL is the power possessed by man to choose freely between two contradictory actions without being forced by any external agency or by necessity to do so. It is the faculty of man to decide in the last resort between two opposing possibilities, in spite of pressure of exterior environment, and in spite of the internal contention of different motives. Man being conscious of this power, the partisans of the theory of free-will argue that as we *feel* so we *know* that we are masters of ourselves, and that the power to decide must necessarily be inherent in us.

The theory of free-will thus supposes that man possesses genuine moral freedom, is able to determine the course of his thoughts and volitions and to decide which motives shall prevail in his mind. His decisions are determined neither by external nor internal compulsion, and are exempt from the principle of causation. For the human will can only be called really free if it is neither the result of an outside power nor the effect of man's own nature or environment. This free volition is due to man's self not entirely accounted for by character, motives, and circumstances. Moreover, the decision resulting from a really free-will cannot be foreseen or explained by anything except the will of man. The volition must therefore be somewhat spontaneous, that is, no one is able to predict with precision and infallibility the possible decision to which a man may arrive; otherwise it would follow that the act of volition

has been determined by causes independent of the free-will of man.

The opponents of the theory of free-will are called determinists, and the partisans of free-will may consequently be defined as indeterminists. The question of free-will ramifies into metaphysics, psychology, ethics, and theology, and is one of the few most important philosophical problems of all times. Alfred Fouillée rightly said that free-will or determinism is the philosophical question *par excellence*, and indeed all the questions dealing with human efforts and human duties must at one time or another take this problem into consideration. The whole fabric of legislature of criminology and penology, is differently affected, according to whether free-will is admitted or denied.

Since time immemorial man believed that he possessed a certain power to determine his actions. Vaguely he felt this power, but he only began to speculate on this question later on. To the ancient Greek philosophers the problem of free-will did not as yet present itself very clearly. The Eleatics, Socrates, Plato, and Aristotle did not yet discuss the problem in a way in which it is looked upon by modern philosophers. The Stoics were determinists, i.e. opponents of the theory of free-will, whilst Epicurus advocated the idea of free-will or indeterminism.

It was, however, with the advent of Christianity, that the problem of free-will assumed a new aspect. The Schoolmen invented the term of *liberum arbitrium* and discussed its extent and limits. Whilst the pagan philosophers, interested in the problem, paid particular attention to the contradiction which existed between human independence and the continuous chain of causes called by the Greeks εἱμαρμένη and by the Latins *fatum* (fate or destiny), Christianity was above all preoccupied with the contradiction existing between human free volition and divine omnipotence.

Whilst again the Greek and Roman philosophers, the Fathers of the Church, the Schoolmen, and the Scholars of the Reformation based their arguments upon reason, modern philosophers and psychologists argue from the point of view of experimental psychology. On the one hand, it must be admitted that if the word morality is to have any meaning at all, man must be free and responsible for his acts; duty, obligation, remorse, and responsibility would otherwise become empty words. If man's actions are determined by an external force, acting independently of him, he cannot be held responsible for his actions. On the other hand, psychology teaches us that mental life is made up of a series of mental phenomena. Every state of mind stands in relation to some other phenomenon; in other words, the phenomena of inner life, like those of external nature, are explained by the law of cause and effect. A man is moved to act by certain motives, but these motives themselves are the result of certain external influences as modified by character, which, in its turn, is the result of previous acts, either of the individual or of his ancestors.

The vexed question of free-will is still a subject of controversy and a problem of the keenest interest. The rapid growth, however, of the sciences of physics, sociology, and biology, and especially of the theory of evolution which looks upon man as a mere link in the chain of casual development, tends to prove that the idea of freewill is a mere illusion.—BIBLIOGRAPHY: D. Stewart, *Moral Philosophy*; W. James, *Principles of Psychology*, and *The Will to Believe*; A Bain, *The Emotions and the Will*; Ladd, *Psychology, Descriptive and Explanatory*; J. Ward, *The Realm of Ends*; H. Bergson, *Time and Free Will*; Renouvier, *Les Dilemmes de la métaphysique pure*; E. Boutroux, *La Contingence des lois de la nature*.

FREEZING, or SOLIDIFICATION, the changing of a liquid into a solid. Substances which are crystalline when solid undergo the change from the liquid state at a definite temperature, called the freezing-point. Other substances, such as wax, have no unique temperature of solidification, but gradually become solid while cooling through a certain range of temperature. While solidifying, a substance undergoes a change of volume, and gives out latent heat. For crystalline bodies, the temperature of solidification of the liquid is the same as the melting-point of the solid, and methods of determining this temperature are described under art. *Melting-point*. The range of freezing-point temperatures is very wide, varying from that of helium, below —270° C., to tungsten, which melts about 2,800° C.; carbon is supposed to melt about 4,000° C. A knowledg of these freezing- or melting-points is very useful in thermometry, and when testing a thermometer of wide range a series of bodies is chosen for which the melting-points are known. (*See* THERMOMETER.)

Change of Volume. In most cases the change from liquid to solid is accompanied by a diminution of volume, but metals from which castings can be made, such as brass and steel, and a number of substances of which water is the most notable, increase in bulk as they become solid. The change in the case of water is almost 9 per cent, so that ice is less

dense than water, and an iceberg in sea-water floats with about one-tenth of its volume above the water surface.

Effect of Pressure. When pressure is applied to a substance, it affects the temperature of solidification. If a substance contracts on solidifying, an increase of pressure raises the freezing-point. The freezing-point of water is lowered 1·13° C. by a pressure of 1 ton per square inch, or a pressure of 135 atmospheres is required to freeze water at −1° C. Water has been kept in the liquid state at −20° C. by applying a pressure of 13,000 atmospheres.

When water fills a closed space while subjected to a temperature below zero, it exerts a great pressure on the containing walls; this is the cause of the bursting of water-pipes during severe frost. When the temperature of snow is near the melting-point, a snowball may be formed by the pressure of the hands, but if the snow is considerably below zero, it does not cohere readily. The icy track sometimes made when a loaded cart passes over a snow-covered road is caused by the melting of the snow by pressure and its subsequent freezing into a film of ice when the pressure is released. For the same reason a weighted loop of wire hung on a block of ice slowly cuts through the ice but leaves the block solid at the finish. This effect is a contributing factor in the motion of glaciers, the ice melting where there is much pressure. (*See* GLACIERS.)

Supercooled Liquids. Water and other liquids may be cooled below their normal freezing-points without freezing if all air is removed and vibration is prevented. When a crystalline particle is dropped into the supercooled liquid, the latter suddenly freezes with evolution of latent heat and rise of temperature to the normal freezing-point. Water has been kept in capillary tubes at −20° C. without freezing.

Effect of Solution. Water which contains a dissolved salt freezes at a lower temperature than pure water; sea-water freezes at −4° C. The greater the amount of salt dissolved, the more is the freezing-point lowered. If a number of grammes of a substance be taken equal to the number which specifies the molecular weight of the substance, the amount thus measured is termed a gramme-molecule. It is remarkable that if a gramme-molecule of any non-electrolytic substance is dissolved in a large mass of liquid, the lowering of the freezing-point of the liquid is the same, whatever the substance. If, from the lowering observed in a dilute solution, the depression of the freezing-point is calculated which would be caused by dissolving one gramme-molecule in a hundred grammes of the solvent, we obtain the molecular depression of the freezing-point or the cryoscopic constant of the liquid; for water the value is 18·6.

Cryohydrates. When a weak solution of a salt in water is gradually cooled, pure ice is formed and the solution becomes stronger; finally the saturated solution freezes into a solid called a cryohydrate. The stronger the solution to begin with, the lower is the temperature at which ice begins to form.

Freezing Mixtures. As a general rule, solids when dissolved in water cause a fall of temperature. This is the case with common salt, and when snow is substituted for water, the salt dissolves to form a liquid and there is a marked fall of temperature. Freezing mixtures are made by mixing together two or more substances which form a solution at a temperature below zero. If equal weights of salt and snow are mixed together, a liquid is formed which has a temperature of about −20° C.; when four parts of calcium chloride are mixed with three parts of snow, the liquid formed falls to about −50° C. Such mixtures are employed to obtain low temperatures for laboratory experiments.

Freezing Machines. The principle employed in the Carré ammonia apparatus is the production of cold by evaporation. (*See* EVAPORATION.) Ammonia gas is freed, by heat, from a strong aqueous solution of ammonia, and led to a closed vessel containing another vessel with the water to be frozen, where it is condensed. When, after cooling, the liquid ammonia is evaporated, the gas abstracts latent heat from the water which is thus frozen. Much greater cold can be produced by the evaporation of liquid air. *See* LIQUEFACTION OF GASES; VAPORIZATION.

Solidification of Gases. Oxygen, nitrogen, and hydrogen, once known as permanent gases, have been solidified from their liquids. By rapidly evaporating a mass of liquid air, Dewar obtained about a pint of solid air. Nitrogen, hydrogen, and helium have also been solidified by a similar cooling process, though with greater difficulty.—BIBLIOGRAPHY: C. H. Draper, *Heat*; W. C. D. Whetham, *Solution and Electrolysis*; Kaye and Laby, *Physical Tables*.

FREIBERG (fri'berh), a German mining town, the centre of the mining district of Saxony, 19 miles by rail W.S.W. of Dresden, near the Mulde. There are still remains of its former walls, towers and ditches, but their site has mostly been converted into a promenade. The principal buildings and establishments are the cathedral,

the mining academy with a museum attached, the town house, the castle (now a military magazine), and the silver refinery. The Freiberg district yields silver, copper, lead, and cobalt. Pop. 34,742.

FREIBURG (frī'burh), or **FREIBURG IM BREISGAU**, a town of Baden, on the Dreisam, 42 miles S.S.E. of Strasbourg. It consists of the town proper, still possessing some remains of fortifications, and of large suburbs. The chief buildings are the cathedral, a large and beautiful Gothic structure, with a fine portal richly sculptured, and surmounted by a tower with a spire of exquisite open work 380 feet high; the Ludwigskirche; the university, founded in 1456; the museum, and theatre. The manufactures are numerous, but not individually of great extent. Pop. (1925), 90,475.

FREIGHT, the sum paid by a merchant or other person hiring a ship or part of a ship, for the use of such ship or part during a specified voyage, or for a specified time; also any sum charged for the transportation of goods.

FREISING (frī'zing), a town of Germany in Bavaria, on the left bank of the Isar, 16 miles N.N.E. of Munich. It has a fine old cathedral church. Pop. 14,974.

FREISTADTL (frī'stât-l), a town of Czechoslovakia, formerly in Hungary, on the Waag, with a large trade in cattle. Pop. 9,000.

FRÉJUS (frā-zhüs; ancient **FORUM JULII**), a town, France, department of Var, on the Mediterranean, 45 miles N.E. of Toulon. Among its Roman antiquities are the remains of a port, quays, and lighthouse, a triumphal arch, an amphitheatre, and aqueduct. Pop. 4,000.

FREMANTLE, Hon. Sir Edmund Robert, G.C.B., British admiral, born in London in 1836. He entered the navy in 1849, and saw service in the Burmese War of 1852, in New Zealand in 1864–6, and in the Ashanti War in 1873–4. He became a rear-admiral in 1885, was commander of the Channel Squadron in 1886, commander-in-chief in the East Indies from 1888 to 1891, in China from 1892 to 1895, and at Plymouth from 1896 to 1899. He was knighted in 1889, and retired with the rank of admiral. He published *The Navy as I have known it* (1905). He died in 1929.

FREMANTLE, the chief seaport of Western Australia, at the mouth of the Swan River, 12 miles from Perth, with which there is communication both by rail and river-steamer. There are several fine buildings, including the town hall, court-house, and the Episcopal and Roman Catholic churches. The river is crossed by a long wooden bridge. The unsatisfactory harbour accommodation has been improved by blasting and the construction of moles. A pleasure resort, Fremantle has several beaches for bathing, while a little farther away is the popular Point Walter. Electric tramways serve the town and district. The manufactures include aerated waters, boots, soap, furniture, and confectionary. Pop. (1931), 35,143.

FRÉMONT, John Charles, American explorer, born at Savannah, Georgia, 1813, died in 1890. He conducted five separate and adventurous expeditions which explored the passes of the Rocky Mountains, and practically opened up the great far west. He took an active part in the conquest of Upper California, and served in the Civil War. Afterwards he became a lawyer and an active promoter of railroads.

FREMONT, an American city, capital of Sandusky County, Ohio. It has a considerable trade, lines of steamers running from the city, which stands at the head of steam navigation on the River Sandusky, to the principal ports of Lake Erie. Pop. 11,407.

FRENCH, John Denton Pinkstone, Earl French of Ypres, O.M., K.P., G.C.B., G.C.V.O., &c., British soldier, born at Ripple, Kent, in 1852. After four years in the navy he entered the 8th Hussars in 1874, and served in the Sudan campaign of 1884–5 with the 19th Hussars, which regiment he commanded from 1889 to 1893. He held staff and other appointments from the latter year until 1899, when he was gazetted as major-general to command the cavalry division in Natal. He commanded the troops at Elandslaagte in that year, left Ladysmith in the last train to get through before the investment, and was then appointed lieutenant-general commanding the cavalry division in South Africa.

At the end of 1899, he commanded in some very successful operations at Colesberg, and subsequently relieved Kimberley (Feb., 1900), his cavalry also contributing much to the success of Lord Roberts's further operations in the advance to Bloemfontein and Pretoria and afterwards. He was frequently mentioned in dispatches. In 1901 he was appointed to the command of the First Army Corps at Aldershot, and became Inspector-General of the Forces in 1907. In 1913 he was made field-marshal, but resigned in March, 1914, in consequence of a controversy between the army and the Cabinet, over the service of the army in Ulster.

At the outbreak of the European War he re-entered the army and com-

manded the Expeditionary Force in France, and fought the battles of Mons (Aug., 1914) and of Ypres (19th Oct. to 21st Nov., 1914). In Dec., 1915, French was succeeded by Haig, whilst he himself took command of the home forces, and was raised to the peerage as Viscount French of Ypres and High Lake, Roscommon. In 1918 he was appointed Viceroy of Ireland. In 1919 he published his account of the First Expeditionary Force under the title "1914." He was succeeded in the Lord-Lieutenancy of Ireland by Viscount Fitzalan, and was created an Earl in 1921. He died in 1925.

FRENCH BEANS, or **KIDNEY-BEANS,** the *haricots* of the French, are the products of the *Phaseŏlus vulgāris,* supposed to be a native of the East Indies, but now commonly cultivated in all parts of the globe. This plant is a twining annual, bearing alternate leaves, on footstalks, composed of three oval pubescent follioles. The flowers are whitish, somewhat resembling those of the pea. The seeds are more or less kidney-shaped. A great number of varieties are cultivated, among which is that commonly called *Lima bean.* They are eaten prepared in various manners.

FRENCH BERRIES, known also as *Avignon Berries* and *Yellow Berries,* the fruit of the *Rhamnus Clusii,* or other species of buckthorn, rather less than a pea, have a bitter and astringent taste, and are used by dyers and painters as a yellow colouring-matter.

FRENCH EQUATORIAL AFRICA, or **FRENCH CONGO,** an African territory bounded on the south and east by the Rivers Congo and Ubangi and by the Anglo-Egyptian Sudan, on the north by the Sahara, and on the west by the Cameroons (part of which is now included in French Equatorial Africa), Rio Muni, and the Atlantic; total area, 912,049 sq. miles; pop. (1931), 3,192,282. In 1910 the French Congo was divided into three colonies, Gabun, Middle Congo, and Ubangi-Shari (including Chad Territory), and the name was changed to French Equatorial Africa. In 1911 France ceded parts of the colony to Germany, but received them back in 1919. In 1920 the Chad territory was separated from the Ubangi-Shari and erected into a colony.

The chief rivers are the Gabon, Ogowe, and Kwilu, and the principal stations are Libreville (capital of Gabun Colony), Brazzaville (capital of Middle Congo), Bangui (capital of Ubangi-Shari), Fort Lamy (capital of Chad), Njola, and Loango. In spite of the fact that the region is very unhealthy, a considerable trade is carried on in caoutchouc, cocoa, coffee, ivory, ebony, mahogany, palm-oil, &c. The natural resources of the colony are comparatively undeveloped; there are 300,000 sq. miles of tropical forest awaiting exploitation, and a lack of adequate means of transport is a serious drawback.

Each colony has a Lieutenant-Governor under the Governor-General, who resides at Brazzaville. Every colony, too, has an administrative council and a separate budget, though there is a general budget for French Equatorial Africa. Railway mileage is about 2,366 miles; a new railway line was completed in 1930 between Brazzaville and Pointe-Noire on the Atlantic. There is a radio service with France. The total length of telegraph line is about 3,253 miles.—Cf. F. W. H. Migeod, *Across Equatorial Africa.*

FRENCH HONEYSUCKLE (*Hedysārum coronarium*), the inappropriate name of a leguminous plant, a common perennial in gardens, where it is grown for the sake of its beautiful scarlet flowers. In Sicily and Spain it is largely cultivated as a green crop, yielding an enormous quantity of herbage.

FRENCH LANGUAGE AND LITERATURE. *See* FRANCE.

FRENCH POLISH, a solution of shell-lac in alcohol, used for giving a smooth surface-coating to furniture and cabinet-work. The most common of the varnishes known under the name of French polish are prepared as follows: pale shell-lac, 5½ ounces; finest wood-naphtha, 1 pint: dissolve. Or pale shell-lac, 3 lb.; wood-naphtha, 1 gallon.

FRENCH REVOLUTION. *See* FRANCE.

FRENCH SUDAN. Since 1920 the official name of Upper Senegal-Niger (q.v.)

FRENCH WEST AFRICA, a vast region belonging to France, and comprising Senegal, the Colony of the Niger, French Guinea, the Ivory Coast, the Upper Volta Colony, the territory of Mauritania, French Sudan, Dakar and dependencies and Dahomey. Upper Volta ceased to be a colony in 1933. Its area and population were divided as follows: 27,220 sq. miles and 268,239 inhabitants were added to Niger; 59,219 sq. miles and 2,018,837 inhabitants to the Ivory Coast; and 20,226 sq. miles and 713,167 inhabitants to French Sudan. It extends from the Atlantic to Lake Chad, where it meets the hinterland of the French Congo. The limits of French influence have been partly defined by conventions arranged with Great Britain in 1890, 1898, 1904 and 1906. The delineation

of the boundary was completed in 1912, and approved by the French and British Governments in 1914. The whole is under a Governor-General, whose seat is the rising port of Dakar, connected by railway with St. Louis. In the interior are Kayes, Bafulabé, and Bammaku (connected by a railway), Timbuktu, and Jenné. Area, 1,799,039 sq. miles; pop. (1931), 14,575,973. *See* articles on the various colonies, and TOGOLAND.

FRENSHAM, village of Surrey. It is nearly 4 miles to the S. of Farnham. The common is used by the military, being convenient for Aldershot. On it are three mounds called the Devil's Jumps. Frensham is noted for its ponds, used for boating, bathing and fishing. There are two, the larger covering 90 acres.

FRERE, Sir Henry Bartle Edward, statesman and administrator, born at Clydale, Wales, 1815, died at Wimbledon 1884. He entered the East India Company's civil service in 1833; mastered the native languages with great rapidity, and introduced important improvements into the system of tax collection.

From 1847 to 1850 he was Resident at Sattara, and at the latter date succeeded Sir Charles Napier as Chief Commissioner at Scinde. He rendered valuable services during the Mutiny, at the close of which he was nominated to the Viceroy's Council at Calcutta.

He returned to England in 1867. In 1872 he negotiated a treaty with the Sultan of Zanzibar, abolishing the slave-trade in that ruler's dominions. In 1877 he went to South Africa as Commissioner for the settlement of native affairs, but this mission was a failure. He was the author of a life of his uncle, John Hookham Frere, and numerous lectures and pamphlets. —Cf. John Martineau, *Life and Correspondence of Sir Bartle Frere.*

FRERE, John Hookham, born in London 1769, died at Malta 1846. He is now chiefly remembered as one of the writers in the *Anti-Jacobin Review* at the close of the eighteenth century; and afterwards connected with the establishment of the *Quarterly Review* in 1809. A satirical poem published by him in 1817, entitled *Prospectus and Specimen of an Intended National Work, by William and Robert Whistlecraft,* followed by another entitled *The Monks and the Giants,* obtained in their day much popularity.

His translations in verse of some of the comedies of Aristophanes are well known for their remarkable excellence, though superseded by the much more scholarly and livelier version of Rogers. He entered Parliament in 1796, and succeeded Canning as Under-Secretary for Foreign Affairs in 1799. From 1818 to 1819 he acted as British Ambassador in Spain, and subsequently held other diplomatic posts in Portugal and Prussia. The latter years of his life were spent in Malta.—Cf. Gabrielle Festing, *J. H. Frere and his Friends.*

FRESCO PAINTING, a method of mural painting in water-colours on wet and caustic grounds of lime. Mineral or earth pigments are employed, which resist the chemical action of lime. In drying, as the plaster absorbs carbonic acid from the air and hardens, the colours are incorporated with the plaster, and are thereby rendered as permanent as itself. In producing fresco paintings, a finished drawing on paper, called a cartoon, exactly the size of the intended picture, is first made, to serve as a model. The artist then has a limited portion of the wall covered with plaster, and upon this he traces from his cartoon the part of the design intended for the space. As it is necessary to the success and permanency of his work that the colours should be applied while the plaster is damp, no more of the surface is plastered at one time than what the artist can finish in one day. A portion of the picture once begun, needs to be completely finished before leaving it, as fresco does not admit of retouching after the plaster has become dry. On completing a day's work, any unpainted part of the plaster is removed, cutting it neatly along the outline of a figure or other definite form, so that the joining of the plaster for the next day's work may be concealed.

The art is very ancient, remains of it being found in Crete, Egypt, India, Greece, and Mexico. Examples of Roman frescoes are found in Pompeii and elsewhere. After the beginning of the fifteenth century fresco painting became the principal process used by the greatest Italian masters, until it was displaced by the use of oil paint; an intermediate stage being the use of oil or tempera on a fresco foundation.

Fresco Secco is distinguished from true or *buon* fresco by being executed on dry plaster, which is moistened with lime-water before the colours are applied. In *spirit fresco* a wax and varnish medium is used to apply colour to a dry plaster ground. Fresco painting has in recent years again been revived, and works of this kind have been executed in the British Houses of Parliament and other public and private buildings, especially in Germany.

FRESHFIELD, Douglas William, English traveller, was born in 1845, and was educated at Eton and at University College, Oxford, where he graduated in 1867. He was called to

the Bar in 1870, but devoted himself mainly to travel, having visited and explored Syria, the Caucasus, Armenia, Algeria, Corsica, and the Alpine and Himalaya regions. He published the following interesting and readable accounts of his journeys: *Travels in the Central Caucasus and Bashan* (1869), *The Italian Alps* (1875), *Climbs in the Caucasus* (1888), *The Forests of Abkhasia* (1890), *The Exploration of the Caucasus* (1896), *Round Kangchenjunga* (1904), *Hannibal once more* (1914), and *Below the Snow Line* (1923). He was editor of the *Alpine Journal* from 1872 till 1880, and president of the Alpine Club from 1893 till 1895, besides being for a long time one of the honorary secretaries of the Royal Geographical Society.

FRESHWATER, watering place in the west of the Isle of Wight, on the Yar, 2 miles from Yarmouth. Some distance from the village is Freshwater Bay. Pop. 3,439.

Near Freshwater is Farringford, long the residence of Lord Tennyson. A landmark is High Down, 485 feet high, on which there is a memorial cross to the poet. Part of this is the property of the National Trust and has been renamed Tennyson Down.

FRESH-WATER STRATA, in geology, strata formed by the deposition of mud or sand in lakes or rivers, or by fresh water filtering into caverns, the character of the strata being determined by an examination of the contained fossils. They are generally more limited in area than those deposited by the sea.

FRESNEL (frā-nel), **Augustin Jean,** French physicist, born 1788, died 1827. He did more perhaps than any other man to establish the undulatory theory of light, elucidated the phenomena of interference, diffraction, and polarization, and greatly improved the illuminating apparatus of lighthouses. *See* his biography by Arago in volume 1 of his complete works, published by the French Government, 1866–70; also E. T. Whittaker, *History of the Theories of Æther and Electricity.*

FRESNILLO (-nil'yō), a city, Mexico, state of and 37 miles N.N.W. of Zacatecas. In its vicinity are celebrated silver- and copper-mines. Pop. 27,000.

FRESNO, a town of the United States, in California, in a great irrigation district, with important fruit, corn, and wine industries. Pop. (1930), 52,513.

FREUD, Sigmund, Austrian physician and psychologist, born at Freiberg, Moravia, 6th May, 1856. He studied at Vienna and Paris under Charcot, and was appointed professor of neuropathology at Vienna in 1902. His contributions to science are a new method for the analysis and treatment of hysteria, called psycho-analysis, and a theory of dreams. Dreams, according to Freud, represent the gratification of suppressed wishes in a disguised manner. It must, however, be observed that the method of psychological investigation to which Freud gave the name of psycho-analysis was already discussed by Max Nordau in his *Entartung* (Degeneration, 1893). His works include: *Papers on Hysteria* (1895), *Interpretation of Dreams* (1913), *Delusion and Dream* (1917), *Psychopathology of Everyday Life* (1901 and 1914), *Three Contributions to the Theory of Sex* (1905 and 1918), *Totem and Taboo* (1913 and 1919), *Symptoms of Inhibition and Fear* (1926), *The Problem of Analysing the Layman* (1926), *Discontent existent in Culture* (1930). *See* PSYCHO-ANALYSIS.

FREY (frē), Norse god, also called Freyr. He was the god of sunshine and fertility and possessed a famous sword. In order to win the love of Gerda he gave away this weapon and so was conquered in his last fight.

FREYA, in the northern mythology, the goddess of love, and wife of Odin; she was a friend of sweet song, and loved to hear the prayers of mortals. She had a famous necklace, much celebrated in Scandinavian legends. Freya is the sister of Frey and the daughter of Njörd, and often confounded with Frigga.

FREYTAG (frī'tāh), **Gustav,** German poet, dramatist, and novelist, born 1816, died in 1895. He was editor of the *Leipzig Grenzboten* from 1848 to 1870, and produced numerous successful plays, tales, and poems. Among his more famous works are: *Soll und Haben*, *Bilder aus der Deutschen Vergangenheit*, *Die Verlorene Handschrift*, and *Die Ahnen*, a series of six romances illustrative of old German life.

FRIAR (Fr. *frère* Lat. *frater*, brother), in the Roman Catholic Church an appellation common to the members of all religious orders, but more especially to those of the four mendicant orders, viz. (1) Minors, Grey Friars, or Franciscans; (2) Augustines; (3) Dominicans or Black Friars; (4) White Friars or Carmelites.

FRIAR'S-BALSAM, an alcoholic solution of benzoin, styrax, tolu balsam, and aloes, used as an application for wounds and ulcers.

FRIAR'S CRAG, beauty spot on the banks of Derwentwater. It is on the east side of the lake, about a mile from Keswick. Since 1921 it has been the property of the National Trust. Here is a Ruskin memorial.

FRIBOURG, or **FREIBURG** (frē-bör, frī'burh), a canton of Switzerland, surrounded by the cantons of Berne and Vaud, except a narrow part, which touches the Lake of Neufchâtel. The southern part is mountainous, the northern part more level. The whole canton abounds in excellent pasturage, and cattle-breeding and dairy husbandry are the chief occupations of the inhabitants. Area, 644 sq. miles; pop. (1930), 143,230, of whom the great majority are Roman Catholics speaking French. The canton sends seven representatives to the National Council.

FRIBOURG, the capital of the canton, is picturesquely situated on the Saane, 17 miles S.W. of Bern. It stands partly on a rocky eminence at the edge of a ravine nearly surrounded by the river, which is here spanned by a suspension bridge 168 feet above the water. The Gothic church of St. Nicholas contains one of the finest organs in Europe. Pop. (1930), 21,557.

FRICOURT, a village of France, department of Somme, 5 miles east of Albert. It was captured by the Germans during the European War, and retaken by the Allies in Aug., 1918.

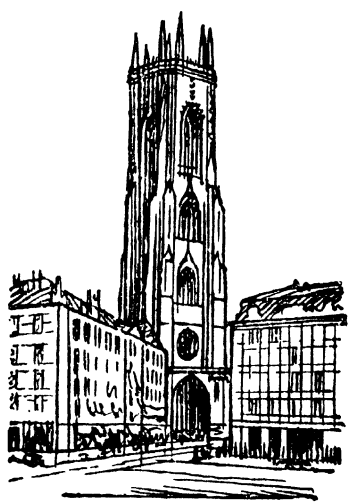
FRICTION, a force which is brought into play when one body moves or tends to move over another. It always acts as a resistance to motion; when it prevents motion, it is called static friction; when slipping takes place, it is known as kinetic friction. Static friction may have any value between zero and a maximum which is reached just before slipping takes place, and which is called limiting friction. When slipping begins, the friction force suddenly diminishes to a smaller value; it is a matter of common experience that a greater force is required to start a mass in motion against friction than is necessary to keep the mass moving.

Friction is proportional to the normal or perpendicular pressure between the two surfaces in contact, and the ratio of the friction force to the normal pressure is called the coefficient of friction. Friction is independent of the area of the rubbing surfaces, and when motion takes place, the friction is independent of the speed of slipping except for very low speeds. These laws assume that no change takes place in the surfaces as the result of rubbing—a condition which is never realized. Friction may be diminished by smoothing the surfaces, by the use of rollers, wheels, or ball-bearings, and by applying lubricants such as oil, graphite, &c

Friction is the ultimate force employed in stopping vehicles by means of brakes. It is by means of friction we are able to hold objects in our hands, and to walk on the ground. Friction always produces heat, and, when the surfaces are unlike, it also generates electricity. The particles of a fluid exert friction against each other, and against any solids in contact with them.

FRICTION CLUTCH or **COUPLING,** a device by which a constantly rotating shaft gradually communicates its motion, without shock, to a driven part.

FRIDAY, the sixth day of the week, from the A.Sax. *Frige-dæg,* the day



Fribourg, Church of St. Nicholas

sacred to *Frigga,* the Norse goddess of love. It is the day of religious gatherings among Mohammedans. *See* GOOD FRIDAY.

FRIDESWIDE, English saint. Daughter of Didan, ealdorman of Oxford under Ethelbald, she fled from a Mercian noble's importunities to Binsey and built an oratory. She died about 735. Her well is still visited. Becoming abbess of an Oxford nunnery, which was appropriated by Austin canons in 1004, she has been Oxford's patron saint since 1180 and was canonized in 1481. Her day, Oct. 19, which was removed from the calendar at the Reformation, is still commemorated locally. On the site of her chapel in Oxford, Wolsey erected Christ Church cathedral.

FRIEDLAND (frēd'lânt), (1) a town of Northern Bohemia, Czechoslovakia. Wallenstein was created Duke of Friedland in 1622. Pop. 7,000. (2) A small town of East Prussia, 28 miles S.E. of Königsberg, on the River Alle. Pop. 3,000. The Russians under Benningsen were here defeated on the 14th June, 1807, by the French under Napoleon. (3) A town of Mecklenburg-Strelitz, 30 miles N.E. of Strelitz. Pop. 7,550.

FRIEDRICHRODA, a German town, in the former Duchy of Gotha, charmingly situated in the valley of the Schilfwasser, a favourite health and summer resort. Pop. 7,000.

FRIEDRICHSHAFEN, town and lake port of Württemburg, Germany. It stands on the Lake of Constance. It is a pleasure resort, but is chiefly famous as the headquarters of the Zeppelins, which were built here and made their trial flights over the lake. There is a harbour and steamers ply between the various places on the lake. Pop. 11,289.

FRIENDLY ISLANDS, or TONGA ISLANDS, a cluster in the South Pacific Ocean, between lat. 15° and 23° S., and long. 173° and 177° W. They consist of three groups, Tongatabu, Haapai, and Vavau, which are divided from each other by two narrow channels, and number altogether about 150, with a collective area of about 385 sq. miles. The largest island is Tongatabu, in the south group, which contains the capital, Nukualofa. Vavau, in the north group, which is named after it, is next Tongatabu in size; the centre group is called Haapai.

The islands are nearly all volcanic, with coral reefs and rocks about them; earthquakes and volcanic eruptions are frequent, during one of which, in Oct., 1885, a new island 2 miles in circumference suddenly appeared. These islands were discovered in 1643 by Tasman, but received their collective name from Cook. They are governed by a native Christian prince under British protection. In April, 1918, the native King George II was succeeded by his daughter Salote. The trade is considerable, the chief exports being copra and fruit. Pop. (1931), 27,700 Tongans, 482 Europeans, 265 half-castes, and 392 other Pacific islanders: total 28,839.

FRIENDLY SOCIETIES, societies formed for the mutual advantage of the members, and based on the principle that it is by the contribution of the savings of many persons to one common fund that the most effectual provision can be made for casualties affecting, or liable to affect, all the contributors.

Mutual provident associations, taking the friendly society form, may be grouped under five main heads: (1) Affiliated Societies: (2) Ordinary Societies, subdivided into (*a*) Centralized or General Societies, (*b*) Peculiar Trade and Profession Societies, (*c*) Local, including Dividing, Clubs, (*d*) Societies of Women; (3) Collecting Societies; (4) Medical Societies; and (5) Other Societies registered under the Friendly Societies Act, including (*a*) Cattle Insurance Societies, (*b*) Benevolent Societies, (*c*) Working Men's Clubs, and (*d*) Specially Authorized Societies, i.e. those existing for purposes to which the Treasury specially extends any of the provisions of the Act. Divisions (1) and (2) offer a sickness as well as a funeral benefit to their members, and some of them offer a deferred annuity or superannuation as an optional benefit in addition.

Each registered society or branch must have a registered office, and each society must send annually to the Registrar of Friendly Societies a return of income and expenditure, and assets as audited. Every five years the financial condition of societies is inquired into and a report made by a valuer. The funds are guarded against maladministration or fraud, and facilities for the prosecution of the offender or offenders given. The Friendly Societies Act of 1896 consolidated the law on the subject, and was supplemented in some ways by the Collecting Societies and Industrial Assurance Companies Act of the same year.

The following figures of membership and funds in the year 1913 are taken from the annual report of the Chief Registrar of Friendly Societies:

	Members.	Funds.
1. Affiliated Societies	2,928,186	£33,017,726
2. Ordinary Societies	3,763,369	£28,810,212
3. Collecting Societies	9,726,213	£14,839,173
4. Medical Societies	130,189	£78,129
5. Other Societies	820,607	£3,526,687

Mutual provident association, on the voluntary principle and in a friendly society form, as an economic duty, is at present characteristic mainly of the English-speaking races. The affiliated societies (or orders, as they are called) extend their operations beyond the confines of the United Kingdom to America and the British colonies and dependencies. These societies are fraternities or brotherhoods, occupying in part the position of the old craft guilds.

The Independent Order of Odd-

fellows (Manchester Unity) and the Ancient Order of Foresters far outstrip all the other orders in numerical and financial strength, the former possessing in 1930 a membership of 746,087, and in its lodges a capital of £20,861,967, whilst the latter had in the same year 555,929 members, and funds to the sum of £12,935,917 in its branches, or courts as they are termed. The amount of relief work done by these societies may be estimated from the fact that during 1918 the Manchester Unity paid out £766,267 in sickness benefit and £297,680 in funeral benefit, while the A.O.F. paid out £530,353 and £231,879 respectively.

The Loyal Order of Ancient Shepherds (Ashton Unity) is another powerful fraternity, being particularly strong in Scotland; other orders are known as Druids, Rechabites, Free Gardeners, Sons of Temperance, Romans, Locomotive Steam Enginemen and Firemen's Friendly Society, &c. The Independent Order of Rechabites and the Order of Sons of Temperance exhibit the economic phase of the temperance movement, and the former especially has increased very rapidly in recent years. The Locomotive Steam Enginemen, &c., is confined to railway employees, and is the only peculiar trade society which is constituted as an order. In this group, as a rule, the constitution and government are purely democratic, consisting of individual branches (called lodges, courts, tents, senates, &c.), local gatherings of branches (generally called districts), and a central executive elected from annual or biennial parliaments of branch delegates.

The general group consists of bodies with one central office and a scattered area of membership up and down the country, as the Hearts of Oak, the National Sick and Burial Association, and the United Patriots; or of bodies known as county societies, because the membership of each society is restricted to the geographical area of some one county—generally of the east and south of England. Before it became a collecting society the Hearts of Oak was by far the largest of the general group. In the case of these bodies the funds are centralized, and not retained in districts and lodges (or courts), as is the case with the orders.

Among the societies connected with peculiar trades, the most important are those connected with mining. These are accident insurance organizations, the funds of which are subsidized by the employers as a contribution towards their liabilities in the case of fatal or non-fatal casualties to the workmen in their employ. By means of them the workmen were able to contract themselves out of the Employers' Liability Act of 1880 and the Workmen's Compensation Act of 1897. Membership is almost entirely confined to the coal-getting miners. Since the Workmen's Compensation Act of 1906 a contracting-out scheme, however, has to be registered.

Local benefit clubs have had their day, and are being displaced by branches of the affiliated orders. A large proportion of this division are tontine or dividing societies, i.e. temporary combinations on the mutual basis, which break up and divide their capital every twelvemonth or so, and then commence anew.

The collecting societies insure mainly for funeral benefit, but do pay other benefits. The larger members of the group have nearly swallowed up the smaller, and in Britain there are four societies of over 100,000 members, which comprise between them over 90 per cent of the members and funds. These societies are: Liverpool Victoria Legal, Royal Liver, the Hearts of Oak, and Scottish Legal, the membership of the first two exceeding 4 and 3 millions respectively, while the Hearts of Oak has nearly half a million members.

As a rule, these societies are trading concerns chiefly for the benefit of the promoters and collectors, these latter calling from door to door for the weekly pence of the members, but this does not apply to the Hearts of Oak. There is only a technical difference between them and the industrial insurance companies, and as a result of the recommendations of the Industrial Insurance Committee which reported early in 1921, legislation is foreshadowed whereby collecting societies will be required to make a deposit of the same amount as that required from insurance companies conducting life insurance business.

Separate societies used formerly to be established consisting wholly of 'juveniles,' in connection with societies of the general group and branches of the affiliated orders, but in 1895 the necessity for such separate societies was done away with by an enactment that every society may have members of any age exceeding one year. Societies of women, however, have now begun to play a very definite part in the voluntary thrift movement. Altogether the number of different bodies of one class or another registered as separate societies or branches, in Great Britain and Ireland, is about 30,000.

Though friendly societies exist mainly for the benefit of the 'masses,' the friendly society form of mutual insurance is that under which some flourishing assurance societies, such as the Clergy Mutual, the National

Provident, and the United Kingdom Temperance, were originally established; and we may instance as more recent examples of its adaptation to the 'classes,' the establishment in London of a society of the general type for the benefit of the medical profession, the Medical Sickness and Annuity Friendly Society; and the Clergy Friendly Society, restricted to members of the Church of England.

The three prime necessities for securing financial stability and efficient government are: (1) Registration, (2) Valuation, (3) Graduation. This last requisite refers to the adoption of a graduated scale of annual contribution according to age on joining.

Friendly societies exist also in the colonies and in foreign countries. In



Friends' Meeting House, Eastcheap, London

the several Australasian colonies more than £3,000,000 has been accumulated by these societies. In France a distinction is drawn between societies that are simply authorized and those that are approved, and these latter enjoy many privileges, which amount to a considerable State subsidy. In Belgium, also, a distinction is made between recognized and non-recognized societies. In Holland half the population are insured in some sickness benefit society. In Spain the history of these societies may be traced back to the mediæval guilds. *See also* BUILDING SOCIETIES; CO-OPERATIVE SOCIETIES.—BIBLIOGRAPHY: J. F. Wilkinson, *The Friendly Society Movement*; Fuller, *The Law relating to Friendly Societies*; A. C. Stevens, *The Cyclopædia of Fraternities*; *Annual Reports of the Chief Registrar of Friendly Societies*.

FRIENDS, SOCIETY OF, commonly known as **QUAKERS,** a society of Christians which took its rise in England about the middle of the seventeenth century. George Fox, a native of Drayton, in Leicestershire, was the first to teach the religious views which distinguish the society. He commenced his ministerial labours in 1647, and immediately fell under persecution. But persecution, as usual, enlisted the sympathies of many in his cause. After making multitudes of converts he organized them into a Church, which became, although not until after severe persecution, one of the recognized sects of Christianity. Among the other eminent members of the society in its early days we may mention William Penn, Robert Barclay, George Whitehead, Stephen Crisp, Isaac Pennington, John Crook, Thomas Story, &c.

The early Quakers were marked as a peculiar people by their testimonies against oaths, a paid ministry, and tithes; their use of the singular pronouns when addressing only one person; their refusal to take off the hat as a compliment to men; the plainness of their apparel; and their disuse of the ordinary names of the months and days. The name Quakers was given to them in derision, and though they accepted the name they call themselves by that of Friends. A Derby magistrate was the originator of the derisive epithet according to Fox himself—"because I bade him tremble at the word of God." The persecution and intolerance of which they were the victims, both in England and America, only tended to confirm the faith and strengthen the bond of union among the members of the rising society; and in neither country could it induce the sufferers to relinquish their conformity to what they regarded as duty.

From the diffusion of more enlightened views on the subject of religious liberty, Acts were successively passed by the English Parliament, relieving Friends from the oppression under which they suffered, tolerating their mode of worship, marriage, &c., and allowing them in a court of justice to make an affirmation in place of taking an oath in the usual way. The same liberal policy was pursued in America. One of the brightest chapters in the annals of Quakerism is that relating to the founding of the colony of Pennsylvania. *See* PENN, WILLIAM; PENNSYLVANIA.

But, as in other reforming sects, so among the Quakers, success in the course of time gradually undermined their zeal, and deprived them of many of their characteristic qualities. Gradually the spread of wealth modified the stringency of their 'sumptuary' rules, and there was in consequence a rapid decline of the ancient discipline. Coincident

with these relaxations of rule arose disputes as to doctrine. About the year 1827 Elias Hicks, a native of the state of New York, created a schism in the society by promulgating opinions denying the miraculous conception, divinity, and atonement of Christ, and also the divine authority of the Scriptures. About half the sect in America followed Hicks, and have since been known as the Hicksite Friends.

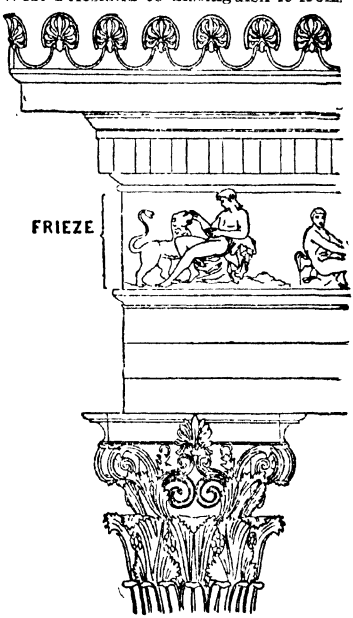
The schism made much stir among Quakers in Great Britain as well as in America, and a movement was begun in favour of higher education, and of a relaxation in the formality of the society. This movement, headed by Joseph John Gurney, of Norwich, was strenuously opposed by a body of Quakers in America, and the result was a division among the Orthodox Friends themselves, and the origin of a new sect, known as Wilburites, from John Wilbur, its founder.

The society, or the orthodox section of it, believes that, under the gospel dispensation, all wars and fightings are strictly forbidden; the positive injunction of Christ, 'Love your enemies,' &c., entirely precluding the indulgence of those passions from which alone such contests can arise. They also believe that the express command, 'Swear not at all,' prohibits the Christian from the use of judicial as well as other oaths. In like manner, following the spirit of the Scriptures, they believe that a special call is necessary to constitute a true minister of the gospel that the faithful minister should not preach for a pecuniary reward, that the essential baptism is of the Holy Ghost, not by water, and that the Lord's Supper is also entirely of a spiritual nature. They therefore renounce both these sacraments so far as the ordinary outward forms are concerned. As to the cardinal doctrines of Christianity, the incarnation, crucifixion, resurrection, redemption through Christ's death, justification, &c., their beliefs are similar to those of orthodox Christians generally. There are about 100,000 members in the United States and Canada. In Great Britain there are 19,151 members and 395 places of worship; Ireland has 2,122 members and 24 places of worship.—BIBLIOGRAPHY: George Fox, *Journal*; J. Besse, *The Sufferings of the Quakers*; T. E. Harvey, *The Rise of the Quakers*.

FRIERN BARNET, an urban district in North Middlesex, England, 3 miles south-east of Barnet, with an ancient church. The London County Lunatic Asylum is here. Pop (1931), 23,081.

FRIES (frēs), **Elias Magnus,** Swedish botanist, born 1794, died 1878. In 1824 he was appointed professor of botany at the University of Lund, and in 1836 was transferred to that of Upsala. His botanical writings are very numerous, and cover the entire field of botany. He devised a natural system of classification, based on morphology and biology, which differs in many respects from those of Jussieu and Decandolle.

FRIESLAND, the most northerly province of Holland, sometimes called West Friesland to distinguish it from



Frieze of the Choragic Monument of Lysicrates, Athens

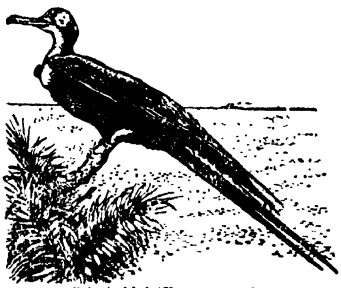
East Friesland, now the district of Aurich in Hanover. It is generally flat, and parts of it are below sea-level. The area is 1,251 sq. miles, four-fifths of which are under cultivation. Leeuwarden is the captial. Pop. (1931), 402,241. *See* FRISIANS.

FRIEZE (frēz), in architecture, that part of an entablature which lies between the architrave and cornice. It is flat, and usually enriched with figures or other ornaments. (*See* ENTABLATURE.) Also an ornamental strip below any cornice.

FRIG'ATE, in the navy, an obsolete term applied to a vessel of a size larger than a sloop or brig and less

than a ship of the line; usually carrying her guns (which varied from about thirty to fifty or sixty in number) on the main deck and on a raised quarter-deck and forecastle, or having two decks. Such ships were often fast sailers, and were much employed as cruisers in the great wars of the eighteenth and early part of the nineteenth centuries. Since the introduction of ironclad vessels the term *cruiser* has been applied to ships taking the place of the frigates of former days.

FRIGATE-BIRD, or MAN-OF-WAR BIRD (*Fregata aquila*), a tropical web-footed bird, the type of a family (Fregatidæ) allied to the pelicans. Including the long tail, the male bird reaches 3 feet in length, but the body is comparatively small. The bill is longer than the head, strong, hooked



Frigate-bird (*Fregata aquila*)

at the point, and sharp. In proportion to the size of the body the wings are longer than those of any other bird, having an extent of 7 feet or more. The flight of the frigate-bird is powerful and graceful. It neither swims nor wades, but catches flying-fish in the air or forces fishing-birds in flight to let go of their prey, which the frigate-bird dexterously seizes as it falls.

FRIGGA, or FRIGG, in northern mythology, the wife of the god Odin, the goddess after whom Friday (O.E. *Frigedæg*) is named. She is a goddess in some respects corresponding with Venus, and is often confounded with Freya (q.v.).

FRILLED LIZARD, an Australian lizard, *Chlamydosaurus Kingii*, so called from a curious membrane-like ruff or tippet round its neck, covering its shoulders, which lies back in plaits when the animal is tranquil, but which rises when it is irritated or frightened. It can run for some distance on its hind legs. A full-grown specimen is about 3 feet in length.

FRIMAIRE (frē-mār; Fr., from *frimas*, hoar-frost), the third month of the French republican calendar, dating from 22nd Sept., 1792. It commenced 21st Nov., and ended 20th Dec.

FRIMLEY, village of Surrey. It is 33 miles from London, on the Southern Rly. It is in near proximity to Aldershot and three miles from Bagshot and is mainly residential. Bret Harte is buried in the churchyard. A colony for tuberculous ex-soldiers and sailors was inaugurated here after the Great War. Pop. 16,472.

FRINTON, watering place and urban district of Essex. It is 2¼ miles from Walton-on-the-Naze and 68½ from London, on the L.N.E. Rly. Of late it has become a fashionable seaside resort. Pop. (1931), 2,196.

FRISIAN ISLANDS, chain of islands off the west coast of Europe from Denmark to Holland. Long subjected to marine erosion, their diminution, observed since Roman geographers first described them, has been retarded in part by sand dunes, earthen embankments and dykes. There are north, east and west groups, respectively Danish, German and Dutch. The N. Frisians, mostly off N. Schleswig, include Fanö, Sylt, Föhr, Amrum, Pellworn and Nordstrand. The E. Frisians include Norderney, Borkum, Wangeroog, Spiekeroog, and others, all favourite summer resorts and bathing stations. The W. Frisians include Rottum, Schiermonnikoog, Ameland, Terschelling, Vlieland and Texel, screening the Zuyder Zee.

They derived their name from the Frisians, a Teutonic people inhabiting the neighbouring territory of Friesland early in the Christian era.

FRISIANS, a German tribe who, about the beginning of the Christian era, occupied the territory between the mouths of the Rhine and the Ems. They became tributaries of Rome under Drusus, and lived for some time on friendly terms with their conquerors, but were driven to hostilities by oppression. In time they extended as far eastward as Slesvig, and even made settlements on the Firth of Forth, and probably in other parts of Northern Britain.

About the end of the seventh century the Frisians in the south-west were subdued by the Franks under Pépin d'Héristal, who compelled them to accept Christianity. A century later the eastern branch of the tribe was conquered and Christianized by Charlemagne. Their country was divided into three districts, two of which were annexed, on the division of the Carlovingian Empire, to the possessions of Louis the German, and the other to those of Charles the Bald.

The latter part was called West Frisia (W. Friesland), and the two former East Frisia (E. Friesland). Their modern history is chiefly connected with Holland and Hanover.

Frisian Language. The *Frisian Language* holds in some respects an intermediate position between Anglo-Saxon and Old Norse. Of all the Teutonic dialects it is the most nearly related to English. Its ancient form exists only in some remarkable collections of laws. Three dialects of it are now recognized: the West Frisian, spoken in the Dutch province of Friesland, about Leeuwarden, Bolsward, &c., and used to some extent in literature; the East Frisian, spoken between the mouths of the Ems and Weser; and the North Frisian, spoken on the west coast of Schleswig and South Jutland, and on the islands Sylt, Föhr, Amrun, &c.

FRIT (*Oscinis frit*), a small greenish-black fly, the larvæ of which do great damage to barley crops in some parts of the north of Europe, and to oats in Britain.

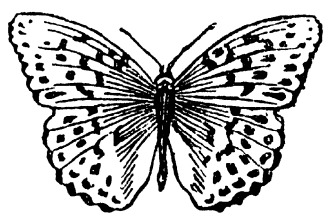
FRITH, William Powell, R.A., born at Studley, near Ripon, in 1819, died in London 1909; studied at the Royal Academy School and practised portrait painting. From 1840, when he exhibited his *Malvolio* at the Royal Academy, he produced a great number of scenes from Shakespeare, Molière, Dickens, Sterne, Goldsmith, &c., besides his immensely popular pictures, *Coming of Age in the Olden Time* (1849), *Life at the Sea-side* (1854), *Ramsgate Sands* (1854—bought by Queen Victoria), *The Derby Day* (1858—now in the National Gallery), *The Railway Station* (1862), *Before Dinner at Boswell's Lodgings* (1868—sold in 1875 for £4,567), *The Private View at the Royal Academy* (1881), &c. He was commissioned by Queen Victoria to paint the marriage of the Prince of Wales. He was elected A.R.A. in 1845, and R.A. in 1852, and was a member of several foreign academies. Large engravings have been produced from a number of his pictures. In 1887–8 he published his autobiography, 3 vols. 8vo.

FRITH GILDS, among the Anglo-Saxons, voluntary associations of neighbours for purposes of order and self-defence. They repressed theft, traced stolen cattle, and indemnified, from a common fund raised by subscription, members who had been robbed.

FRITHJOF (frēt'yof), an Icelandic hero, supposed to have lived in the eighth century. After a series of adventures, recorded in an ancient Icelandic saga of the thirteenth century, he marries Ingebjörg, the widow of the king Hring. The story forms the groundwork of Tegner's popular poem *Frithjof's Saga*, and has been frequently translated.

FRIT'ILLARY (Fritillaria), a genus of plants, nat. ord. Liliaceæ, natives of north temperate regions. *F. Meleagris*, or common fritillary, is found in meadows and pastures in the eastern and southern parts of England. Several species, as *F. imperialis* or crown-imperial, are cultivated in gardens, chiefly introduced from Persia and the warmer parts of Europe.

FRIT'ILLARY, the popular name of butterflies belonging to the largest and most widely distributed family (Nymphalidæ), comprising between 4,000 and 5,000 species, and distinguished by the reduced condition of the front pair of legs, which are useless for walking. British species are:



Fritillary
Argynnis Paphia (Nymphalidae)

silver-washed fritillary (*Argynnis paphia*), dark-green fritillary (*A. aglaia*), queen of Spain fritillary (*A. lathonia*), great tortoiseshell (*Vanessa polychloros*), small tortoiseshell (*V. urticæ*), peacock (*V. io*), red admiral (*V. atalanta*), painted lady (*V. cardui*), purple emperor (*Apatura iris*). Some of the most gorgeous tropical butterflies, such as species of Morpho, belong to the same family.

FRIULI (frī-o'lē) formerly an independent duchy at the head of the Adriatic, and from 1866 to 1918 forming part of Italy and Austria. It was one of the most important duchies of the Longobard kingdom, and up to the fifteenth century, when it was conquered by Venice and its territories dismembered, it retained a considerable degree of independence. The inhabitants, called Furlani, are Italian for the most part, but speak a peculiar dialect. Since the Treaty of Rapallo (1920), Friuli has belonged to Italy, although the Austrian portion of it was claimed by Yugo Slavia Area, 3,300 sq. miles; pop. 670,899.

FRO'BISHER, Sir Martin, one of the great Elizabethan navigators, born near Doncaster, England, about

1535, died at Plymouth 1594. He made three expeditions to the Arctic regions for the purpose of discovering a north-west passage to India, and endeavoured to found a settlement north of Hudson Bay, hopes of immense wealth to be found in these northern regions having taken the public fancy. In 1585 he accompanied Sir Francis Drake to the West Indies. In the fight with the Spanish Armada in 1588 he commanded one of the largest ships in the fleet, and was knighted for his services. In the years 1590 and 1592 he commanded squadrons against the Spaniards and took many rich prizes. In 1594 he was sent to the assistance of Henry IV of France, when, in an attack on a fort near Brest, he was mortally wounded.—BIBLIOGRAPHY: Hakluyt Society Publications; Rev. F. Jones, *Life of Frobisher*.

FRODSHAM, market town of Cheshire. It is 11 miles from Chester,



Common Frog, showing the stages of growth from the egg to the fully-developed frog

on the L.M.S. Rly. Chemicals and cotton are manufactured. Near the town the Weaver falls into the Mersey and the district around is known as Frodsham Marshes. Pop. 5,100.

FROEBEL (*frœ'bĕl*), **Friedrich Wilhelm August,** German educationist, born 1782, died 1852. After an unsettled and aimless youth, and with somewhat imperfect culture, he started teaching, and soon developed a system which has become famous under the name of *Kindergarten* (q.v.). He is the author of *Die Menschenerziehung*, and *Mutter- und Koselieder*, a book of poetry and pictures for children. A Froebel Society, for the promotion of the Kindergarten system, was established in 1874. *See* EDUCATION.—BIBLIOGRAPHY: R. H. Quick, *Educational Reformers*; D. J. Snider, *Life of F. Froebel*.

FROG, the common English name of a number of animals belonging to the class Amphibia, having four legs with four toes on the fore feet and five on the hind, more or less webbed, a naked body, no ribs, and no tail. Owing to the last peculiarity frogs belong to the order of amphibians known as Anura or tailless Amphibia. They constitute the family Ranidæ, which ranges over most of the world, except Australia (save the extreme north-east), New Zealand, and South America (south of the equator).

Typical species are the common or grass frog (*Rana temporaria*), edible frog (*R. esculenta*), and the bull frog (*R. catesbiana*) of North America. The tongue is fleshy, and is attached in front of the jaw, but is free behind, so that its hinder extremity can be shot out to catch insects. Frogs are remarkable for the transformations they undergo before arriving at maturity. In the spring the spawn is deposited in ponds and other stagnant waters in large masses, each blackish egg being surrounded by a gelatinous sphere. The eggs hatch out into fish-like tadpoles, which at first breathe by external and later on by internal gills. The adult form is reached by loss of gills and tail, and the development of lungs and limbs.

Frog, in engineering, two short pieces of rail. They are joined together to form an angle between the railway lines at a railway crossing or at a point where the rails lead to a siding, serving to guide the wheels of a train from one set of lines to another. When used at a crossing the contrivance is termed a cross frog.

FROG-BIT (*Hydrocharis morsus-ranæ*), ord. Hydrocharidaceæ, a small water-plant of England, with floating kidney-shaped leaves, and white flowers of three petals.

FROG HOPPER, family of homopterous insects (*Cercopidæ*). The greyish or greenish adults have four stiff opaque wings and hind legs strengthened for vigorous leaping. They constantly prick the young leaves for sucking. The pricks enlarge and wither the leaves. The larvæ surround themselves with white froth. *See* CUCKOO-SPIT.

FROGMORE, an English royal palace in the Little Park, Windsor. In the grounds is the Mausoleum where rest the remains of the Duchess of Kent, the Prince Consort, and Queen Victoria. The building is in the shape of a Greek cross, with a central dome 70 feet high.

FROISSART (frwȧ-sȧr), **Jean,** a French poet and historian, was born in 1337 at Valenciennes, died in Flanders between 1400 and 1410. He received a liberal education, and took orders in the Church, but his inclination was more for poetry and gallantry. At the age

of eighteen he went to England, where, having already the reputation of being a gay poet and narrator of chivalric deeds, he was received with great favour, Philippa of Hainault, wife of Edward III, declaring herself his patroness. After returning to the Continent and travelling for some time, he again visited England, and from 1361 to 1366 he was a secretary to the queen. He also visited Scotland, and was entertained by King David Bruce, and William, Earl of Douglas. In 1366 he left England and again travelled.

After the death of Queen Philippa, Froissart became *curé* of Lestines in Hainault, and was patronized by Wenceslaus, Duke of Brabant, who was himself a poet, and of whose verses, united with some of his own, Froissart formed a sort of romance called *Meliador*. On the death of Wenceslaus he entered the service of Guy, Count of Blois, who gave him the canonry of Chimay, and induced him to take in hand the history of his own time. After twelve years of a quiet life he again began his travels, chiefly for the purpose of collecting further matter for his *Chronicle*, and he again visited England after a lapse of forty years. Little is known of the closing part of his life, which is said to have terminated at Chimay.

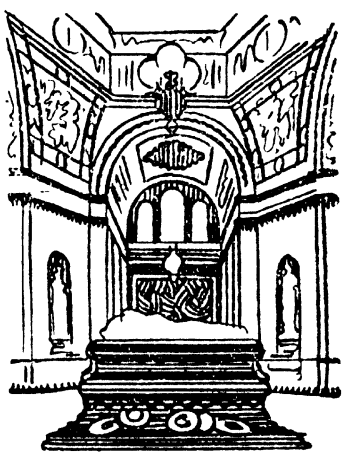
His *Chronicle*, which reaches down to 1400, gives a singularly vivid and interesting picture of his times, and also presents his own character in a pleasing light. The best editions of his *Chronicle* are those of Buchon, which also contains his collected *Poésies* (Paris, 1835–6, 3 vols.), of Kervyn de Lettenhove (Brussels, 1863–77, 25 vols.), and of S. Luce (Paris, 1869–88). The earliest, and in some respects the best, English translation is that of Lord Berners (London, 1525), although that by Thomas Johnes (1803–5) is more exact.—Cf. Madame Darmesteter (Duclaux), *Froissart*.

FROME, or **FROME-SELWOOD**, a town, England, county Somerset, on a small river of the same name, 24 miles south-east of Bristol. The staple manufactures are woollen cloths. Previous to 1885 it sent one member to Parliament; it now gives its name to a parliamentary division. Pop. (1931), 10,738.

FROND, in botany, a term often applied to the leaves of ferns and other cryptogamous plants.

FRONDE (frond), a French party during the minority of Louis XIV, which waged civil war against the Court party on account of the heavy fiscal impositions laid on the people by Cardinal Mazarin, whom the queen mother had appointed Prime Minister after the decease of Louis XIII (1648). At the head of the Fronde stood the Cardinal de Retz (q.v.), and afterwards the Prince Louis Condé. The result of this contest, which lasted from 1648 to 1654, served only to strengthen the royal power. The name is from Fr. *fronde*, 'a sling,' a member of the Parliament having likened the party to boys slinging stones in the streets, who dispersed on the appearance of the authorities.—Cf. G. S Gordon, *The Fronde*.

FRONTENAC', Comte de, French statesman. Louis de Buade was born in 1620, of a family holding land in



Frogmore Mausoleum

Bearn. He became a soldier and in 1672 went to Canada as governor. He remained there until 1682 and was again governor from 1689 to 1698. Frontenac died in Quebec, 28th Nov., 1698. His harsh methods of rule made him unpopular, but he ranks as one of the makers of Canada.

FRONTI'NUS, Sextus Julius, a Roman of patrician descent, born about A.D. 40, died 106. He was Governor of Britain from 75 to 78, and distinguished himself in the Wars of the Silures. He appears to have been twice Consul, and was appointed by Nerva to superintend the aqueducts, on which he also wrote. His *De Stratagematibus*, a treatise on war, and his *De Aquæductibus Urbis Romæ* are still extant.

FROSCHDORF (frosh'dorf; called by the French *Frohsdorf*), a village in Lower Austria, on the River Leitha,

about 30 miles from Vienna. It is remarkable for its magnificent castle, which has acquired a kind of political importance since 1844, when it became the head-quarters of the Bourbon party. It was the favourite residence of the Comte de Chambord (died in 1883), who greatly improved and beautified the interior.

FROST is the name we give to the state of the weather when the temperature is below the freezing-point of water (32° F.). The intensity of the cold in frost is conveniently specified in *degrees of frost*, or the number of degrees by which the temperature of the atmosphere is below the point at which the freezing of water commences. Frost is often very destructive to vegetation, owing to the fact that water, which is generally the chief constituent of the juices of plants, expands when freezing, and bursts and thus destroys the vesicles of the plant. In the same way rain-water, freezing in the crevices of rocks, breaks up their surfaces, and often detaches large fragments.

When the dew-point, or temperature at which the air would just be able to hold the quantity of aqueous vapour it actually contains, is below 32° F., and the air is cooled to that dew-point, the vapour is deposited directly in the solid form, as *hoar frost*. On the other hand, if the vapour has first been deposited at a higher temperature, and the ground is subsequently cooled below 32°, there is the phenomenon of frozen dew. *Rime* is distinct from hoar frost. It is produced during fogs by accumulation of frozen moisture on trees or other objects. *Glazed frost* is a transparent coating of ice, due to the freezing of rain after falling, or the contact of moist and comparatively warm air with very cold surfaces.

FROST-BITE is caused by the freezing of the superficial tissues of the body. The skin of an area, e.g. an ear, a finger, or a toe, may be frozen hard and no ill effects follow thawing, but more commonly after thawing the skin of the affected part becomes red and swollen and covered with blebs. Later, parts of the skin and underlying tissues may die and come away as a dry gangrenous mass. The extent of the damage depends on the duration of the cold and its intensity. During the process of thawing, intense pain is experienced, which passes away, to be followed by itching and tingling. The result is great deformity if the nose or ears are affected.

During the winter months of the European War (1914–8) in France many soldiers were invalided with so-called frost-bite of the feet. This was known later as trench-foot, and was not true frost-bite, but was due to changes in the blood-supply of the feet, brought on by prolonged exposure to damp conditions.

FROSTED-GLASS, glass roughened on the surface, so as to destroy its transparency, in consequence of which the surface has somewhat the appearance of hoar-frost.—The term *frosted* is also applied to the dead or lustreless appearance of gold and silver jewellery when the surface is unpolished.

FROTH or **FOAM**, the collection of small bubbles caused by fermentation or by boiling or agitating a liquid.

THE ANCIENT ORDER OF FROTH BLOWERS was a charitable organization formed in 1923. Its song was "The more we are together, the happier we shall be."

FROTH-FLY, or **FROG-HOPPER**, the common name of hemipterous insects of the family Cercopidæ, the immature stages of which are found in a frothy exudation on plants. *See* CUCKOO-SPIT.

FROUDE (frōd), **James Anthony**, historian and miscellaneous writer, born at Totnes, Devonshire, 1818, died 1894. He was educated at Oxford, was elected Fellow of Exeter College, and received deacon's orders. In 1848 he resigned his fellowship and withdrew from orders on the publication of his *Nemesis of Faith*. Between the years 1856 and 1869 appeared his great work *The History of England from the Fall of Wolsey to the Defeat of the Spanish Armada*, which was very popular, though it received but doubtful approval from historians. He was for some time editor of *Fraser's Magazine*, to which he contributed many articles, as well as to other periodicals.

In 1869 he was elected rector of St. Andrews University; travelled in the United States in 1874; and visited the Cape Colony on a political mission, 1874–5. He was made literary executor to Carlyle, and his *Life of Carlyle*, *Carlyle's Reminiscences*, and *Letters and Memorials of Jane Welsh Carlyle*, as edited by him, provoked an extraordinary amount of interest and controversy. Among his other works are: *Short Studies on Great Subjects*; *The English in Ireland in the Eighteenth Century*; *Julius Cæsar*; *Oceana, or England and her Colonies*; and *The English in the West Indies*.—BIBLIOGRAPHY: Herbert Paul; *Life of Froude*; A. Cecil, *Six Oxford Thinkers*.

FRUC'TIDOR, the twelfth month of the French republican calendar (dating from 22nd Sept., 1792), beginning 18th Aug., and ending 16th Sept.

FRUIT, in botany, the mature ovary of a plant, composed essentially of two parts, the pericarp and the seed. In a more general sense the term is applied to the edible succulent products of certain plants, generally covering and including their seeds.

The hardier sorts of fruits, such as are indigenous to Britain, or which have been cultivated to any important extent there, are the apple, pear, plum, cherry, apricot, peach, and nectarine; the gooseberry, currant (red, white, and black), raspberry, strawberry, mulberry. The more important fruits requiring a warmer climate are the fig, date, grape, orange, lime, banana, tamarind, pomegranate, citron, bread-fruit, olive, almond, melon, and coco-nut. Some fruits are of immense economic importance, either as food for great numbers of people, or as the basis of beverages in extensive use. The date is a type of the first class, and the grape, from which wine is produced, of the second. The total value of the fruit imported into the United Kingdom in 1913 was over £16,000,000. In 1932 the United Kingdom imported 41,272,056 cwts. of raw fruit valued at £30,142,020; 1,678,195 cwts. of dried fruit valued at £3,396,476; and 3,315,940 cwts. of preserved fruit valued at £6,447,236. *See* BOTANY.

FRUIT-PIGEON, the name given to the pigeons included in Carpophāga and related genera, birds of very brilliant plumage, occurring in India and the warmer parts of Australia. They are so called because they feed entirely on fruit.

FRUSTUM, in geometry, the part of a solid next the base, left by cutting off the top portion by a plane parallel to the base; or part of any solid between two planes, which may be either parallel or inclined to each other, as the *frustum* of a cone, of a pyramid, or of a sphere, the last of which is any part comprised between two parallel circular sections.

FRY, Charles Burgess, English athlete. Born at Croydon, 25th April, 1872, he was educated at Repton, Oxford, where he excelled as an athlete. He represented his university at cricket, athletics and Association football and held the world's record for the long jump. Afterwards he played cricket for Sussex and for years was one of the leading batsmen in the country. In 1900 he scored 3,147 runs, and he played for England on several occasions. Fry devoted his energies to training boys for the sea and conducted an establishment at Hamble. He has written books on cricket and on the League of Nations, and has come forward as a Liberal politician.

FRY, Elizabeth, philanthropist, the third daughter of John Gurney, of Earlham Hall, near Norwich, was born 1780, died at Ramsgate 1845. In her eighteenth year a sermon preached by William Savery, an American Quaker, at Norwich, had the effect of turning her attention to serious things, and making her adopt decided views on religious matters. About this time also she made the acquaintance of Joseph Fry, a London merchant and a strict Quaker, to whom she was married in 1800.

In 1810 she became a preacher among the Friends. Having paid a visit to Newgate in 1813, she was so



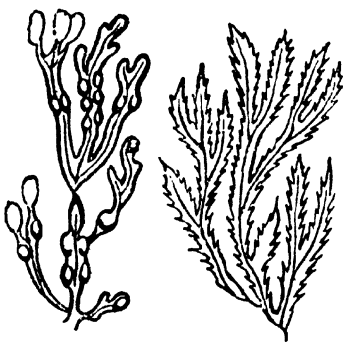
Elizabeth Fry

impressed by the scene of squalor, vice, and misery which she there witnessed, that the amelioration of prison life became with her a fixed object. In 1817 she succeeded in establishing a ladies' committee for the reformation of women-prisoners in Newgate, along with a school and manufactory in the prison, the results of which proved eminently satisfactory. These improvements were shortly afterwards introduced by her means into other prisons. In the pursuit of her philanthropic labours she made tours through various parts of the United Kingdom, and also visited France, Belgium, Germany, and Holland.—Cf. G. King Lewis, *Elizabeth Fry.*

FRYATT, Charles, British sailor, born 2nd Dec., 1872, shot by the Germans on 27th July, 1916. Entering the merchant service in 1904, he obtained his master's certificate in

1905, and was promoted captain in 1913. During the European War, Captain Fryatt's ship, the cross-Channel steamer *Brussels*, was attacked by a German submarine on 3rd March, 1915, but escaped. On the 28th of the same month it was again attacked by a U-boat near the Maas Lightship, and almost succeeded in ramming the submarine. Captain Fryatt was thanked by the British Admiralty for his action, but the enemy pretended that he had acted against the usages of war, as he did not belong to the combatant forces.

On 23rd June, 1916, Captain Fryatt was captured by a German destroyer, taken to Zeebrugge, and thence to Ruhleben and Bruges, where he was tried by court-martial as a *franc-tireur*. Sentenced to death on 27th of



Fucus
Twin Bladder Wrack Serrated Wrack

July, he was shot on the same day. After the conclusion of the European War, Captain Fryatt's body was brought to England and buried at Dovercourt on 9th July, 1919.

FUAD, Ahmed Fuad Pasha, King of Egypt, born 26th March, 1868, the youngest son of Ismail Pasha, and brother of Hussein Kamil, the first Sultan of Egypt. He was educated in Italy and Switzerland, and at the Artillery School at Turin. He succeeded his brother as Sultan in 1917, and became King in 1922.

FUAD PASHA, Mehemed, Turkish statesman and man of letters, was born at Constantinople 1814, died at Nice 1869. His diplomatic career took him to London, Madrid, and Russia; he was four times Minister of Foreign Affairs, and for five years Grand Vizier; and was the chief support of the reform party in the Turkish Empire. He wrote poetry, political pamphlets, and a Turkish grammar, which has been translated into several languages.

FUCA'CEÆ, a nat. ord. of dark-coloured Algæ, consisting of olive-coloured sea-weeds, distinguished by their organs of reproduction, which consist of oögonia and antheridia, contained in chambers or conceptacles, united in club-shaped receptacles at the ends or margins of the fronds. Fucaceæ exist in all parts of the ocean, and, though all are probably occasionally attached, they may persist as floating masses, like the gulf-weed. *See* FUCUS; BROWN ALGÆ.

FU-CHOW. *See* FOO-CHOW.

FUCHSIA (fū'shi-a; named after the discoverer, Leonard *Fuchs*, a German botanist), a genus of beautiful flowering shrubs, natives of South America, Mexico, and New Zealand, nat. ord. Onagraceæ, characterized by having a funnel-shaped, coloured, deciduous, four-parted calyx, sometimes with a very long tube; four petals set in the mouth of the calyx-tube, and alternating with its segments; eight exserted stamens, and a long style with a capitate stigma. This is one of our most common decorative greenhouse plants, while the hardy varieties out of doors in the open border form an important feature with their wonderful profusion of flowers.

FUCHSINE, coal tar derivative, also known as magenta or roscine. It consists of rosaniline hydrochloride and is an important direct dyestuff for wool, silk, and leather, and, with a mordant, for cotton. It occurs as brilliant iridescent crystals which form a deep red solution in water and are also very soluble in alcohol.

FUCINO, or **CELANO** (fū'chē-nō, chel-ā'nō; Lat. *Fucinus Lacus*), formerly a lake of Southern Italy, about 11 miles long and 5 miles broad, 2181 feet above sea-level, in the province of Aquila in the Central Apennines. As the lake often rose and submerged the neighbouring lands, the Emperor Claudius caused a tunnel to be constructed to carry off its surplus waters into the Garigliano. This vast work was soon allowed to fall into disrepair. Between 1852 and 1876, however, it was repaired and enlarged by a company, and the lake has now been thoroughly drained, and 36,000 acres of rich arable land reclaimed.

FUCUS, a genus of sea-weeds, family Fucaceæ, comprising various common sea-weeds which have a flat or compressed forked frond, sometimes containing air-vessels. Many of the species are exposed at low water; they form a considerable proportion of the sea-weeds thrown up on some

coasts, and are used for manure and for making kelp. Most contain iodine.

FUEGO. *See* TIERRA DEL FUEGO.

FUELS are materials which can be burnt economically for the generation of heat to be applied to some useful purpose, such as domestic heating, steam raising, firing of furnaces, &c. They may be solid, liquid, or gaseous, and may be used in the natural state or after being prepared by some suitable process.

Solid fuels contain combustible matter consisting largely of carbon and hydrogen either combined or in the free state, and incombustible matter in the form of ash. Liquid and gaseous fuels consist mainly of combustible matter, and generally contain little ash. The combustible matter in solid fuels is present in two forms, viz. volatile matter, which is driven off when the substance is submitted to heat out of contact with air, the residue left behind being charcoal when wood is heated, and coke when coal is heated, each of these materials consisting of fixed carbon together with the ash present in the original material.

Natural fuels. The natural fuels are wood, peat, coal, natural oils, and natural gas. Wood may be considered as the natural fuel of man; it was the first and for many ages the only fuel with which he was acquainted. It is still used to some extent for domestic purposes, and in certain parts of the world for some industrial purposes also. It cannot be considered a satisfactory fuel, owing to the large amount of water it retains. In the growing condition, the cells and vessels are filled with sap, and freshly-felled wood contains about 50 per cent. of water, the amount varying with the nature of the wood, the part of the tree from which it is taken, the age of the tree, and the season of felling. A tree which has had its bark stripped off, and has been exposed to the air, loses moisture, and the remaining air-dried wood contains 15 to 25 per cent of water. During the burning of the wood much heat is used up in the evaporation of the water remaining.

Peat consists of partially-decayed vegetable matter occurring in beds of varying thickness from a few feet upwards. In this country the peat is composed almost entirely of the remains of mosses. The top layers of the peat-bogs contain tangled roots and stems of plants only slightly decayed, are light-brown in colour, and of low specific gravity. Lower down the material becomes darker and denser, and at the greatest depth it may have passed into a nearly black compact mass in which all trace of the original matter is lost. When freshly got, peat contains up to 80 per cent. of water, and after air-drying, contains 10 to 15 per cent.

Peat, even in the air-dried condition, is not a good fuel, as it contains too much water, and may in addition contain a considerable amount of ash. There is a tendency, however, towards the increased use of peat as a fuel, and there is every probability that peat and peat products will become much more important as fuels in the future than they have been in the past. It is estimated that there are over 9,000 sq. miles of peat deposits in Great Britain.

Coal is by far the most important natural fuel. In its strictly correct usage the name comprises only the compacted carbonaceous materials such as lignite, bituminous coals, and anthracite. Lignite or brown coal differs from ordinary coal in being the result of partial mineralization of vegetable tissues. It is used for domestic, manufacturing, and locomotive purposes in districts remote from ordinary coal-fields.

Bituminous coals include all the most important classes of carboniferous fuel, and are divided by Sir Richard Redmayne into the following classes: (1) gas, (2) coking, (3) house, (4) manufacturing or iron smelting, and (5) steam, which grade one into the other. The names given to the different classes signify the purposes for which they are most suitable.

Anthracite represents a stage of mineralization beyond coal. It contains up to 98 per cent of carbon and very little volatile matter. Owing to its hard and compact structure and difficulty of ignition, it is only useful for steam raising where forced draught is used. It is largely used for malting purposes and for drying hops, where a steady heat is required; for domestic purposes and hot-house heating it is burnt in specially-designed stoves, and is also used to some extent in iron smelting and in the manufacture of producer-gas. The importance of coal as a fuel may be realized from the fact that the estimated world's production of coal in 1913 was about 1,321,000,000 tons, and in 1931 about 1,035,318,000 tons.

Natural oils or petroleums are found in many parts of the world, and are largely used as fuel for steam raising and general industrial purposes. Before use, they are generally submitted to distillation, and are thus to an extent prepared fuels, and will be considered below.

Natural gas occurs in certain localities in very large quantities, and in Pennsylvania has been used as a fuel,

on a large scale. The first attempts at using the gas were made in 1879, when pipes were laid to convey the gas to the works in Pittsburgh. The pressure of gas at Pittsburgh varies between 100 and 200 lb. per square inch. Natural gas is composed chiefly of marsh gas, with some hydrogen and nitrogen, and has a high heating value.

Prepared Fuels. Prepared fuels may be either solid, liquid, or gaseous in form, the chief prepared solid fuels being charcoal, peat charcoal, peat briquettes, coke, coalite or semi-coke, coal briquettes, and pulverized coal.

Charcoal is the result of heating wood out of contact with the air, by which means the volatile matter is driven off, and a carbonaceous residue is left which retains the form of the wood so perfectly that it shows distinctly the annual rings of growth of the wood. Charcoal was at one time a very important fuel, but is now mainly used only where wood is abundant and coal is scarce. It is still used for certain metallurgical purposes with advantage, owing to its freedom from injurious substances. It is made in heaps, kilns, and for special purposes in iron retorts.

With regard to prepared peat fuel, the chief problem in its economic utilization consists in freeing it from the excessive amount of water it contains, and many mechanical systems of treating peat by consolidation have been tried. Recent experiments by the Fuel Research Board, which was established in 1917, have shown that machine-cut peat dries more quickly than peat cut by hand-power, which is unmacerated. By the thorough maceration of the peat material, followed by briquetting and drying, the best peat briquettes are made. Peat charcoal has been made to some extent by pulping the peat, pressing the mass into blocks, and then charring in retorts.

The Board of Fuel Research maintains at Greenwich a Fuel Research Station, which has laboratories at Stoke, Glasgow, Nottingham, Newcastle-on-Tyne and elsewhere. In 1931 a world fuel conference met in London.

Of recent years much as been done to use fuel resources, particularly coal in this country, more advantageously. Pulverised fuel is largely replacing ordinary coal, and extensive plants have been erected for the carbonization, under careful control, of that material whereby the maximum quantity of certain desired products can be obtained. Attempts have been made to commercialize the production of refined oil-fuel (petrol) from coal, and recently a mixture of oil and finely powdered coal has been used with success.

Coke is by far the most important prepared fuel at the present time, especially from a metallurgical point of view. It is the product obtained by heating coal without access of air; when volatile gaseous and liquid matters are given off, and a residue of coke is left which consists of the fixed carbon plus the ash of the original coal. There are two classes of coke on the market, gas-coke which is obtained as a by-product in the coal-gas industry; and metallurgical coke, which is a hard coke produced by the carbonization of selected coals in special ovens at a very high temperature.

In addition to these classes of coke there is a product obtained by low-temperature carbonization, originally known as coalite. Gas-coke is suitable for ordinary fires and for domestic purposes, as it ignites more readily than metallurgical coke, owing to its higher content of volatile matter, and when burnt in suitable grates or stoves, forms an excellent domestic fuel. It is smaller in size than oven coke, and is more vesicular, more friable, and softer, and is therefore unsuitable for use in blast-furnaces, since it is incapable of sustaining the burden without crumbling.

Metallurgical or blast-furnace coke, on the other hand, is large in size and combines great strength with porosity. The coal selected for its manufacture is of a strong caking variety, low in ash, and generally contains from 20 to 30 per cent of volatile matter. This class of coke is manufactured either in beehive ovens, in which the valuable by-products such as tar, ammonia, &c., are lost, or in specially designed coke ovens arranged for the recovery of these by-products. The practice of by-product coking had become almost universal in Germany before the European War, and in the United Kingdom by-product ovens are gradually replacing other forms, in 1919 about 80 per cent of the metallurgical coke made here being produced in by-product ovens.

In the manufacture of coalite and similar low-temperature carbonization products, a temperature of about 400° to 500° C. is used, and a large increase in the tarry-matter products is obtained, together with a friable coke which kindles and burns quickly.

Coal briquettes have become of considerable importance within recent years. They are usually made of fine coal compressed with some form of cementing material. Tar or pitch is generally used, but dextrine, molasses, clay, Portland cement, lime, &c., have also been suggested, and there are

many forms of presses used in their manufacture.

The burning of finely-pulverized coal for steam raising, furnace purposes, &c., has made great strides during recent years, although it has been used for many years in special industries, such as in Portland cement kilns. For this purpose dried and finely-powdered coal is blown through special burners, and under proper conditions behaves practically as a fluid.

The prepared liquid fuels consist of distillation products from the treatment of natural oils, the products of distillation of oil shales, and various oil and tarry matters from gasworks, coke-oven plants, gas producers, and blast-furnaces. By the distillation of natural oils, the lighter oils are first obtained for special purposes, and the residue is used for fuel oil. Large quantities of oil are obtained from the distillation of bituminous shales, the product being submitted to fractional distillation for the separation of oils having different qualities and uses. Blast-furnace and other tars are also submitted to fractional distillation, yielding light oils, fuel oils, and pitch.

The utilization of oil fuels has many advantages over solid fuels, including the following: a reduction in weight of about 40 per cent, and in volume by about 35 per cent; a reduction in the number of stokers required; a very small amount of ash to be handled and disposed of; prompt kindling and early attainment of maximum temperature. The fires may also be extinguished at any moment, and great uniformity of combustion and hence heating power is obtained. The advantages of liquid fuel are rapidly being realized, and, by means of specially-designed burners, oil is being used in steamships, power-stations, and for many industrial purposes, including metallurgical furnaces.

With regard to artificial gaseous fuel, there are many types used for lighting and heating purposes. These include ordinary coal-gas, coke-oven gas, producer-gas, water-gas, oil-gas, and waste-furnace gas, especially that from iron blast-furnaces. Coal-gas is obtained by heating coal in closed retorts, and is used for lighting purposes, and to a considerable extent for domestic heating. Generally speaking, it is too expensive for furnace heating, but there are many minor operations in which its use is convenient. From the similarity of the operations involved, it will be realized that coke-oven gas is not dissimilar from coal-gas, and in many districts it is used for domestic and special purposes, the gas necessary for heating the ovens being made specially in producers from coke.

Producer-gas is the most important gaseous fuel used in the industries, and is made by the partial combustion of coal or coke, with a limited supply of air, in specially-designed chambers known as producers. Although a certain amount of the total heat of combustion of the fuel is developed in the producer itself, this is compensated for by the introduction of a certain amount of steam with the air. In contact with incandescent fuel, this steam is decomposed, giving hydrogen and carbon monoxide, two combustible gases which greatly increase the heating power of the gas. The air blown into the producer with the steam results in the introduction of nitrogen, which dilutes the gas, so that its calorific value is somewhat low.

For special purposes water-gas is used, which results from the decomposition of steam alone by means of carbon in an incandescent state; this water-gas is a rich gas consisting practically of hydrogen and carbon monoxide. As it is necessary to supply a considerable amount of heat for this reaction to take place, the operation is intermittent in action, the supply of steam to the producer being cut off from time to time, and air blown through to render the carbon incandescent. If this were not done, the temperature of the producer would gradually fall until steam passed through unaltered.

Oil-gas is made by the destructive distillation of oil at a high temperature, with or without the use of steam; it is largely used for lighting purposes, and is also used for furnace work on a small scale.

The gas evolved from certain metallurgical furnaces, and especially from iron blast-furnaces, is very similar in composition to ordinary producer-gas, and forms a valuable gaseous fuel. It is largely used for firing boilers, heating the hot-blast stoves in connection with the furnaces, and direct in gas-engines. Great attention is being given to the thorough cleaning of the gas, as its efficiency as a source of heat is greatly increased in this way.

The use of gaseous fuel in the various industries has many advantages, including the following: the perfect control under which the supply of gas and air may be maintained; perfect combustion without smoke may be obtained with only a very slight excess of air over that necessary for combustion; much higher temperatures can be obtained than are possible with solid fuel, especially when both the gas and the air are preheated; a commoner fuel may be used; and the gas can be conveyed to

different parts of the works through pipes with great ease.—BIBLIOGRAPHY: W. A. Bone, *Coal and its Scientific Uses*; Sexton and Davidson, *Fuel and Refractory Materials*; H. S. Jevons, *The Coal Trade*.

FUENTE (fu̯-en'tā; i.e. 'fountain'), with affixes, the name of numerous small towns in Spain. **Fuente-de-Cantos**, province of Badajoz, on the north slope of the Sierra Morena, has 8,500 inhabitants; **Fuente-owejuna**, province of Cordoba has 15,500.

FUENTERRABIA, city of Spain. It stands on the Bidassoa, near its mouth, 9 miles from San Sebastian, on the railway line from Paris to Madrid. The old town, still surrounded by its walls, has a castle and other buildings dating from the Middle Ages. Near it is a new town, a fishing centre and a watering place. Pop. 5,500.

FUENTES D'ONO'RO, a village of Spain, province of Salamanca, about 15 miles w.s.w. of Ciudad Rodrigo, the scene of two engagements fought between Wellington and Masséna on 3rd and 5th May, 1811, the result of which was that the French were forced across the Portuguese frontier, and an end was put to the French invasion of Portugal.

FUERO (fu̯-ā'rō), a Spanish word signifying jurisdiction, law, privilege, and applied historically to the written charters of particular districts and towns. In 1833 a civil war broke out in the Basque provinces, in assertion of the *fueros* of that district, which lasted ten years, and was pacified only by the formal recognition of the Basque privileges in 1844 by the Queen and Cortes of Spain. The Basque *fueros*, however, were finally abrogated in 1876 as a result of the Carlist rising.

FUERTEVENTU'RA, one of the Canary Islands, separated from Lanzerota by the Strait of Bacayna. Cabras on the east coast has a good harbour. Area, 665 sq. miles. Pop. about 12,960.

FUGGER FAMILY, a distinguished German family, early admitted among the hereditary nobility, and now represented by two main lines of descendants and several minor branches. The founder of this family was *Johann Fugger*, a master weaver who settled in Augsburg in 1368 and acquired much property. His descendants became leading bankers, merchants, and mine-owners; were liberal and public-spirited men, patrons of art, and several of them became distinguished soldiers and statesmen.

Among the most eminent of the family was *Jakob Fugger* (1459–1525), who carried on great commercial operations, advanced money to the Emperors Maximilian and Charles V, and by the former was raised to the rank of nobleman, being also imperial councillor under both. Charles V raised Jakob's two nephews, Raimund and Anton Fugger, to the dignity of counts. He also invested them with the estates of Kirchberg and Weissenhorn, which had been mortgaged to them, granted them a seat at the Imperial Diet, and letters giving them princely privileges. Afterwards the highest places of the empire were held by the Fuggers, and lines of counts and princes still represent the family.—Cf. A. Stauber, *Das Haus Fugger*.

FUGITIVE OFFENDERS ACT, 1881, provides for the arrest in any part of His Majesty's Dominions of persons accused of having committed certain offences in any other part, and for their being brought back to the *locus delicti* for trial. Upon apprehension a fugitive offender may be committed to prison in the place of arrest to await his return, and if committed must not be surrendered for trial for at least fifteen days thereafter, during which period he may apply for a writ of habeas corpus or other like process. If not surrendered for trial within one month of his committal, the fugitive may apply—if in England or Ireland to the High Court of Justice or the Court of Appeal, if in Scotland to the High Court of Justiciary, and if in a British possession to any court having the like criminal jurisdiction—to be discharged out of custody.

The offences covered by the Act are treason, piracy, and every offence punishable in the *locus delicti* by imprisonment with hard labour for at least twelve months or by any greater penalty. A modified form of the regulations may be applied by Order in Council to any group of British possessions (excluding the United Kingdom, Channel Islands, and Isle of Man) lying contiguous or otherwise suitable, *quoad* the members of the group. *See also* EXTRADITION.

FUGUE (fūg; Lat. *fuga*, flight), a musical term signifying a polyphonic composition constructed on one or more short subjects or themes, which are harmonized according to the laws of counterpoint, and introduced from time to time with various contrapuntal devices, the interest in these frequently-heard themes being sustained by diminishing the interval of time at which they follow each other, and monotony being avoided by the occasional use of episodes, or passages open to free treatment.

FUJIYAMA, or **FUSI-YAMA,** a dormant volcano of a symmetrical cone-like shape, in the Island of Honshiu, Japan, the sacred mountain of the Japanese. It has been quiescent since 1707; is 12,395 feet in height, and is visible in clear weather for a distance of nearly a hundred miles.

FUKIEN, a maritime province of South-Eastern China; area, 46,332 sq. miles. The Strait of Formosa separates it from the island so named. The coast is deeply indented by bays and studded with islands. The interior is generally mountainous, but is highly cultivated and generally fertile. The principal products are rice, wheat, barley, tea, silk, sugar, indigo, camphor, and tobacco. The capital is Foochow. Pop. 14,329,594.

FULCRUM, the point of support of a lever. In engineering, the body or pin supporting a lever; in mechanics, the point about which a lever turns, and through which the reaction of the lever on its support passes.

FULDA, a town of Germany, in the Prussian province of Hesse-Nassau, on a river of the same name, 54 miles S.S.E. of Cassel. It is irregularly built; contains a cathedral, a handsome edifice, erected at the beginning of the eighteenth century; a castle, once occupied by the prince bishops; a library of 50,000 volumes; and has manufactures of cotton, woollen, and linen goods. The town derives its origin from a once-celebrated abbey founded by St. Boniface (Winfried), the apostle of Germany, in 744. Pop. 26,057.

FUL'GURITE, any rocky substance which has been fused or vitrified by lightning. More strictly, a vitrified tube of sand formed by the intense heat of lightning penetrating the sand, and fusing a portion of the materials through which it passes.

FULHAM (fŭl'am), a metropolitan borough of the county of London, bounded by the Thames, and the boroughs of Chelsea, Kensington, and Hammersmith. It contains the palace of the Bishop of London, and returns two members to Parliament. Pop. of municipal borough (1931), 150,940.

FU-LIN. The country of Fu-lin is mentioned in Chinese texts as early as the beginning of the fifth century. It is vaguely referred to sometimes as a great island in the Western Sea (the Mediterranean) famous for its trees and precious stones. Of special interest is the fact that it was the scene of the Chinese version of the 'diamond valley legend.' The natives, reputed to be skilled in working implements and vessels of precious stones, obtained gems from a deep ravine. They threw down pieces of flesh, which were seized by eagles, and collected the precious stones, especially diamonds, that dropped from the flesh. This legend was carried from the Hellenistic Orient to China. There are two Fu-lins—the 'Lesser Fu-lin,' which was Syria, and the 'Greater Fu-lin,' which was the Byzantine Empire. According to Laufer, the name was originally Fu-lim or Fu-rim. As 'Rim' is still the Russian word for Rome, it is possible that Fu-lin was derived from a dialectic rendering of the capital of the Roman Empire.

FULLER (fŭl'ẽr), **Andrew,** English Baptist minister and theological and controversial writer, born 1754, died 1815. In 1782 he accepted the pastoral charge of a Baptist church at Kettering, in Northamptonshire, in which office he continued till his death. His theology was a moderate Calvinism, and he devoted much of his energy to the subject of foreign missions. His works, frequently reprinted, appeared in Bohn's Standard Library.

FULLER, Margaret. *See* OSSOLI (MARGARET FULLER).

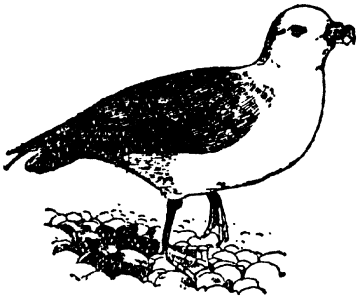
FULLER, Thomas, an eminent historian and divine of the Church of England, born in 1608 at Aldwinkle, in Northamptonshire, died 1661. He was sent to Queens' College, Cambridge, where he graduated B.A. in 1625, M.A. in 1628. He afterwards removed to Sidney Sussex College in the same university; and being chosen minister of St. Benet's Parish, Cambridge, he became very popular as a pulpit orator. In 1631 he obtained a fellowship at Sidney Sussex, and was collated to a prebend in the cathedral of Salisbury. He was next chosen rector of Broad Windsor, Dorset, and lecturer at the Savoy, London.

In 1643, during the Civil War, he went to Oxford and joined the king; left in a few months for the army, in which he became chaplain to Sir Ralph Hopton, and employed his leisure in making collections of details concerning English history and antiquities. At the close of the war he took refuge in Exeter, and was appointed chaplain to the infant Princess Henrietta Anne. Shortly before the Restoration he was reinstated in his prebendal stall, and soon after that event was made one of the king's chaplains.

Several of his writings are English classics, remarkable for quaintness of style, wit, sagacity, and learning. Among the more important are: *History of the Holy War; The Holy and Profane State; Pisgah Sight of Palestine; Church History of Britain;*

and the *Worthies of England*, a production valuable alike for the solid information it affords about the provincial history of the country, and for the profusion of biographical anecdote and acute observation on men and manners.—Cf. J. E. Bailey, *The Life of Thomas Fuller*.

FULLER-MAITLAND, John Alexander, British musical critic, born in 1856. Educated at Westminster School and Trinity College, Cambridge, he was musical critic for *The Guardian*, *The Pall Mall Gazette*, and *The Times*. He edited the revised edition of Grove's *Dictionary of Music*



Fulmar (Fulmarus glacialis)

and Musicians (1904–10), and wrote *Masters of German Music* (1894), *English Music in the 19th Century* (1902), and *The Age of Bach and Handel* (The Oxford History of Music)

FULLER'S EARTH, a variety of clay or marl, compact but friable, unctuous to the touch, and of various colours, usually with a shade of green. It is useful in scouring and cleansing cloth, as it absorbs the grease and oil used in preparing wool. It consists of some 60 per cent of silica with alumina and water, and the usual impurities of clays. Its properties are probably due to physical texture. There are extensive beds of this earth in southern English counties, and the name has been given to a stage in the Middle Jurassic series.

FULLING-MILL, a mill used for fulling or felting woollen cloths; the modern name for such a mill is *milling-machine* (q.v.). An apparatus used for the same purpose and anterior to the milling-machine is known as *fulling-stocks*. The principal parts of this apparatus in its simplest form are the wheel and one or two projecting studs from its sides, which, while rotating, raise two levers, the ends of which are formed of large blocks of heavy wood, and shaped very much like a pig's foot.

The cloth to be fulled is saturated with soap and water, and placed in a suitably shaped receptacle into which the pig's-foot levers descend. The weight of the levers supplies the necessary pressure to the fabric, and at the same time their shape causes the fabric to roll gradually in the receptacle, so that all parts may be equally treated and fulled, i.e. made more compact. These simple stocks were subsequently replaced by more scientific stocks, which performed the same kind of action on the cloth but at a much higher speed.

FULMAR, an Arctic sea-bird (*Fulmārus glaciālis*) of the family Procellaridæ or petrels, about the size of a large duck. It inhabits the northern seas in prodigious numbers, breeding in Iceland, Greenland, Spitzbergen, the Shetland and Orkney Islands, and the Hebrides. It feeds on fish, the blubber of whales, and any fat, putrid, floating substance that comes in its way. It makes its nest on sea-cliffs, and lays only one egg. The natives of St. Kilda valued the eggs above those of any other bird.

The fulmar is also valued for its feathers and down, and for the oil found in its stomach, which was one of the principal products of St. Kilda. When caught or assailed, it lightens itself by disgorging the oil from its stomach. There is a second and larger species (*F. pacificus*) found in the Pacific Ocean, and a third (*F. glacialioides*) in the Antarctic.

FUL'MINATE. word meaning to explode and used in that sense by scientists. Fulminate of mercury is a powerful explosive used in percussion caps and detonators. Fulminic acid is found with mercury and other metals, but never alone.

FULMINIC ACID, an acid known only in the form of its salts—mercury fulminate, $Hg(CNO)_2$, and silver fulminate, $(AgCNO)_2$, both of which are powerful detonators. *See* DETONATING POWDERS.

FULTON, Robert, an American engineer, the introducer of steam navigation on American waters, was born in Pennsylvania in 1765, died 1815. He adopted the profession of portrait and landscape painter, and in his twenty-second year proceeded to England for the purpose of studying art under West. There he became acquainted with the Duke of Bridgewater, Earl Stanhope, and James Watt, and was led to devote himself to mechanical engineering. In 1794 he took a patent for a double inclined plane, which was intended to supersede locks on canals; and he also

patented a mill for sawing marble, machines for spinning flax and making ropes, and a dredging-machine.

In 1797 he went to Paris, where he produced the first panorama that was exhibited there. He also, after some trials, was successful in introducing a boat propelled by steam upon the Seine. During a visit to Scotland he had seen and obtained drawings of the *Charlotte Dundas*, a steam-vessel which had plied with success on the Forth and Clyde Canal. His chief occupation in Paris, however, was the invention of torpedoes for naval warfare. He returned to America in 1806, and built a steamboat of considerable dimensions, which began to navigate the Hudson River in 1807. Its progress through the water was at the rate of 5 miles an hour. In 1814 he constructed the first war steamship, and was engaged upon an improvement of his submarine torpedo when he died.—BIBLIOGRAPHY: C. D. Colden, *Life of Robert Fulton*; H. W. Dickinson, *Robert Fulton, Engineer and Artist: his Life and Work.*

FULWOOD, urban district of Lancashire. It is just outside the borough of Preston and its industries are those of that town. Pop. (1931), 7,387.

FU'MAGE (Lat. *fumus*, smoke), a tax on every house with a chimney, mentioned in *Domesday Book*, and commonly called smoke-farthings. It is supposed to have been the origin of the *hearth-money* imposed by Charles II, and repealed by I William and Mary, cap. x. Edward, the Black Prince, imposed a tax of one florin for every hearth in his French dominions.

FUMARIA'CEÆ, a small nat. ord. of Dicotyledons, closely allied to Papaveraceæ. The species are slender-stemmed, herbaceous plants, generally erect, though some climb by means of their twisting leaf-stalks. They are all astringent and acrid plants, and are reputed diaphoretics and aperients. They are found in the temperate and warm regions of the northern hemisphere and South Africa.

FUMIGATION is the application of vapours for the purpose of disinfecting rooms, clothing, bedding, and the like. For this purpose the most commonly used substances are: sulphur, either burned openly or in the form of sulphurous acid gas in cylinders; chlorine, generated from chlorinated lime; formaldehyde, commonly used as formalin. The efficiency of gaseous disinfectants is open to question, and certainly in the strengths usually in use they are not effective as germicidal agents.

FU'MITORY, the common name of Fumaria, a genus of plants, nat. ord. Fumariaceæ. Several species are known, natives of Europe and Asia, and two or three are found in Great Britain growing in dry fields and roadsides, and also frequently in highly-cultivated gardens. They are slender annual herbs with much-divided leaves and purplish flowers in racemes at the top of the stem or opposite the leaves. *F. officinālis*, the best-known species, was at one time much used in medicine for scorbutic affections.

FU-NAN, the Chinese name for Camboja, from which they imported in the early part of the Christian era various products, including, as is stated, 'white pomegranates' and 'red pomegranates.' The 'white pomegranate' was especially prized, and supposed to contain the virtues of white jade. It was therefore called *Yu liu*. *Yu* is jade.

FUNARIA, a genus of mosses, one of which, *F. hygrometrica*, is common in Britain, especially on spots where a wood-fire has been, and grows in all parts of the world.

FUNCHAL (fun-shäl'), the capital of the Island of Madeira, situated on a bay on the south coast. It stretches for nearly a mile along the shore, and presents a thoroughly European appearance. It is a coaling-station for steamers, and is much resorted to by invalids afflicted with pulmonary complaints. There is a substantial trade in wines. It has a broadcasting station (24 M.; 0·05 kw.). Pop. 24,687.

FUNCTION, in mathematics, a quantity the value of which depends on the values of one or more other quantities. The area of a rectangle, e.g., is a function of its base and its height, or, definitely, $A = bh$. By the introduction of suitable units, any relation such as this between concrete quantities can be regarded as a relation between abstract numbers. In pure mathematics the quantities dealt with are therefore always purely numerical. In the equation $A = bh$, A, b, and h are called the *variables*, for they are capable of taking an unlimited number of values. The equation as it stands gives A in terms of b and h; it gives an explicit answer to the question: what is the value of A when b and h are known? We say in this case that b and h are the *independent variables*, A being the *function* or *dependent variable*.

It is obvious that the choice of a particular variable as the one which is *dependent* is to some extent arbitrary; we might, e.g., want the height of the rectangle when the base and area are given. We would then write the equation $h = A/b$, and h would be

the dependent variable. When there are only two variables, it is usual to denote the independent variable by x, and the dependent variable by y, so that y is a function of x. The variety of functions is endless, but certain functions are much more important than others, owing to the simplicity of their properties, and the frequency with which they occur in nature. In the development of mathematical theory, these specially important functions occur in a fairly definite natural order, the properties of the simpler kinds being needed for the investigation of the kinds which are more complex.

The chief functions of elementary mathematical analysis are:—

(1) The *polynomial*, or *rational integral algebraic function*,

$$y = a + bx + cx^2 + \ldots + kx^n,$$

where n is a positive integer, and a, b, c, . . ., k are *constants*, that is to say, numbers which do not change as x varies.

(2) The *rational function*, any function which can be expressed as the quotient of one polynomial by another, as

$$y = \frac{2}{x^2 + x + 1} - \frac{x + 1}{x + 2}.$$

(3) The explicit *irrational algebraic function*, any function expressible in terms of roots of rational functions, as

$$y = \sqrt{x - \sqrt[3]{(x^2 + 2x + 4)}}.$$

A function is said to be *explicit* when its value is directly given in terms of x, by an equation of the form $y = a$ certain expression in x. A function is *implicit* when the equation connecting x and y does not give y immediately in terms of x. If, e.g., $y^2 - 6xy + 8x^2 = 0$, y is an implicit function of x. In this case it happens that the equation can be solved, leading to $y = 4x$ or $y = 2x$, so that the implicit function is made up of the combination of two simple explicit functions. But in many important cases the equation in x and y cannot be solved so as to give y explicitly. A very important example of these cases is:

(4) The general *algebraic function*, a function y given by a rational integral equation containing x and y with their powers, as $x^5 + y^5 = 3xy + 1$. The theory of algebraic functions has been carried to a highly advanced stage, and is one of the most important branches of modern higher mathematics. Early writers divided all functions into two classes, *algebraic* and *transcendental*.

(5) The *exponential function*, $y = a^x$, and its inverse.

(6) the *logarithmic function*, $y = \log_a x$, where a is a positive number. These functions are said to be *inverse* to each other, because if $y = a^x$, then $x = \log_a y$, and conversely. Similarly the nth power and the nth root are inverse functions, for if $y = x^n$, then $x = \sqrt[n]{y}$. It is found that the properties of the exponential and logarithmic function take their simplest form when the number e (*see* EXPONENTIAL THEOREM) is taken as the base, the functions then being $y = e^x$, and $y = \log_e x$. The outstanding results in the theory of these functions are that

$$e^x = 1 + x + \frac{x^2}{1\cdot 2} + \frac{x^3}{1\cdot 2\cdot 3} + \ldots, \text{ and}$$

$$\log_e(1 + x) = x - \tfrac{1}{2}x^2 + \tfrac{1}{3}x^3 - \tfrac{1}{4}x^4 + \ldots,$$

the series being infinite. The series for e^x holds for all values of x, but that for $\log_e(1 + x)$ does not converge unless x is a proper fraction, positive or negative, or + 1.

(7) The direct *circular functions*, $y = \sin x$, $y = \cos x$, $y = \tan x$, with their reciprocals. Their simpler properties and relations are developed in elementary trigonometry. Of special interest are their *addition theorems*, e.g. $\sin(x + a) = \sin x \cos a + \cos x \sin a$. The functions can be expanded in infinite series of powers of x, either by algebraic methods as in higher trigonometry, or by Maclaurin's Theorem (q.v.) in the calculus. The series for $\sin x$ and $\cos x$ hold for all values of x. They are (x being in radians, as always in higher mathematics):

$$\sin x = x - \frac{x^3}{1\cdot 2\cdot 3} + \frac{x^5}{1\cdot 2\cdot 3\cdot 4\cdot 5} - \ldots,$$

$$\cos x = 1 - \frac{x^2}{1\cdot 2} + \frac{x^4}{1\cdot 2\cdot 3\cdot 4} - \ldots$$

It follows from these series and that for e^x, given above, that $e^{ix} = \cos x + i \sin x$, and $e^{-ix} = \cos x - i \sin x$ where $i = \sqrt{-1}$. These relations between the exponential and the circular functions, involving the imaginary unit i, are typical of similar relations of far-reaching importance, the full development of which belongs to the *theory of functions of a complex variable*, a complex variable being a number of the type $x + iy$, where x, y are real, and i stands for $\sqrt{-1}$. The beauty and power of modern mathematics arise from this theory. Its simpler ideas are expounded in textbooks on higher trigonometry. More extended developments will be found in the treatises mentioned below.

(8) The *inverse circular functions*, $y = \sin^{-1}x$, $y = \cos^{-1}x$, $y = \tan^{-1}x$, &c.; now often written $y = \text{arc sin}x$, $y = \text{arc cos}x$, &c. These are inverse to the direct circular functions, e.g. if $x = \sin y$, then $y = \sin^{-1}x$. For a given value of x between 1 and −1,

there are an infinite number of values of y which make $x = \sin y$; for definiteness, $\sin^{-1}x$ is conventionally defined to be that angle *between* $\frac{1}{2}\pi$ *and* $-\frac{1}{2}\pi$ whose sine is x; $\tan^{-1}x$ is made to lie between these same limits, but $\cos^{-1}x$ between 0 and π. These functions also are expansible in series of powers of x of simple type. That for $\tan^{-1}x$ is the most important; viz. if x is numerically not greater than 1, then

$$\tan^{-1}x = x - \tfrac{1}{3}x^3 + \tfrac{1}{5}x^5 - \ldots$$

Putting $x = 1$, we get Gregory's series for π, viz. $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots$

The above list includes most of the functions usually discussed in elementary analysis. The *hyperbolic functions* may also be mentioned. They are defined in terms of the exponential function; thus $\cosh x = \frac{1}{2}(e^x + e^{-x})$, $\sinh x = \frac{1}{2}(e^x - e^{-x})$, $\tanh x = \sinh x/\cosh x$, &c. Their analogy with the ordinary circular functions is obvious from (7) above.

All the above functions are *analytic*; this means that for any value of x near a given value a (special values perhaps excepted), the function can be expanded in an ascending series of powers of $x - a$. Combinations of analytic functions, such as $\sin(\log\tan x^3)$ are analytic.

An important property of functions is their *continuity*. Speaking broadly, a function of x is continuous for a given value of x, when a small change in x produces only a small change in the function; but a much more precise definition is given in theoretical discussions. A function which has a derivative (*see* CALCULUS) is necessarily continuous, but the converse is not true; functions have been devised which are continuous for every value of x, and yet have no finite derivative for any value of x. An example is the function constructed by Weierstrass,

$$y = 1 + a\cos(\pi bx) + a^2\cos(\pi b^2x) + a^3\cos(\pi b^3x) + \ldots,$$

where a is a positive proper fraction, and b is an odd integer such that ab is not too small, not less than 6, say.

In higher analysis, some of the chief functions which occur are:

(i) The *Gamma* (Γ) *function*, defined when x is positive by the integral $\int_0^\infty e^{-t}t^{x-1}dt$. An equivalent function, the Π function of Gauss, is sometimes used, $\Pi(x)$ being the same as $\Gamma(x + 1)$.

(ii) The *Beta function* of two variables x and y, given by

$$\mathrm{B}(x, y) = \int_0^1 t^{x-1}(1 - t)^{y-1}dt.$$

This function can be expressed in terms of Gamma functions (*See* G. A. Gibson, *Treatise on the Calculus.*)

(iii) *Elliptic functions* (q.v.).

(iv) Jacobi's *Theta functions*. These are defined by certain infinite trigonometrical series, and have remarkable properties. One of the four types is

$$\theta_3(z, q) = 1 + 2q\cos 2z + 2q^4\cos 4z + 2q^9\cos 6z + \ldots,$$

the indices of the powers of q being the squares of the natural numbers; the modulus of q must be less than 1 to ensure convergence. Elliptic functions can be expressed in terms of these θ functions. (*See* Whittaker and Watson, *Modern Analysis.*)

(v) Functions defined by differential equations (q.v.). For *periodic functions, see* FOURIER SERIES. *Harmonic functions*, or *potential functions*, are functions which satisfy Laplace's equation (q.v.). *Green's functions* occur in the theory of Laplace's and other differential equations.—BIBLIOGRAPHY: G. A. Gibson, *Treatise on the Calculus*; E. W. Hobson, *Functions of Real Variables*; Whittaker and Watson, *Modern Analysis*; Harkness and Morley, *Theory of Analytic Functions*; A. R. Forsyth, *Theory of Functions of a Complex Variable.*

FUNDAMENTALISM, religious movement in the U.S.A. It arose about 1910 when a number of Christians in Tennessee and other states decided to require from those professing their faith the acceptance of the fundamental doctrines of Christianity, not only the virgin birth, the atonement and the resurrection, but the verbal inspiration of the Bible.

FUNDI, or **FUN-DUNGI,** a kind of grain allied to millet (the *Paspalum exile*), much cultivated in the west of Africa. It is light and nutritious, and has been recommended for cultivation in Britain as food for invalids.

FUNDS, PUBLIC, and **FUNDED DEBT,** money lent to the Government and constituting a national debt. These debts are distinguished as unfunded or floating when they are contracted to be paid off at a specified date; funded, when the interest only is paid, and the debt itself need never be paid at all. Funding a debt then means simply rendering it irredeemable, or redeemable only at the option of the borrower. Thus there are at present two kinds of funded debt in Great Britain—terminable annuities, in which the payment of interest for a given term of years, or for the life of the annuitant, extinguishes the debt; and permanent funds, upon which interest is due till the redemption of the debt, but in which no period is fixed for redemption. To

this class belongs the great bulk of the National Debt (q.v.).

A Sinking Fund is a fund or stock set apart, generally at certain intervals, for the reduction of a debt of a Government or corporation.

FUNDY, BAY OF, a large inlet of the Atlantic, on the east coast of North America, separating Nova Scotia from New Brunswick. At its inner extremity it divides into Chignecto Bay, and Minas Channel and Basin, with smaller continuations. It is noted for its impetuous tides, which cause a rise and fall of from 12 to 70 feet, and the navigation is dangerous. At its entrance are Grand Manan and other islands.

FU'NEN (Dan. *Fyen*), the largest of the Danish islands except Zealand, from which it is separated by the Great Belt, and from Jutland by the Little Belt; circuit, about 185 miles; area, 1,132 sq. miles. The interior, towards the west, is covered by a range of low hills, but, with this exception, it is composed of large and fertile plains, under good cultivation. The largest stream is the Odense, which has a course of about 36 miles. The chief towns are Odense, Svendborg, and Nyborg. The pop. is 252,258.

FUNERAL RITES, the rites and ceremonies connected with the disposing of the dead. Among the ancient Egyptians the friends of the deceased put on mourning, and abstained from gaiety and entertainments for from forty to seventy days, during which time the body was embalmed. (*See* EMBALMING.) Among the ancient Jews great regard was paid to a due performance of the rites of sepulture; and among the ancient Greeks and Romans to be deprived of the proper rites was considered the greatest misfortune that could happen. The decorous interring of the dead with religious ceremonies indicative of hopes of a resurrection is characteristic of all Christian nations. With Roman Catholics the body is the object of solemn ceremonial from the moment of death until interment. The Church of England funeral service is too well known to require any notice.

Among other Protestant bodies there is usually no formal service, but before the interment prayer is offered up or an ordinary religious service held in the house of the deceased or his relatives, or, in the case of a public funeral, in some public place. The delivery of funeral orations by laymen is a common practice in France, and not infrequent in America. The wake, or watching, is celebrated in some parts of the United Kingdom, particularly in its remoter districts. In Ireland the wake of the lower classes is usually a scene of tumult and drunkenness. For many curious customs at funerals see Brand's *Popular Antiquities* and Strutt's *Manners and Customs*; *see also* BURIAL.—BIBLIOGRAPHY: Sir J. G. Frazer, *The Golden Bough*; E. B. Tylor, *Primitive Culture*; Sir J. Lubbock (Lord Avebury), *Origin of Civilization*.

FÜNFKIRCHEN, now **PECS** (fünf' kirh-ĕn; 'Five Churches,' supposed to be the Roman *Colonia Serbinum*), a free town of Hungary, on the slope of a hill, 105 miles S.S.W. of Budapest. It is the see of a bishop, and the cathedral, a handsome Gothic structure, is one of the oldest ecclesiastical edifices in Hungary. Fünfkirchen once had a flourishing university, attended by 2,000 students. Its industries comprise the manufacture of fine pottery, woollens, leather, and liqueurs. In the neighbourhood brown coal and black marble are worked. Pop. 61,801.

END OF VOLUME IV

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