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THE ECONOMICS OF
CHEMICAL INDUSTRIES

THE ECONOMICS OF CHEMICAL INDUSTRIES

BY

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PREFACE

It is the purpose of this book to familiarize the readers and especially students with the characteristic background and the economics common to the American chemical industries.

There is no text, and none can be written, which would remain up to date and at the same time cover in detail *all* the peculiar economic and management problems which have appeared in this field, and will be steadily arising in new and manifold forms. This task is ably taken care of by the excellent trade papers which serve the industry and which should be used for supplementary reading and as sources of information on current events and details.

The trade papers, on the other hand, cannot furnish the systematic and fundamental preparation which is necessary for the proper understanding, appraising, and solving of chemical economic problems. This is the kind of special training which this book is intended to provide and promote. Its main aim is to demonstrate what has been done so far in chemical economics, and it describes the dangerous as well as the practical and useful economic policies which should be understood by those who actually are or hope to be dependent on the industry.

As no branch of economics is as yet an exact science, and because in real life only very few of the economic decisions which have to be made daily can be based on integrated formulas and complicated charts, such theoretical approach has been avoided. Instead, the *basic rules* and *methods* have been described, purposely in simple form, so that they can be remembered by all and put to actual use, modified and adjusted, of course, by good judgment in view of existing details.

No attempt has been made in this book to tie economics directly in with engineering. This tendency is more predominant in chemical education than in the training which is foreseen for other industries. The method undoubtedly has its excellent points, but also its weaker sides. Not all those concerned with chemical industries have or had the advantage of a complete engineering training, nor do nor will they have to solve primarily technical problems in their daily work. The truly economic part has been treated only once before by Haynes, in his "Chemical Economics," and chemical school programs either

have shown a serious gap, or have had to be improved by costly general courses and by extensive reading, which referred to chemical economics and management only sporadically.

This study aims to overcome these shortcomings, at least in part. Further efforts should be made to extend this introductory chemical economic training with special, detailed, and thorough economic surveys of the various branches of chemical production.

In preparing the manuscript the writer has been greatly benefited by the generous assistance of Mr. Sidney D. Kirkpatrick, Editor of *Chemical and Metallurgical Engineering*; Professor D. D. Jackson, Executive Officer, Chemical Engineering Department, Columbia University; Shailer L. Bass, Dow Chemical Company; T. K. Heston and A. S. Rudd, Standard Statistics; W. J. Schappa, Grasselli Chemicals; A. F. Stranahan, Economist's Division, New York Stock Exchange.

Special thanks and recognition are further due to Mr. Robert L. Taylor, Assistant Editor of *Chemical and Metallurgical Engineering*.

The responsibility for findings, conclusions, and statements, naturally, is that of the author.

EDWARD H. HEMPEL.

NEW YORK, 1939

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THE ECONOMICS OF CHEMICAL INDUSTRIES

CHAPTER 1

SCOPE, STATISTICAL RECORD, AND IMPORTANCE OF THE CHEMICAL INDUSTRIES OF THE UNITED STATES

SCOPE

Though it may seem a simple matter to define a chemical industry, an attempt to do this on any *one* theoretical principle appears futile and contrary to established practice.

However, in discussing the chemical industries collectively one cannot neglect this problem. A definite classification becomes of practical importance as soon as one attempts to present figures for these industries combined as a group or to describe their common economic background. Immediately the question arises which industries should be included and which should be left out.

The steel and iron industries, food industries, and automotive industries, for instance, are easily defined and recognized on the basis of the similar characteristics of their products. Chemical industries cannot be grouped on this basis. The many chemicals which are being produced on an industrial scale are not alike in nature, nor are they being used for like purposes.

Therefore one is forced to look for other principles by which the group may be determined.

According to definition, "chemistry is the science dealing with the constitution of matter and with the intramolecular changes which materials undergo under the influence of certain processes, altering the physical properties of matter."

On this basis, one might attempt to define a chemical industry as any industry which transforms materials through certain processes into substances of a different molecular structure. For further definition one might add that the certain processes consist of:

(*a*) *Mechanical processes,* such as grinding, mixing, classifying, and filtering, which in the chemical industries are only preparatory or auxiliary.

(*b*) *Physical processes,* such as distillation, evaporation, crystal-

lization, heating, and cooling, which may alter the physical state of a substance and thus widen its field of uses.

(c) *Chemical processes* involving actions with acids and alkalis or oxidizing and reducing agents, actually effecting intramolecular changes and creating new substances.

In order to make it still better understood one might define as a chemical industry any industry which transforms the matter contained in raw materials or crudes into chemicals of a higher order better suited for further uses.

This definition would be well in line with basic concepts, but it would include in the scope of chemical industries all metallurgical industries, oil refining, the rubber industries, and a few other manufactures. Strictly speaking, this is as it should be. These industries are chemical industries, but in everyday practice they are not considered so because they have grown to such great size that they are given status as separate industries and in the United States are no longer considered within the chemical group.

Therein we have the first important inconsistency in determining the scope of the group.

On the other hand, the large vegetable oil and animal oil and fat industries are usually included in the chemical group in spite of the fact that their products are not obtained by chemical transformation of the raw materials. In this we encounter the second important inconsistency in determining the group according to American practice.

The problems of definition and classification have been dealt with repeatedly by our statistical agencies, especially the U. S. Bureau of the Census, Washington, D. C., and finally have been solved by following established customs and traditional principles of the chemical trade rather than by strict adherence to theoretical limitations.

In order to simplify matters the same procedure has been followed in this treatise, and the industries included in the chemical group are almost the same as those so classified by the Bureau of the Census.

The following industries are included in the group:

1. Alcohol (ethyl) and distilled liquors. Before 1919 and since 1931 the industry has been classified as a beverage or food industry. During prohibition times it was considered a chemical industry. The alcohol and liquor industry really should be segregated into two different groups, but as this appears obviously impossible and as more commercial alcohol than potable liquor is contained in the group, it has been considered here as a chemical industry, contrary to census practices.

2. Ammunition.
3. Artists' materials. This industry is officially allocated to none of the major groups and would not be considered as a chemical industry if it did not cover many products which are closely allied to the paint group: oil colors, tailors' chalks, crayons, gold and bronze mixtures, powders, paints, gold and aluminum enamel, paint for chinaware, drawing inks, and similar materials. The inclusion of this industry is also contrary to census practice.
4. Baking powders and yeast.
5. Blackings, stains, dressings.
6. Bluing.
7. Bone black, carbon black, and lamp black.
8. Chemicals not elsewhere classified. This group as reported by the census is a "basket group" in which are included some of the most important branches of chemical productions: acids, nitrogen and fixed nitrogen compounds, sodium compounds, potassium compounds, aluminum and alum compounds, miscellaneous organic and inorganic chemicals. It is regrettable that these rather heterogeneous groups are not as yet reported separately as fully recognized classifications and that not *all* the data are being shown for every one of them which are reported for many other industries of much less importance than those still combined in this classification.
9. Cleansing and polishing preparations.
10. Compressed gases.
11. Druggists' preparations.
12. Drug grinding.
13. Explosives.
14. Fertilizers.
15. Fireworks.
16. Glue and gelatin.
17. Grease and tallow, not including lubricating greases.
18. Ink, printing.
19. Ink, writing.
20. Lubricating oils and industrial greases.
21. Matches.
22. Mucilages, pastes and others.
23. Oil, cake and meal, cotton seed.
24. Oil, cake and meal, linseed.
25. Oils, essential.
26. Oils not elsewhere classified.
27. Paints and varnishes.
28. Patent medicines.

29. Perfumes.
30. Rayon and allied products.
31. Salt.
32. Sulphuric, nitric and mixed acids. (Now in chemicals not elsewhere classified.)
33. Soap.
34. Tanning materials.
35. Turpentine and rosin.
36. Wood distillation products and charcoal.

These industries together are considered in this treatise as the chemical group.

STATISTICAL RECORD OF THE ENTIRE GROUP

In order to convey from the start a true picture about the size and economic record of the chemical industry, Table 1 is offered showing the most important statistical data for the entire group. They are based on the official Census of Manufactures and contain as many of the individual 36 branches in each year as were reported in the respective census. The latest available data are those for 1935.

TABLE 1

CHEMICAL INDUSTRIES OF THE UNITED STATES

Statistical Record of the Entire Group

Census	No. of Establishments	No of Employees (Wage and Salary)	Net Investment. Total Assets Minus Reserves	Value of Products	Cost of Materials	Wages and Salaries	Raw Profits
1849	2,757	17,307	$24,026,519	$52,307,907	$34,136,850	$4,382,034	$13,789,023
1859	2,930	23,042	45,005,955	85,880,310	56,543,391	7,001,871	22,335,048
1869	3,310	11,796	67,684,054	131,395,626	79,412,216	12,753,321	39,230,089
1879	4,726	70,554	145,256,448	258,336,564	159,254,327	24,800,851	74,281,386
1889	7,829	117,416	317,681,725	434,034,843	244,014,164	56,911,810	133,108,869
1899	8,722	186,840	499,726,124	621,034,666	334,718,905	87,864,344	198,451,417
1904	11,213	212,716	685,396,601	840,841,218	462,051,400	114,444,122	264,345,696
1909	10,710	265,899	982,124,494	1,171,325,711	656,661,005	235,561,655	279,103,051
1914	10,994	300,298	1,352,923,636	1,336,706,045	846,483,723	210,762,499	279,459,823
1919	10,978	436,416	2,799,551,273	3,490,596,379	2,193,602,732	555,515,406	741,478,241
1921	8,405	319,924	2,800,000,000*	2,316,432,421	1,379,142,139	401,884,479	535,405,803
1923	7,924	347,916	3,300,000,000*	2,814,971,477	1,604,379,209	467,824,161	742,768,107
1925	8,423	362,030	3,870,000,000*	3,298,267,920	1,865,897,247	504,672,743	927,697,930
1927	8,902	373,203	3,965,000,000*	3,401,134,022	1,836,021,391	522,283,987	1,046,128,644
1929	9,677	410,173	4,554,000,000*	3,892,633,196	2,034,651,373	587,042,267	1,270,939,556
1931	8,676	328,401*	4,000,000,000*	2,754,880,288	1,310,204,809	427,575,847*	1,017,099,632*
1933	7,653	324,932†	3,600,000,000*	2,254,825,564	1,029,137,558	329,912,348†	895,745,658‡
1935	8,565	376,601	4,200,000,000*	2,925,488,549	1,495,324,223	457,903,532	972,260,794

* Estimates † Understated ‡ Overstated

The data begin with 1849, but this does not mean that there were no chemical industries in the United State before that year. As will be described, there were quite definite beginnings and even well-developed chemical manufactures long before that date, but no reliable and complete statistical data are available. Only for this reason this record has not been extended further.

The beginnings were modest, but the record of growth is among the most remarkable achieved by any industry. The continued progress can be traced in the steady increase in the number of establishments, the number of employees, net investment, value of products, amounts paid out for materials, wages, and salaries, and in the raw profits retained by the managements.

At first glance it will be noted that the *general rise* in chemical production lasted from the begining until 1919, which still shows the influence of war stimulation. In 1921 the industry appears reduced again to the size which it probably would have achieved in its natural economic development. Disregarding 1919, and again looking at the record, the steadiness of the progress appears unbroken from 1849 until 1929.

The decline in the *number of establishments* which began after 1904 was caused mainly by the rise of large-scale enterprises, mergers, and consolidations and is not indicative of a decline in chemical activities proper.

The *number of employees* reported in the table includes wage earners and salaried men. They are reported separately in the census records, and sufficient information can be obtained there and in the trade magazines about either of these groups. Unfortunately, however, the data on the salary group have been less publicized than those concerning the wage earners, much of the discussion on employment in the industry having been centered on the latter. In order to present the complete employment picture the two groups have been combined; for the purpose of economic analysis this appeared especially advisable, as they together participate in and are dependent upon the industry. The numbers of proprietors and central office employees are not included in the figures. The employment record is somewhat complicated by the fact that in 1931 and 1933 the census method was changed. In 1931 only wage earners were reported while all salaried employees were left out, and in 1933 only the wage earners and the supervisory, technical, and clerical employees are shown, the important group of salaried officers being omitted. These changes in census method naturally made the census employment data appear too low in the most critical

years, and therefore some carefully calculated adjusted figures are offered in the tables. The census figures for 1935 are upon the same basis as those of 1929 and previous years, and with the adjusted figures a fairly correct and complete record has been presented.

Net investments are reported because they are of greatest interest and importance in appraising the record of an industry. Up to and including 1919 the census reports provided investment figures. These have been used in spite of the fact that they are known not to have been uniformly reported by all companies. No other figures are available. After 1919 no more investment data were collected in the census, and thus another important and most informative economic factor was almost forgotten and often overlooked. To avoid this in this study, net investment figures for 1921 and subsequent years have been estimated as carefully as available information permitted. The figures are offered with reservations but are presented because without them the economic picture would be incomplete and would not show the tremendous investment necessary to carry on modern chemical production. The figures indicate the investors' stake and risk in the industry.

The *values of production* represent the wholesale values of the entire chemical output in all years except in 1929, when actual sales are reported. Usually there is not a very great difference between these values in any year, so that for economic purposes the value of production can be held to be the same as its actual wholesale value.

Cost of materials includes the costs of fuel and containers. Economically this figure can be interpreted as the amount which the industry has contributed to material-supplying sources. Thus it represents that portion of the total value of production which was returned into and has benefited the industrial economic system of the country.

Wages and salaries have been combined for reasons explained above. The figures indicate the contribution which the industry has made to maintain the social economic forces. Just as in some years the census reports left out the number of certain salaried employee groups so they did not report the amounts paid to these employees. Therefore, the actual census totals of reported wages and salaries are understatements. Attempts have been made to calculate more truly correct figures, which are shown as adjusted estimates.

"Raw profit," a new term perhaps for some, has been calculated in order to show the share of the total wholesale value of production which the managements had at their disposal after having paid for materials, wages, and salaries. (Raw profit = Total value of products

minus cost of materials and wages and salaries.) Out of this amount the managements have to cover all expenses for manufacturing and distribution, amortization and depreciation of plants and equipment, maintenance, repairs, replacements, research, advertising, interest on borrowed capital, salaries to corporate officers, provisions for all the many necessary reserves, taxes, and finally net profits, either distributed in the form of dividends or interest to investors or carried forward as surplus.

By representing all these data in complete series for the entire period of the statistical history a more thorough economic and social economic analysis of the industry has been made possible than usually has been provided or can be made from fragmentary data covering only one or a few years.

Especially tempting is a direct comparison of the absolute amounts of wages and salaries paid out with the raw profits retained by the managements, or other comparisons of any of the figures with those of other industries. For all such purposes it should be kept in mind that the operating expenses in chemical production are considerably higher than in most other industries. The producing and handling of chemicals cause much greater destruction to plants, equipment, and machinery, require much more research, more expensive containers, reserves, and insurance, and involve many other special expenses, so that the "raw profits" of chemical producers definitely must be reduced to make them suited for such comparisons as indicated above.

As most of the special chemical charges or expenses come from higher requirements for plants and equipment, one might feel that the necessary reduction should be calculated on the basis of fixed assets or net investment. But as fixed assets for the entire industry are not reported and also the net investment data are only estimates, and furthermore have always been much larger in recent years than the value of production, the most conservative method for calculating these extra expenses will consider the value of production rather than net investment.

Financial experts do not agree with production and research men who also have been consulted on this point, nor do they agree on how much should be deducted for "special chemical charges or expenses," but it seems that a deduction of 10 per cent of the value of production is a conservative and at the same time sufficiently close figure, representative of the special expenses which chemical managements have to take care of, and, therefore, should be taken out of chemical raw profits in order to make chemical "raw profit after deduction" indica-

tive of the probable maximum amount or share over which managements really have control according to their own financial plans.

Naturally all these special expenses differ from enterprise to enterprise and are not the same in all branches of chemical production. In some industries (as acid production) they may absorb much more than the 10 per cent used in the following discussion, but, if one considers that quite a few important branches of the industry have less than 10 per cent "special chemical charges or expenses," the 10 per cent deduction from raw profits seems well justified for an economic analysis of the industry as a whole. It also would need much impossible research, and would not have any great influence on the findings, if a different percentage should be applied to the data for the earliest years.

INTERNAL ECONOMIC TRENDS AND CHANGES

In order to present the figures shown in Table 1 in their very important relationships to each other and thus to disclose the internal economic structure of the industry, as well as the changes which have taken place during the last 85 years, Table 2 is presented.

The indexes presented in this tabulation were calculated entirely from the figures presented in Table 1.

Cost of materials, wages and salaries, and raw profits before and after the 10 per cent deduction for the special chemical operating charges (heavier amortization, depreciation, replacement funds, repair, maintenance, leakage) have been simply expressed as percentages of the corresponding values of production.

The turnovers were obtained by dividing the values of production by their corresponding net investments.

The raw returns on investment before and after the 10 per cent deduction were established by multiplying the turnovers by the raw profit percentages. The same raw returns on investment could have been obtained by relating raw profits with the actual investment figures.

Whereas the statistical figures presented in Table 1 show the actual growth of the chemical industries, these indexes now reveal the important changes which have taken place in the economic evolution and in the internal structure of the group.

From the beginning until 1919 the industry spent a varying, but high percentage of the total value of production for raw materials. After 1919 we find this percentage steadily decreasing. This is a rather important feature, as it reflects clearly and measurably the influence

of large volume production. The industry began to save in raw material costs and during 1931 and 1933 obviously was at a special economic advantage in this respect.

TABLE 2

CHEMICAL INDUSTRIES OF THE UNITED STATES

Internal Economic Trends and Changes

Total Value of Production = 100.00.

Census	Cost of Materials, %	Wages and Salaries, %	Raw Profit, Before Deduction, %	Raw Profit, After Deduction, %	Turnover	Raw Return on Investment, %	Returns on Reduced Raw Profit, %
1849	65 26	8.38	26.36	16 36	2 18	57 46	35 66
1859	65 84	8.15	26 01	16 01	1 91	49 68	30 58
1869	60 44	9.71	29 85	19 85	1 94	57.91	38 51
1879	61 65	9 60	28 75	18 75	1 78	51 18	33 38
1889	56 22	13 11	30 67	20 67	1.37	42.02	28 32
1899	53 90	14.15	31 95	21 95	1 24	39.62	27 22
1904	54 95	13.61	31.44	21.44	1.23	38 67	26 37
1909	56 06	20.11	23.83	13 83	1.19	28.36	16 46
1914	63 33	15.77	20 90	10.90	0 99	20 69	10 79
1919	62 84	15.91	21 25	11.25	1 25	26.56	14 06
1921	59 54	17 35	23 11	13 11	0.83	19.18	10.88
1923	56 99	16.62	26.39	16 39	0.85	22 43	13.93
1925	56 57	15.30	28.13	18 13	0.85	23.91	15 41
1927	53 93	15.34	30.73	20.73	0 86	26.43	17.83
1929	52 27	15 08	32 65	22 65	0 68	22.20	15.40
1931	47 56	15.52	36.92	26.92	0.69	25.47	17.88
1933	45 64	14 63	39 73	29.73	0 63	25.03	18.73
1935	51 11	15 65	33.24	23.24	0.70	23 68	16.27

"Returns on Reduced Raw Profits" are obtained uniformly by estimating the "special chemical charges" at 10 per cent of the value of production and multiplying the reduced raw profit by the turnover (26.36 − 10 00 16 36 × 2 18 = 35 66)

In definite contrast to this, the wages and salaries percentages indicate that the industry did not save on labor costs. In spite of technical improvements and large-scale operations, the amounts taken out of the total value of production for labor increased absolutely as well as relatively. By 1919, labor's share was double what it had been in the early days, and thereafter it was fairly well maintained at that percentage.

The raw profits made by management, before and after consideration of the higher operating charges of chemical enterprises, were for

quite a few decades high indeed; and, so long as they were further combined with good turnovers, they furnished raw returns on the investment which were exceptionally high. Even in more recent decades the raw profits may appear to have remained high, but as the investment necessary for modern production had to be increased, the turnovers declined and accordingly the producers received a steadily decreasing return on their investment until their share became approximately equal to the share received by labor. Ever since employers and employees had to decide on what would be a "fair share" for either party or group, this problem has been the crucial point of economic theory and still more of actual practice. It seems, however, that, if both groups participate at equal rates, a high degree of economic equilibrium and possibly the most ideal state of social profit sharing have been achieved.

The method of analysis used above and the indexes obtained might well deserve most careful study, because they show the economic and social truths in reference to the participating social groups much more reliably than any statements based on average wages, which usually are not correct to start with, because part-time workers are included, and still less are comparable with similarly incorrect average wages of other industries, since different industries require different kinds of skill and operate with different degrees of mechanization. For these reasons no attempt has been made to calculate average wages for individual "average workers" or employees or to demonstrate any economic characteristics of the industry by such figures.

It is believed that this presentation of indexes is also much more informative than the method which for analysis purposes mainly uses the value added by manufacture (value of product minus cost of materials) and claims that these amounts reveal the economic importance of an industry. Modern analysis methods tend to measure the growth and importance of any economic factor or activity, not within the industry itself, but by relating it with some other factor or activity.

Therefore, in order to demonstrate the economic importance of the chemical group, every element shown in the statistical record of the chemical group (Table 1) has been expressed as a percentage of the corresponding figure for the entire industries of the United States, and the following highly interesting and easily comprehended set of data has been obtained.

The figures show probably better than could any "value added by manufacture" the absolutely and relatively growing national economic importance of the group.

TABLE 3

CHEMICAL INDUSTRIES OF THE UNITED STATES

Their Economic Importance within the Total Manufacturing Industries

(The Figures show the Percentages obtained in the Totals for all Industries)

Census	Number of Employees, %	Net Investment, %	Value of Products, %	Cost of Materials, %	Wages and Salaries, %	Raw Profit Before Adjustment %	Raw Profit After Adjustment %
1849	1 808	4 506	5 133	6 149	1 851	6 070	3 767
1859	1 757	4 457	4 554	5 481	1 848	4 698	2 892
1869	2 035	3 994	3 881	3 989	2 055	3 902	3 368
1879	2 582	5 206	4 723	4 688	2 616	7 248	4 728
1889	2 491	4 869	4 631	4 727	2 493	6 907	4 655
1899	3 275	5 090	4 776	4 557	3 223	6 766	4 649
1904	3 551	5 403	5 681	5 433	3 592	8 495	5 793
1909	3 463	5 329	5 666	5 408	5 396	6 703	3 890
1914	3 634	5 936	5 513	5 891	4 055	6 193	3 231
1919	4 036	6 296	5 592	5 869	4 138	6 383	3 378
1921	3 870	6 089	5 306	5 443	3 734	7 088	4 022
1923	3 384	6 415	4 649	4 623	3 336	6 281	3.900
1925	3 673	6 450	5 259	5 192	3 637	7 191	4.634
1927	3 815	6 500	5 428	5 226	3 710	7 745	5.225
1929	3 970	6 600	5 527	5 278	3 858	7 624	5 289
1931	4 424	6 667	6 662	6 008	4 578	9 662	7 045
1933	4 738	6 923	7 190	6 118	4 985	11 310	8 463
1935	4 154	6 935	6 393	5 694	4 655	10 064	7 036

An increasing proportion of all industrial employment has been provided by the chemical industries; an increasing part of the national industrial capital has found its way into chemical investments; a steadily more valuable portion of all production has come from the chemical group; chemical producers have bought fairly steadily the same percentage of all raw materials consumed by American industry; wages and salaries paid by chemical industries represent growing portions of the total amounts paid to all industrial employees. In 1849 they paid only 1.851 per cent of all wages and salaries paid by American industry; in 1933 they paid 4.985 per cent, or almost three times that much.

Especially worth noticing are the figures for 1935. They are so remarkably good, and satisfactory in all respects, that if they are achieved again in future years one is led to believe that we are rapidly approaching what quite a few prophets predicted long ago, viz., a

chemical era in industry. So far the chemical industries have been merely the handmaidens for their more glamourous sisters. If the indicated trends are maintained, the chemical industries will have reached the stage where they will increase their economic importance through their own activities. As those chemical industries making products directly salable to consumers increase their own field, they will carry along with them basic chemical production and thus develop a strictly chemical movement "from raw materials to finished products." Rayon, plastics, oil products, synthetic chemicals, fertilizers, and quite a few other groups are definitely in the process of opening up new direct-consumer markets with new products, and it is safe to assume that by this economic process the chemical group will gain ground much more quickly in the future than it has in the past.

THE WEALTH-CREATION FACTOR OF THE GROUP

From a national economic point of view there can be hardly any objection to such a further evolution since the chemical group has as much, if not greater, faculty for creating national wealth as most other industries. Table 4 is offered to demonstrate this point.

TABLE 4

CHEMICAL INDUSTRIES OF THE UNITED STATES

Their Faculty of Creating Wealth Compared with That of Other Industries

All values in million dollars

Industrial Group	Census 1929			Census 1933			Census 1935		
	Value of Products	Cost of Materials	Wealth Creation Factor	Value of Products	Cost of Materials	Wealth Creation Factor	Value of Products	Cost of Materials	Wealth Creation Factor
Total U S industries	*69,961*	*38,178*	1 832	*31,359*	*16,821*	1 864	*45,760*	*26,263*	1 742
Chemical, Table 1	*3,898*	*2,035*	1 913	*2,356*	*1,029*	2 191	*2,926*	*1,496*	1.927
Chemical, Census	*3,708*	*1,936*	1 913	*2,118*	*968*	2 187	*2,837*	*1,447*	1.961
Food, Total .	*11,606*	*8,296*	1 399	*6,604*	*4,210*	1 569	*9,511*	*6,722*	1.415
Animal products	*5,148*	*4,264*	1 207	*2,416*	*1,870*	1 292	*3,627*	*2,988*	1.214
Vegetable products	*5,920*	*3,854*	1 536	*3,510*	*2,162*	1 624	*4,887*	*3,355*	1.457
Textile	*9,243*	*5,104*	1 811	*4,811*	*2,533*	1 899	*6,061*	*3,251*	1 864
Forest products	*3,531*	*1,560*	2 264	*1,127*	*509*	2 214	*1,662*	*776*	2.141
Paper and allied products	*1,892*	*1,093*	1 732	*1,173*	*655*	1 791	*1,523*	*886*	1.720
Petroleum refining .. .	*2,640*	*2,031*	1 299	*1,379*	*1,064*	1 295	*2,464*	*1,781*	1.383
Iron and steel	*7,188*	*3,863*	1 848	*2,463*	*1,401*	1 758	*4,265*	*2,375*	1.796
Machinery	*7,104*	*2,721*	2 611	*2,069*	*789*	2 622	*3,816*	*1,521*	2 508
Motor vehicles	*3,710*	*2,395*	1 549	*1,097*	*768*	1 429	*2,391*	*1,814*	1 318
Electric machinery	*2,301*	*971*	2 370	*563*	*213*	2 604	*960*	*371*	2 589

The creation of national wealth can be measured by the value added by manufacture (value of product minus cost of materials), as is being done in the census reports. But equally, if not more, important seems to be also the *rate at which this wealth is created.* Therefore "wealth-creation factors" have been calculated (value of product divided by cost of materials) for the chemical group, as well as for other industrial activities, and for the national industry as a whole. These indexes might well reveal the economic vitality of their respective groups and any changes for better or worse.

A comparison of the wealth-creation factors of the various industries offered in Table 4 is so informative and conclusively in favor of the chemical industries that no additional comments appear to be needed to stress further the economic desirability and value of this group.

CHAPTER 2

HISTORICAL RECORD

The efforts, foresight, and courage of many men were needed to establish a chemical industry in America, to make it grow, and to bring it to the economic rank which it holds today.

The history of this achievement has been described so well by Williams Haynes in his "Chemical Economics" that there should be no need to do it over again. But as the statistical record alone is lifeless without history, a chronological presentation seems justified and has been attempted.

It aims to report the earliest facts for which there are no statistics, to fill the gaps between the data which are shown, to give them life by reference to names and dates and companies and doings, and to stress those historical, economic, political, and industrial events which helped or retarded the progress of chemical manufacture.

THE COLONIAL PERIOD

The London Company, chartered by the British Government in 1606, financed a settlement at Jamestown, now located in the State of Virginia. The directors of the company had hoped to obtain riches as quickly and easily as had the Spanish and French companies in other parts of the American continent, but the Jamestown settlers soon found that all such hopes were in vain. Forced to produce some visible results for the company, which had subsidized the venture and was to furnish all future supplies, the colonists turned to real work, and lumber, pitch, tar, and wood ashes were the earliest materials which they produced and shipped to England. Within a few years they added corn and tobacco.

The prices which the colonists received for their goods were low. The prices which they paid for imported necessities were high. It was this discrepancy which supplied the first incentive for making themselves those articles which they could and for trading among themselves as soon as sufficient settlements were established along the coast and ships were built in the colonies to carry the trade.

1610 Glass was among the first manufactured products made in Virginia.

1619 The first iron ore was smelted at Falling Creek, Virginia, but production was short-lived because the workmen were massacred by Indians.

1620 Leather was being made in Virginia.

1620 The Pilgrims landed at Plymouth, New England, to attempt exploits similar to those started at Jamestown. Skilled workmen were among the settlers, and they began immediately to ply their arts and crafts. Shoemaking, then begun, is now among the leading industries of New England.

1630 The first tannery operation in New England.

1635—John Winthrop, Jr., established the first plant for production of alum and saltpeter in Boston and thereby became the first producer of chemicals in America. By that time home spinning, tanning, dyeing, soap-making, and meat-pickling had grown to such an extent that there was a steadily increasing demand for these chemicals.

1638 John Winthrop, Jr., founded a salt works in Beverley, Mass.

1640 A fulling mill was built at Salem, Mass.

1643 Pastor Ezekiel Rogers set up a woolen mill at Rowley, Mass The woolen industries which grew out of these beginnings have been ever since among the most important consumers of chemicals

1643 John Winthrop, Jr., established an iron furnace at Lynn, Mass.

1649 John Winthrop, Jr., obtained the first "monopoly" offered in Massachusetts. It granted him the sole right to produce lead, copper, tin, alum, and vitriol and any salts therefrom.

John Winthrop, Jr., organized the first American chemical stock company in 1650. The introduction of this method of financing a manufacturing enterprise is noteworthy in view of the fact that in Europe at that time most manufacturing activities were still financed out of the resources of the masters, which necessarily limited their size and greatly retarded their growth and progress.

1660 From this date until 1696 the British Navigation Acts required that all shipments to Great Britain be made on British vessels Since the colonists were considered Britishers, their trade with England was stimulated while that of other nations was impaired.

1741 Eliza Lucas extracted indigo in North Carolina, thus providing a valuable dye for the American dye houses and for exports.

1750 Coal mining was developed on a larger scale and coal was being used more extensively in Virginia.

1770 William Molyneux opened a commercial dye house with a "full line" of natural dyes.

1774 The British Parliament prohibited exportation of machinery, tools, parts, and plans from England and later on made the emigration

of artisans familiar with the new machines a crime. This was done in order to prevent the European countries and the colonies from taking up the new methods of mechanical production which yielded much better profits than the old handicraft methods. However, these restrictions proved futile.

1775 Christopher Tully, an Irish mechanic, set up a spinning machine in Philadelphia. From this beginning, that city has become one of the great textile centers of the United States.

CHEMICAL MANUFACTURE IN THE NEW REPUBLIC

On July 4, 1776, came the Declaration of Independence. The reasons for this declaration were set forth in the famous document. The suppression of manufacturing activities may not have been the main grievance of the colonists, but they definitely desired to make their own goods in their own shops free from government interference.

The First Congress met in New York on March 4, 1789. In the first session of the National House of Representatives, James Madison introduced a bill for a tariff to raise revenue through import duties. Later on these duties were fixed at 5 per cent *ad valorem* for most products. Of all those products now called chemicals, only salt was mentioned in particular, and the advisability of levying any duty on it was discussed at length. Finally it was decided to impose a duty of one-eighth of a dollar. Imports of arms and ammunitions were admitted free. (See "Abridgment of the Debates of Congress from 1789 to 1856," Vol. 1, D. Appleton and Company, 1857.)

1789 Samuel Slater constructed from memory the first complete set of Arkwright spinning and weaving machinery in the States. At that time the British government imposed life imprisonment or death for removing plans from England. The machine was set up in a factory at Pawtucket, and woolen manufacture created an unexpectedly increasing demand for chemicals in New England.

1790 The Patent Office was created to provide protection for new inventions and processes.

1791 The first U. S. patent was granted to Samuel Hopkins for a potash leaching process. Thus the first patent was a chemical process patent.

1791 Alexander Hamilton made the first report on American manufactures.

While the Census of 1790 revealed that there were 13,929,214 people living in the United States, it included nothing on manufactures, so Hamilton's report contained no statistical data. It did become famous, however, for its proposal of a definite policy for the development of American industries. The following reproduction shows excerpts from the speech:

THE

SOUNDNESS OF THE POLICY OF PROTECTING DOMESTIC MANUFACTURES;

FULLY ESTABLISHED BY

ALEXANDER HAMILTON,

IN HIS REPORT TO CONGRESS ON THE SUBJECT,

AND BY

THOMAS JEFFERSON,

IN HIS LETTER TO BENJAMIN AUSTIN.

TO WHICH ARE ADDED,

EXTRACTS FROM THE ADDRESS OF THE AMERICAN SOCIETY FOR PROMOTING DOMESTIC MANUFACTURES, ESTABLISHED IN NEW YORK.

"Though it were true, that the immediate and certain effect of regulations controlling the competition of foreign with domestic fabrics, was an increase of price, it is universally true, that *the contrary is the ultimate effect with every successful manufacture.* When a domestic manufacture has attained to perfection, and has engaged in the prosecution of it a competent number of persons, it invariably becomes cheaper.

"*The internal competition, which takes place, soon does away every thing like monopoly,* and by degrees reduces the price of the article to the minimum of a reasonable profit on the capital employed.

"*It is the interest of the community, with a view to eventual and permanent economy, to encourage the growth of manufactures* In a national view, a temporary enhancement of price must always be well compensated by a permanent reduction of it.

"This eventual diminution of the prices of manufactured articles, which is the result of internal manufacturing establishments, *has a direct and very important tendency to benefit agriculture.* It enables the farmer to procure, with a small quantity of his labour, the manufactured produce of which he stands in need, and consequently increases the value of his income and property.

"The uniform appearance of an abundance of specie, as the concomitant of a flourishing state of manufactures, and of the reverse, where they do not prevail, afford a strong presumption of their favourable operation upon the wealth of a country." *Alexander Hamilton.*

"*To be independent for the comforts of life, we must fabricate them ourselves.* We must *now* place the *manufacturer by the side of the agriculturist.* The grand enquiry now is, *shall we make our own comforts, or go without them at the will of a foreign nation?* Experience has taught me that manufactures are now as necessary to our independence as to our comfort." *Thomas Jefferson.*

PHILADELPHIA:

PRINTED BY J. R. A. SKERRETT, FOR THE PHILADELPHIA SOCIETY FOR THE PROMOTION OF AMERICAN MANUFACTURES.

1817

These remarks are as true and significant today as they were in 1791, and the history of chemical developments has fully borne them out.

Nowhere in his report did Hamilton refer to chemical production, but the list of manufactures which he reported as already well established is sufficient testimony that there must have been an active demand for chemical products. He enumerated the following among the important and flourishing branches of manufacture:

I. Of skins Tanned and tawed leather, dressed skins, shoes, boots, and slippers, harness and sadlery of all kinds, portmanteaux and trunks, leather breeches, gloves, muffs and tippets, parchment and glue.

II Of iron Bar and sheet iron, steel, nail rods and nails, implements of husbandry, stoves, pots and other household utensils, the steel and iron work of carriages; and for ship building, anchors, scale beams, and weights, and various tools of artificers, arms of different kinds; though the manufacture of these last has of late diminished for want of demand.

III Of wood. Ships, cabinet wares and turnery, wool and cotton cards, and other machinery for manufactures and husbandry, mathematical instruments, coopers' wares of every kind

IV. Of flax and hemp. Cables, sail-cloth, cordage, twine and packthread.

V. Bricks and coarse tiles, and potters' wares.

VI. Ardent spirits, and malt liquors.

VII. Writing and printing paper, sheathing and wrapping paper, pasteboards, fullers' or press papers, paper hangings.

VIII. Hats of fur and wool, and of mixtures of both. Women's stuff and silk shoes.

IX. Refined sugars.

X. Oils of animals and seeds, soap, spermaceti and tallow candles.

XI. Copper and brass wares, particularly utensils for distillers, sugar refiners and brewers, andirons and other articles for household use—philosophical apparatus.

XII. Tin wares for most purposes of ordinary use.

XIII. Carriages of all kinds.

XIV. Snuff, chewing and smoaking tobacco.

XV. Starch and hair powder.

XVI. Lampblack and other painters' colours.

XVII. Gunpowder.

PHILADELPHIA, THE EARLY CENTER OF CHEMICAL MANUFACTURE

As paper-making, dyeing, and iron production located throughout Pennsylvania and the Southern States were much in need of a steady

supply of acid, John Harrison built the first American sulphuric acid plant in Philadelphia in 1792. It was to furnish 300 carboys per year. This event is considered the foundation of real chemical production, because with sulphuric acid many other chemicals can be made. At that time Philadelphia was also the center of a growing textile industry. Still other local products included hats, soap, household goods, sugar, and building materials. As a seaport the city was preferred to other ports by many captains and traders. It is not surprising, therefore, that it became and remained for decades the main producing and trading center for chemicals.

1794 Eli Whitney of Massachusetts constructed a mechanical cotton gin whereby he contributed greatly to the mechanization of cotton manufacturing. The invention made possible a much greater production of cotton goods and thus helped to found a new industry which today is another of the largest consumers of chemicals.

1801 E. I. du Pont began the manufacture of gunpowder at Wilmington, Del., on the advice of Thomas Jefferson. He delivered the first powder in 1802.

1803 An iron foundry was erected in Pittsburgh. This marked the beginning of another great manufacturing center which relied on Philadelphia for the supply of chemicals.

1804 S. Wetherill and Son made the first white lead in Philadelphia, still using vinegar as acid.

1806 John Harrison, seeing the success of Wetherill and Son, added white lead production to his acid plant and also took up other paint chemicals. Since much building was going on, the Philadelphia paint concerns developed quickly into great enterprises, steadily adding new lines of varnish, paint oils, and pigments to their previous products.

When Napoleon decreed an embargo in 1806 which prevented all British and American goods from entering European ports, American exports suffered, but chemical production gained because many raw materials now remained at home awaiting new uses. In order to learn more about the art of making them into chemical products quite a few Americans went abroad to study in England, France, and Germany.

1810 Albert Gallatin, Secretary of the Treasury, obtained from his marshals the first statistical returns on U. S. manufactures. He had them arranged "by a skillful agent" who obtained for all manufactures combined:

Ascertained value of production	$127,694,602
Estimate for omissions	45,068,074
Estimate for "doubtful" reports on cotton milling	25,850,795
Total value of production	$198,613,471
The value of products now considered in the chemical group was probably close to	$10,000,000

1813 Joseph Richardson started making white lead in Philadelphia.

1814 Gerard Troost founded an alum factory at Alum Sable, Md.

1816 Nathan Gifford established a dyewood cutting plant at Poughkeepsie, N. Y., which later became Innis Speiden and Company.

1818 Farr and Kunzi, in Philadelphia, began making acids in competition with John Harrison.

1819 Joseph Richardson sold his white lead business to Mordecay and Samuel Neave Lewis, who promoted many subsequent chemical activities (1827, acetic acid production; 1830, flaxseed crushing). In 1843 George T. Lewis entered the firm, and in 1850 he associated with Charles Lennig to establish the Pennsylvania Salt Manufacturing Company, which produced the first Thompson soda ash saponifier in 1854.

1822 Seidler and Zeitler began the manufacture of fine chemicals in Philadelphia.

1823 Rosengarten bought out Zeitler.

1825 George D. Rosengarten became sole owner of the fine chemical enterprise, which finally developed into Rosengarten and Sons, Philadelphia.

1830 Wood distillation was taken up by James Ward at North Adams, Mass.

By 1830, thirty strictly chemical plants were established in the United States. Their combined capital amounted to $1,158,000, and they produced $1,000,000 worth of chemicals per year. To this would have to be added approximately $18,000,000 worth of soap, turpentine, candles, oils, and other chemical products.

1834 Carter and Scattergood, Philadelphia, introduced the manufacture of nitric acid and hydrochloric acid. It was to be sold mainly to dyeing and bleaching shops.

1836 P. B. Smith, New York, came out with his "Quality" program, a plan to obtain foreign orders for his chemicals. The same "quality" policy has since become a standard policy of many producers.

1839 Eugene Grasselli opened a chemical enterprise in Cincinnati, thus pioneering chemical production in the Middle West.

1843 Samuel Morse was granted $30,000 by Congress to construct a

telegraph line from Washington to Baltimore. This had no direct bearing on chemical production, but it marks the beginning of a new era of modern civilization and of a new industry which has aided the development of many chemical products.

1846 The tariff enacted under President Polk provided that imports could be bonded in government warehouses until duty was paid. The chemical industries have taken advantage of this innovation ever since it went into effect.

By 1846, Irish immigrants began to enter the United States in great numbers, and, in view of the misfortunes which they had had as farmers in their own country, many of them preferred to work in shops. Today a great number of their descendants can be found in chemical plants.

1847 Alexander Cochrane started the A. Cochrane Chemical Works at Malden, Mass. Sulphuric and other acids were his main products. In 1872 the name of the firm was changed to Merrimac Chemical Company. Now located in Everett, Mass., and a subsidiary of Monsanto Chemical Company, it is one of the largest chemical enterprises in the New England states.

By 1848, Germans, discontented with political affairs in their own land, began to come to America. Quite a few well-trained and experienced craftsmen were among them, and these men helped in building the new manufacturing enterprises or established shops of their own.

1849 Charles Pfizer and Company was incorporated for the manufacture of fine chemicals in Brooklyn, N. Y. Tartaric acid, cream of tartar for baking powders, citric acid (made from sugar), and other chemicals have been introduced and commercially promoted by this firm, which is still in existence.

The Census of Population taken in 1850 showed 5,371,876 males over 15 years of age. Of these 2,363,958 were farmers and 909,786 laborers. Among the rest were 465 chemists, 6,139 apothecaries, 3,243 dyers and bleachers, 115 fireworks makers, 144 glue makers, 32 linseed-oil manufacturers, 59 patent-medicine producers, 132 perfumers, 220 powder makers, 507 turpentine distillers, 326 varnish makers, 39 white-lead manufacturers, 164 pot and pearl ash producers, 5,479 barkeepers, 5,147 soldiers, 41,149 students, and 943 professors.

THE HEAVY CHEMICAL INDUSTRIES BEGIN

After the earliest periods of settlement and after the building of homes and shops had progressed in the East, America took to the

West and South with agriculture as its main industry. As Liebig's ideas of fertilizing the ground had just become known, it is not surprising that fertilizer production became a new chemical industry in Europe as well as in the United States.

1850 The first American fertilizer plant was erected in Baltimore, Md.
1853 The second commercial fertilizer plant was built by Dr. Chappel.
1854 The third fertilizer plant was founded by B. M. Rhodes.

By this time 20,000 tons of American and 60,000 tons of imported fertilizers were being consumed per year in the United States.

1854 George T. Lewis and Charles Lennig began the large-scale production of Thompson soda ash through the Pennsylvania Salt Company, at Natrona, Pa. This company was the earliest pioneer in the manufacture of sodium salts, the manufacture of which is now also a "heavy" chemical industry.
1857 Samuel Warren, at Buffalo, N. Y., refined coke-oven tar for the first time in America.

A rather serious business depression followed upon the hectic expansion and speculation which had begun in 1850. However, it did not interrupt industrial progress.

1860 Perkin's aniline dyes were introduced into American dyeing by the Pacific Mills of Lawrence, Mass.
1860 Wharton erected a spelter works at Bethlehem, Pa., for the production of zinc. After two years of operation he produced 3,700,000 pounds per year.
1863 Herreshoff began fish-scrap fertilizer production in Rhode Island.
1865 The South Carolina phosphate rock fertilizer industry became sufficiently well developed to supply all domestic needs as well as some in foreign countries.

The Civil War had greatly stimulated the demand for chemicals, but its end in 1865 was followed by general business stagnation and financial troubles of all kinds. Greenbacks and confederate paper currency flooded the country. People were unemployed, and mills were idle.

1868 Gustav and Edward Mallinckrodt, just returned from Germany and France, opened a fine chemical plant in New Orleans. They made and refined ammonia, chloroform, nitrous ether, and, after 1884, photographic chemicals.
1870 Rose and Lowell started to make phosphorus at Mount Holly, N. J. Until then England had supplied all such material needed

in the United States at monopoly prices. Rose and Lowell matched the price at $1.25 per pound, whereupon the English phosphorus was offered at 70 cents per pound and Rose and Lowell were forced to close shop. In 1872 the British importers again asked $1.20 for their goods. Rose and Lowell started anew, but when they offered American phosphorus at the same price the importers reduced theirs to 50 cents per pound. That price the harassed producers could not match. They had to give up and leave the market to the British producers who sold at 60 cents per pound, duty paid. This episode not only reveals the sales tactics current at that time, but also is an interesting example of the risks involved in chemical enterprise.

CHEMICAL MANUFACTURES BECOME INDUSTRIES

The 1870's, 1880's, and 1890's were the decades of greatest and soundest economic expansion in the United States. Railroads, transportation, mining, agriculture, construction work, and home-building—all were extended, enlarged, and increased in a manner unprecedented.

Manufacturing, partly providing the lead and partly following in the wake of this expansion, quadrupled its output from 3.4 billion dollars in 1869 to 13 billion dollars in 1900, and, by adding to its previous facilities more than 8.1 billion dollars in the form of useful investment, transformed itself into a mighty industry. New specialized processes bloomed within a few years into highly important new branches of production which created new goods, while the old branches turned out their products in such quantities that they began to outdistance even England, the leading industrial nation of the world.

In these processes of transformation and growth the chemical producers did not stay behind. They embarked upon the most troublesome but also the most practical period of their history—that period of invention, construction, and improvement of their basic processing equipment which made possible the production of the larger quantities and varieties of chemicals needed.

At first they tried to import chemical equipment and processes from England, Germany, or France, but quite often they had to discard them or make costly changes. The apparatus was the best Europe had to offer, but it was not designed to be operated by unskilled workmen and inexperienced foremen, nor was it always large enough to handle the quantities desired.

Thus during this period the chemical industries found themselves faced with three difficult tasks: (1) to learn how to make as many

as possible of the chemicals on the growing list of those required by American industry; (2) to create the production facilities needed to fill the quantity demands for some of these; and (3) to import those necessary chemicals which they could not make.

1872 August Klipstein began to import French and German chemicals made by Renault in France and Gehe in Germany. Out of humble beginnings the company grew into one of the best known and respected chemical enterprises in the United States and abroad.

1876 The Centennial Exhibition in Philadelphia showed the industrial and economic progress so far achieved by American producers and greatly stimulated further efforts.

1879 Specie payment (the payment of gold in exchange for banknotes), which had been suspended since the introduction of the inconvertible paper greenbacks in 1863 during the Civil War, was resumed, and public and private credit were greatly improved.

The Census of 1879 was the first in which the chemical industries were treated as a group. W. L. Rowland, special agent of the Superintendent of the Census, wrote in his letter of transmittal: "Sir: I have the honor to submit herewith the final report on the manufacture of chemical products in the United States. As this is the first official report on this branch of industry, its preparation has been attended with extraordinary difficulty, owing to the lack of full and reliable information, particularly in matters of historical interest." He complained about the great variety of processes employed and so divided his work into two parts: (1) general (chemical) industry, and (2) salt production.

In reference to the first part Mr. Rowland stated: "In this report the plan adopted is, so far as possible, similar to that employed by the statisticians of France." Accordingly he included: aniline colors, anthracene, alum, borax, bromine, phosphorus, castor oil, stearic acid, candles, soaps, glycerine, nitroglycerine, manufactured manures, dry colors, white and other salts of lead, barytes, zinc oxide, acetate of lime, potash, soda, sulphur, sulphuric acid, and glucose. Preparations of drugs, pharmaceutical mixtures, and proprietary medicines are not enumerated.

The stress laid upon salt production, in connection with chemical manufacture, is often a surprise to non-chemists, because they think of salt mainly as a product used in the preparation of foods. This, however, absorbs only a minor portion of all the salt produced. Much more salt, or more correctly brine, is used for the production of salt chemicals, primarily soda, which is required in enormous quantities

for making paper, textiles, glass, soap, rayons, petroleum, and many other products.

In 1879 three establishments made only 40,259,938 pounds of soda salts in the United States, but interest in these products was great, because almost ten times as much was still imported annually from foreign countries. (Soda imports in 1879 were 360,301,309 pounds.) The old Leblanc process was costly and cumbersome, and it had not been developed in the United States because English soda was shipped as ballast and could be imported for less than it would have cost to make it.

But only a few short years before (1875) rock salt had been discovered in Ontario County in the State of New York. In 1878 a test well sunk near Wyoming, N. Y., had yielded rock salt and brine, and, since much drilling was going on also in other places, salt and its uses received much attention.

This interest in salt was increased further by Solvay's recent success in making soda much more cheaply by applying ammonia to brine. His plant at Couillet in Belgium had been in operation since 1865, and branch plants had been opened in Dombasle, France, and Cheshire, England.

To apply the same process in the United States was only a matter of making the proper financial and legal arrangements. When salt brines were discovered south of Syracuse by an enterprising group of citizens, Rowland Hazard, who headed them, made arrangements with the Solvay Company to use its process for making soda in the United States. On January 10, 1884, the Solvay Process Company of Syracuse began to operate a soda plant, and thus was introduced into American chemical industry a process which proved itself of greatest importance to chemical and other industrial producers alike.

1885 In the strictly chemical field another new company began to operate: Roessler and Hasslacher. These two partners, whose enterprise was destined to become nationally known, set up their first small plant in Brooklyn but soon moved to Perth Amboy to make there metal-base chemicals, formaldehyde, acetone, chloroform, and other products which had a sufficient market. Those chemicals which they did not care to make they bought from German producers.

1888 Coal-tar distillation, another chemical branch of great importance, was started in 1882 on a commercial basis by Dr. Harry Walker Jayne, who made benzol, nitro benzol, and naphthalene in Philadelphia. His plant was taken over by the Barrett Company in 1888 and moved to Frankfort, Pa.

By 1890 the United States was generally recognized as a world power. Agriculture furnished wheat and cotton for international trade, industry was flourishing, and the people were prosperous. However, all these successes were not without their economic shadows. Trusts of doubtful character had been formed, and their tactics had been disadvantageous to consumers and labor alike. Labor had resorted to self-organization since 1885, strikes had been frequent, and in 1886 the American Federation of Labor had been formed for the benefit of all laboring people.

The public and the trade had not been organized against the trusts, but protection of their interests had been sought through the Interstate Commerce Act which dealt with secret discounts, rate favors, and other questionable business practices then in vogue.

Because the act was poorly worded and failed to achieve the desired improvements, a new measure, the Sherman Anti-Trust Act, was passed by Congress and signed by President Harrison in 1890. It declared illegal "any contract, combination in the form of trusts or otherwise, or conspiracy in restraint of trade or commerce among the several states or with foreign nations."

This law was more effective in restraining the trusts, and it became of very great importance in that it indirectly induced industry to resort to "mergers" for its further expansion.

Many of the new chemical corporations which were established after 1891 were therefore destined either to merge other companies into their own corporate structure if they had sufficient capital funds, or to be absorbed themselves when their financial or technical resources were no longer able to stand the competition of stronger business rivals.

THE ELECTROCHEMICAL INDUSTRIES BEGIN

James Willson produced by chance the first electric furnace calcium carbide at Spray, N. C., in 1892. The first carbide plant was established at Holcomb Falls, near Lynchburg, Va.

1892 The Michigan Alkali Company was organized by the J. B. Ford family for the production of soda ash at Wyandotte, near Detroit, Mich.

1893 The Mathieson Alkali Company was founded at Saltville, Va.

1893 The Chicago World's Fair, international in scope, greatly stimulated the exchange of ideas on equipment and new lines of chemicals.

A prolonged coal strike, which lasted from February to June, 1894, caused disorders in six states and production difficulties in many coal-using enterprises. It is especially significant, therefore, that in the same year electrochemical production of soda, chlorine, and bleaching powder was started on a large scale at Rumford Falls, Me.

1895 Industrial bleaching of wood pulp by the direct use of chlorine was carried out for the first time by the Burgess Sulphite Fibre Company.

1897 Electrolytic Caustic Soda production was started in the large Dow Chemical Works at Midland, Mich., and in the Mathieson Alkali Company's second plant at Niagara Falls.

1898 The Union Carbide Company, another electrochemical plant, was put into operation at Niagara Falls for the manufacture of acetylene and electric furnace products.

1899 The Pittsburgh Plate Glass Company organized the Columbia Chemical Company for soda production at Barberton, Ohio.

1899 Through the merger of twelve minor companies the General Chemical Company was formed to specialize in acids and fine chemicals.

1900 Semet-Solvay built their first tar oil still.

PROGRESS IN SPITE OF TROUBLE

At the beginning of the new century 8,722 industrial establishments produced chemicals. The greatest progress in technique and value of output had been made in the "heavy" lines, i.e., acids, fertilizer, and soda. They served the great basic industries of the country. The oil, varnish, and solvent industries had been well started on their way, and fine chemical production was carried on throughout the country with great success. Only chemicals for which domestic raw materials were not available or production was too expensive were imported. The automobile, gasoline, rubber, rayon, and plastics industries had not as yet developed far enough to render of any importance their highly specialized chemical needs. As these new industries grew, however, they provided an unprecedented and entirely new stimulation which carried chemical production to the height it reached in 1919.

1901 The U. S. Steel Corporation was consolidated as the first billion dollar enterprise (capital $1,319,000,000), setting an example which inspired the formation of other not quite so impressive consolidations.

1902 Bradley and Lovejoy pioneered the Atmospheric Products Corporation, Niagara Falls, and thus attempted to add synthetic

fertilizer production to the growing list of electrochemical enterprises in that locality.

1902/3 A strike of 147,000 anthracite miners was settled by arbitration after lasting five months. The strike was a forerunner of a long list of minor strikes, and it started a period of unsettled labor conditions which prevailed until 1914.

1903 February 14, a joint Department of Commerce and Labor was created by Congressional action. The Department of Commerce was to help in fostering commerce; the Labor section was to improve the status of labor.

1903 Sulphur mining using the Frasch process was started at Sulphur Mine, La., and an important raw material industry was added to the southern group.

1903 The stock market collapsed as a result of speculation and "indigestible securities." The "millionaires' panic" followed.

A new labor union, the Industrial Workers of the World, was organized as "one big union for workmen of all trades" in 1905. It favored class struggle, the Marxist International, direct action, sabotage, and overthrow of the wage system.

1906 The first Pure Food and Drug Act was passed by Congress, and President Theodore Roosevelt expressed his general desire for "a new standard of morals in business."

1907 Shortage of currency led to a minor financial crisis and business depression.

1909 Synthetic nitrogen production was permanently established by the operations of the new American Cyanamid Corporation at Niagara Falls.

1910 Haber perfected his synthetic nitrogen process in Germany.

1913 President Wilson signed the bill creating a special Department of Labor with a seat in the Cabinet.

1914 On July 1, prohibition of alcoholic liquors was put into force in the Navy.

CHEMICAL PRODUCTION DURING THE WAR

The outbreak of hostilities among the European nations (July 31, 1914) caused a crisis in New York and a decline in business. At first the supply of most chemicals was not seriously affected, nor was there during the first year any decided scarcity or anxiety even about those chemicals previously imported from Germany.

As soon, however, as it became evident that the war would last much longer than anticipated and the Allied governments began to

draw upon American supplies, a sudden rush demand was created which taxed most plants to capacity.

In order to create general interest in the production of chemicals, Adrian Nagelvoort and Charles F. Roth organized the First Chemical Exposition in New York, which began on September 21, 1915, and was so well received that *Metallurgical and Chemical Engineering* reported: "Certainly never before in the history of the world have the New York daily papers shown as much interest in chemistry as during the exposition week." [1] Dr. Charles H. Herty, as speaker of the evening, pleaded for the right attitude toward the American chemist, support by American capital, and a protective tariff, at least for a limited time.

1916 September 8. The desired protection was granted by Congress in the form of an Act To Increase the Revenue, and for Other Purposes (Sixty-Fourth Congress, Session I, Chapter 463). Title V of the act, dealing with coal-tar products, established a free list for coal-tar crudes and a dutiable list for semi-manufactured and final coal-tar products, dyestuffs, derivative colors, medicinals, and explosives. The duties ranged from 15 to 30 per cent ad valorem, and additional special duties were provided, ranging from 2½ cents to 5 cents per pound, to be effective for a period of five years. The act stipulated that after five years the special duties should be gradually reduced, so that at the end of ten years the special duties would not be levied any longer, provided that the President should find "that there is not being manufactured or produced within the United States as much as sixty per centum in value of the domestic consumption."

The same Act (Title VII, Section 700 ff.) also created a Tariff Commission and defined "that it shall be the duty of said commission to investigate the administration and fiscal and industrial effects of the customs laws of this country now in force or which may be hereafter enacted, the relations between the rates of duty on raw materials and finished or partly finished products, the effects of ad valorem and specific duties and of compound specific and ad valorem duties, all questions relative to the arrangement of schedules and classifications of articles in the several schedules of the customs law, and, in general, to investigate the operation of customs laws, including their relation to the Federal revenues, their effect upon the industries and labor of the country, and to submit reports of its investigations as hereafter provided."

[1] *Metallurgical and Chemical Engineering*, Vol. XIII, No. 11, October 1, 1915.

1917 March 21. President Wilson appointed as commissioners of the Tariff Commission: Frank W. Taussig, David C. Roper, David J. Lewis, William Kent, William S. Culbertson, and Edward P. Costigan. On April 16, 1917, the Commission submitted its first report and soon began an extended survey of the chemical industry (minor acids and heavy chemicals) and of dyes and coal-tar chemicals in particular, production of which had been started in sufficient volume to prevent serious shortage at least in the textile industries.

1917 On April 6, 1917, the United States declared war on Germany. This increased the demand for chemicals far beyond production capacity and made necessary an enormous expansion of plant facilities.

Coal-tar products, phenol, dyes, pharmaceuticals, perfumes and nitro products were among those whose production was especially developed.

As time went on and need became emergency, prices of chemicals rose with the willingness of governments and speculators to pay any amount for desired products. In view of constant pressure and government encouragement, mass production was provided for, where normally only small quantities had been made.

1917 September. The Tariff Commission published its First Census of Dyes and Coal-Tar Chemicals and followed it up by its Second Census in 1918.

The net investment in all chemical enterprises combined appears to have increased from 1.35 billion dollars in 1913 to 2.80 billion dollars in 1919. Prices rose to 250 per cent—in some lines to 350 and 400 per cent—of their pre-war levels, and production was stepped up accordingly.

The race against time, the mad scramble to build, make, and deliver was just approaching its climax when the war ended. The frantic demand was almost immediately and very drastically reduced. Orders were stopped, and the whole gigantic effort began to show its reverse side in the form of plant capacity doomed to idleness, gigantic but not needed construction jobs under way, excess stocks of special war materials not needed for peace-time production, and other materials available in too large quantities offered at rapidly declining prices in an oversold market.

Gladly had the industry helped win the war, and cheerfully had it organized its plans and enterprises in the Chemical Alliance. But it

learned a costly lesson in war economics when the excess capacity had to be written off, contract jobs had to be finished and paid for, haphazard equipment had to be removed, and plant sites which had been picked for convenience rather than lasting value had to be abandoned. Enormous profits had been made by some, but heavy losses had to be taken by all.

The war had changed more in two short years than had been changed before in decades. Some of the changes were good: more alertness, more enterprising spirit, more experience, more understanding of operation on a large scale. Other changes were less desirable: more speculation in financial matters, more recklessness in management affairs, and less restraint in many respects. But as a whole the industry had gained for itself a firmer economic foothold than ever before.

POST-WAR ECONOMICS

In order to make available to American producers those patented and secret processes which until the war had been owned by foreign interests, and to establish those industries which had not been developed, the Chemical Foundation was incorporated under Delaware laws.

The corporation, in principle a patent holding company, was underwritten by some thirty chemical companies, with a capitalization of $460,000. Its purpose was to purchase approximately 4,500 patents from the Alien Property Custodian. These patents pertained to various industries. Only relatively few were of a strictly chemical nature, among which were some for coal-tar processing and dyes. Congress authorized the sale, and the Foundation, according to its statute, began to grant non-exclusive licenses for the use of its patents to any American citizen, copartnership made up of American citizens, or any American company 75 per cent of whose stock was owned by Americans.

To aid and encourage the companies in the development of the new processes, imports of dyes and dyestuffs were limited and for five years were placed under special regulations. Duties were raised, and all imports of coal-tar products were closely controlled.

Through intensive research and costly experimentation the various branches of the coal-tar industries were developed, and since then the American chemical industries have produced a full range of chemical products. Economically they began a new phase in their evolution; technically they started out on a new era of further perfecting their facilities to produce.

1920 As the changes from war to peace-time production involved not only internal management problems but difficult economic readjustments as well, various meetings were organized to include all the chemical industries in an effort to devise definite plans for solving these problems. Combination of efforts in obtaining export sales, vertical cartelization, exchange of waste products, and similar plans, were proposed as solutions However, little came from all these cooperative ideas Most companies, especially those with sufficient financial resources, preferred to work out their own plans of readjustment, relying mainly on merger policies where they appeared feasible.

Among the first important mergers was the formation of the Allied Chemical and Dye Corporation which combined the Barrett Company, General Chemical Company, Solvay Process Company, Semet-Solvay Company, and the National Aniline and Chemical Company. With a capitalization of $150,000,000 the new company was, next to the du Pont, the most important financial group which was strong enough to develop a definite and well-considered "chemical interest" policy of its own.

The depression of 1921 was merely the necessary adjustment following the economic excesses of the war. It was brought on in the chemical industries as in most others by high-pressure competition in a definitely reduced market. In the desire to obtain volume orders for the expanded equipment, prices were reduced to such an extent that only companies very strong financially could stand the strain on their surpluses and reserves. The weak enterprises were weeded out or forced into mergers.

Figures of the Census for 1921 indicate that American industry as a whole operated at 57.1 per cent of maximum capacity (Census of Manufactures, 1921, Table 1044) and that the value of production dropped to 69.94 per cent of its preceding peak in 1919. Value of production for the chemical group declined to 66.36 per cent, and careful examination of the capacity percentages shown for individual chemical branches reveals that the group as a whole followed most closely the general economic trend. This recognition appears significant.

1922 The newly developed coal-tar dye industry was the main topic of discussion. Textile producers and dye users openly expressed their dissatisfaction with the quality of dyes produced and the high prices asked. There was no denying the fact that the new branch of manufacture was overdeveloped and that the protection provided by government had been too liberal, thereby fostering con-

ditions which were not to the interest of all concerned. Finally, when prices had to be reduced, quite a few high-cost producers were eliminated.

Midsummer marked the turning point of the prevailing depression, and the falling off of strikes in the chemicals-consuming industries helped in restoring more "normal" conditions.

The government showed its interest in chemical production by establishing within the Department of Commerce a special "Chemical Division." C. C. Concannon was appointed Chief; T. W. Delahanty, Assistant Chief. Since then the division has rendered most valuable services for the industry.

1923 Business continued to improve, and even the most conservative banks again began to show interest in giving commercial loans.

The dye industry was brought up for public investigation, and after long debates and hearings Congress decided to permit again imports of most German chemicals at high duty rates but without further restrictions because the manufacture of many special chemicals and dyes had been found unprofitable in the United States.

Even the first post-war working agreement between the Grasselli Chemical Company and F. Bayer and Company in Leverkusen, Germany, was not much frowned upon.

American business men and government officials abandoned ostensibly the hostile attitude toward Germany which they had assumed since the War.

1924 Undesirable distribution methods harassed the chemical trade, and a generally prevailing high cost of production caused Commerce Secretary Herbert C. Hoover's famous study "Elimination of Waste in Industry."

1925 During the early part of 1925, chemical sales were still not quite satisfactory, but conditions improved considerably in the second half of the year.

In August, in connection with the Tenth Exposition of the American Chemical Industries, a new phase of improvements was inaugurated by the stress laid upon "exact, carefully tested methods of production by the use of the most modern and scientific apparatus obtainable." This drive eliminated much of the obsolete equipment and apparatus still in use.

A few events of international importance occurred: the German-French Potash Agreement was signed in May; the International Explosive Agreement was concluded during the fall, Dynamite

Nobel, Koeln-Rottweiler, British Dynamite Trust Company, and du Pont participating.

1926 Business was good and steady. Automobile production, oil refining, and textile manufacture progressed better than had been expected, and the demand for chemicals increased accordingly.

Outstanding events: An alcohol investigation, aiming to stop the terrific leakage of permit alcohol into prohibited channels by a new Congressional bill and a reduction in the number of enforcement officers! A potash field survey, endowed with $200,000, to find more domestic sources for fertilizer potash. A special proclamation by President Coolidge—one of the very few ever issued under the discrimination clause of the Tariff—increasing the duty on imported methanol from 12 to 18 cents per gallon. The American cost of synthetic methanol was 75 cents per gallon; imported German methanol sold for 48 cents per gallon, duty paid. In England the Imperial Chemical Industries trust was formed.

1927 Business in general continued good. Only in the textile and paper industries did signs of overproduction appear. Such conditions were not seriously felt in the chemical trade because chemicals found a ready market in many new products such as plastics and rayons.

The appearance of chemicals "made to specifications" and "for special purposes"—a policy rarely observed by producers in the past—was important.

Major events: The Secretary of the Treasury, Andrew W. Mellon, in collaboration with Congress trying unsuccessfully to find a non-poisonous but effective denaturant for alcohol! Tariff hearings in both Houses of Congress to determine new duty rates for chemical imports.

1928 Business still continued good. The election did not influence conditions to any great extent. Official government opinion was known to be in favor of business and higher tariffs. The stock market had yielded high profits to many, and new stock and bond issues were easily paid out of profits or bought on credit margins. Great mergers were transacted. In the chemical industries quite a few additional "interest groups" were in the process of formation.

THE POST-WAR CLIMAX

During the early part of 1929 the last stages of modernizing equipment were completed; distribution systems had been improved before, and prices of most chemicals had been reduced owing to volume production and competition. The industry had used its profits wisely and generally was in excellent technological and financial condition.

Therefore, the last mad climaxes of stock-market operations, and then the sudden reversals, had relatively little bearing upon chemical enterprises. Because of its diversified markets the industry also bore up well when business became spotty and gradually began to decline.

Shortly before the "crash" a series of mergers had been completed: du Pont had bought Grasselli; American Cyanamid had taken over Kalbfleisch and quite a few others of the now thirty subsidiary companies; Monsanto had exchanged stocks for Merrimac; and Barret, owned by the Allied Chemical and Dye Corporation, had merged the Ehret Company of Philadelphia, National Coal Tar Company of Boston, New York Tar and Chemical Company, and some other enterprises. After these and a few additional minor mergers had been effected the great financial interests had pretty well completed a rearrangement of ownership which strengthened the vertical and horizontal integration of the great chemical groups in a manner satisfactory to all. Thus peace was assured for the doubtful period to come.

DEPRESSION POLICIES

The uncertainty which prevailed throughout the year 1930, during the gradual but not too serious reduction of all industrial activities to approximately 85 per cent of their 1929 peak, was shared fully by the chemical industries.

Attempts to stem the recession of business by further price-lowering proved utterly futile, and President Hoover's tariff, expected to help American industry, proved a boomerang, for retaliatory measures inaugurated by foreign governments kept at home many chemicals and raw materials which otherwise would have found a ready foreign market. Thus chemical producers curtailed production, and those with funds to spare went in for rounding out their previous mergers.

During 1931 the chemical industries really began to feel the decline in general conditions. But then and there they adopted policies which were as useful as they were novel. Instead of giving in to general trends and cutting prices further they searched for new and special products still better suited to their customers' needs.

They also searched for substitutes where consumer industries needed chemicals at lower prices, but in general they did not look to price-cutting for their salvation. Instead they kept on inventing and tried to "beat the depression" by making new and more difficult products by improved processes and new syntheses. Dr. Herty's experiments with slash pine paper and rayon, potable synthetic ethyl

alcohol, the first shipments of potash from the Carlsbad mines, Father J. A. Niewland's chloroprene, the progress in the plastics industries, new solvents, synthetic products made from waste—all are typical of the creative spirit that prevailed.

At the same time, chemical producers began to take advantage of the many chances to save by moving south where many raw materials went begging, labor was plentiful, and power cost much less than in the northern parts of the country.

1932 When all the consumer industries seemed to have come to a standstill and even the biggest orders were not larger than small orders had been only a few years before, the chemical producers hoped for improvements, but they deceived themselves much less than those whose hollow hopes and utterances filled the papers.

Even at the very depth of the depression they did not complain in despair but tried to keep their staffs intact by intensifying what they called "service." They now investigated the manifold chemical problems of their customers and tried to find new ways of making their clients' products better and cheaper with still further improved or better-suited chemicals. Much greater cooperation, mutual understanding, and technical planning resulted from these policies than previously had been achieved by much more costly but useless methods of "sales promotion."

UNDER THE NEW DEAL

The change in government in January, 1933, and the drastic steps of the new administration, bank holidays, higher commodity price policies, and all the other early measures were well received by the industry as signs of action in a national economy obviously in need of some stimulation. Most companies also gave wage increases when this was recommended by the administration as a means of relieving unemployment and had new plants built or old ones enlarged when this appeal was sent out.

Next they combined into one economic group, as they did when they formed the Chemical Alliance during the War, and helped in preparing a code which placed the industry under government control. They also prepared special codes for various chemical branch industries and cooperated fully with the National Industrial Recovery Board when it was established, adopted all working-hour restrictions, and maintained their own wage standards which were in general higher than those required under the codes. In their own laboratories

they continued their researches in new fields. New synthetics, solvents, plastics, cheaper acetic acid, and other chemicals were added to their list of products. When the year closed, indeed, small extra dividends could be distributed by du Pont, Monsanto, and Hercules. Conditions had improved, chemical sales had been better, and the fruits of four years of research and operating improvements began to show.

1934 Repeal of the Eighteenth Amendment in November, 1933. The new regulations on alcohol production and the new government codes for every branch of the chemical industry were the most outstanding features of the year.

All in all, the industries had little trouble in adjusting themselves to the codes. Some inconveniences were caused, but changes were made and few complaints were heard thereafter. Even the new control of competitive conditions and prices, designed to improve selling practices, was accepted by all the chemical branches with little opposition.

Only with the collective bargaining clause for labor did the industry take serious issue. The famous 7A clause of the National Recovery Act, repeated with minor adjustments in every code, was probably more disputed than the Act itself.

Similarly, the Agricultural Adjustment Act did not find all-round approval because it led to serious shortages in vegetables oils (cottonseed oil and hydrogenated products), high prices, taxes, and importation of commodities in which previously the domestic industry had provided a stable, ample, and cheap supply.

1935 In May, 1935, the National Recovery Act and a few other measures were declared unconstitutional by the Supreme Court, and government control, price-setting, meetings, codes, and regulations were abolished. The industry which had not had to change its usual stride much under the codes now did not have to change it much without them.

There is, however, one new feature which took on more definite form, i.e., the great increase in chemical products made for direct consumer use. Plastics, rayons, synthetic rubber, Cellophane, synthetic ethyl alcohol, synthetic fertilizers, and many other products were made in quantities so much greater than ever before that they have become most valiant direct emissaries of the chemical group to the public. In 1935 this new relationship was just beginning to be developed with new ideas and more intensive methods.

The favorable trend was the same through 1936 and 1937. At peace with labor, the chemical industries produced, expanded carefully, and improved their operating techniques. They gave employment to still more men and thus provided in still larger measure what men need most today: jobs and employment.

Economically the chemical industries of the United States not only have a most interesting record; they also represent one of the healthiest and sturdiest industrial groups. This does not mean, however, that their economic structure is without any flaw. There are some definite shortcomings, as will be shown, and the future of the industry seems to depend not so much upon further outward progress as upon a most careful reconsideration and scrutiny of those economic practices and policies which have been followed in the past and in the choice of proper policies for the future.

CHAPTER 3

ECONOMIC STABILITY AND FURTHER PROGRESS THROUGH PATENTS, PATENT LICENSING, AND TRADE MARKS

Economists agree that stable progress is much more desirable than progress carried out along the well-known pattern of sudden spurts and booms followed by reactions. In order to come closer to such an ideal course, a definite knowledge of the peculiar economic means and policies whereby a specific industry actually can achieve stability and economic progress is of greatest importance. Good management, so far considered as the main solution of this problem, helps, if most carefully applied in all phases of operation, but cannot cope fully with all economic problems.

The steady appearance of new technical discoveries, combined with constantly increasing pressure from competitors, and industrial political measures applied directly and indirectly in the most varied forms and with increasing frequency, cause such far-reaching effects that they require special and most careful orientation, not only along managerial but also along economic lines.

In order to review the main means of achieving stable economic progress and to distinguish between useful and detrimental economic policies, those which have special importance for the chemical industries are here discussed: patents and patent policies and their economic aspects, patent licenses and licensing procedures, patent obligations of employees, patent disputes, and trade marks.

Furthermore, as cooperative actions, trade associations, fair and unfair methods and forms of competition, and the relationships between industry and governmental institutions will play an even more important part than they have played so far, these subjects are also covered in a special discussion in Chapter 4.

THE PREDECESSORS OF THE AMERICAN PATENT LAW

Since the earliest days of civilization, the fruits of human thinking have been recognized as the property of the one whose mental effort produced them.

The Greeks had no patent or trade-mark laws or copyright regulations, but they had quite definite rules under which no one would have dared to claim as his own any new thing that he did not really create. Even the slaves who invented a new process or product were usually liberated to become free producers, or at least their owners granted them a semi-free status in which they could exploit their invention and buy themselves freedom. The customs in the Roman Empire and in the Roman organizations of artisans, whose practices were taken over by the western and central European craftsmen and their guilds, were similar.

France was the first nation to attempt to create new industries through government protection by giving financial support and *lettres de patente* to masters from Italy and Spain. These *lettres de patente* gave to their holders special and mostly exclusive rights to produce certain articles, but were operating licenses rather than patents as we know them in the modern sense of protecting the characteristic features of a process or a new product.

When the French Revolution did away with all guilds, royal charters, and special privileges, *lettres de patente* among them, and the right to manufacture was declared free to all who desired it and could fulfill the few simple requirements imposed by law, the necessity arose for some means of definite protection for those who had original and usable ideas. The leaders of the new French democracy soon realized that without such protection further manufacturing progress would be greatly handicapped, and so they appointed in 1789 a special committee, headed by Deputy Boufflers, to work out a treatise on patent rights and patent briefs.

This treatise, submitted to the Assembly in 1789, became the exemplary predecessor of most modern patent legislation. It contained some interesting passages which will bear repeating here:

> The inventor presents himself with his thoughts. Commonly one imagines him as an absent-minded fellow; one thinks that he has a far-away expression, centered on a hundred projects of one kind or other, none of them to be reasonable at all. If an inventor has to face a Committee to pass on and to examine his invention, this Committee is composed of routine savants and jealous manufacturers.
>
> In society which takes as its main aim equality and liberty, it should not remain a matter of privilege but of good standing and law to be able to register a patent.
>
> If there is a right which a man owns, then his own thought is one of the main properties he possesses. His thought is personal, independent

> and precedes any action. Just as the tree which grows in a field is the incontestable property of the owner of the field, so is the idea which comes into the mind of a man, owned by him. The invention which is the source of all manufacture and arts, therefore, is a property. It is a prime property and all the other acts hereafter are nothing else but conventional acts.

The French patent laws, enacted on December 31, 1790, January 7, 1791, and May 17, 1791, recognized patents for five, ten, or fifteen years according to the desire of the inventor. The legislative body could exercise prerogative rights only when a very important invention was involved and could grant not only a fifteen-year patent but also remuneration to help develop the invention for practical application. Remunerations had been in practice under the French kings and had been adopted also by the English Parliament in the case of Watt's patent on the steam engine, granted in 1769.

However, the French deputies did not consider a patented idea as an absolute and permanent right. It was decided that an invention should entitle the inventor to certain priorities, but that he should not obtain a permanent monopoly. At the expiration of the patent period the process was to be made public property and its use permitted free to all. Only during the validity period was the patentee to be the exclusive owner and user of his idea; he was permitted to establish an enterprise in any part of France, to sell his patent like any other property, to cede it to any others, to take redress, to start suits for infringement, and to collect damages for losses suffered therefrom.

In England patents had been made a legal institution in 1623 when James I enacted the Statute against Monopolies in which was granted:

> The sole working or making of any manner of manufactures within this realm, to the true and first inventor and inventors of such manufactures, which others at the time of making such letters, patents and grants shall not use, so as also they be not contrary to the law nor mischievous to the State, by raising prices of commodities at home or hurt of trade or generally inconvenient.

But few patents were granted in England and still fewer in the Colonies, where manufacture was not really desired. Only in exceptional cases the Crown granted patents to Colonists, probably the first to Samuel Winslow in 1641 for a method of making salt, good for ten

years, and another to John Winthrop (son of Governor Winthrop) also for a method of making salt in 1656, good for twenty years.

During and after 1717 a greater number of patents was granted which, as time went on, were given predominantly for periods of seven, ten, or fourteen years:

1717	Edward Hinman, making molasses from corn-stalks	10 years
1717	Thomas Masters, cleaning, curing and refining Indian corn	14 years
1717	Thomas Masters, straw weaving methods	14 years
1718	John Prout et al., making linseed oil	20 years
1719	John Prout et al., making linseed and rape oil, etc.	20 years

Thus patents and patent rights were known in the Colonies, but they were good only for limited areas, Connecticut or Maryland or Pennsylvania, and offered no protection even in the neighboring colony. Their main value rested in the exclusive manufacturing rights for the territory where they had been granted.

The French concept, brought out clearly before and during the Revolution, was different and very much like that adopted by the Colonists, who finally stated in their own Constitution that Congress should have the power: "To promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."

It is upon this clause that an American patent law could be enacted.

THE AMERICAN PATENT LAW

President Washington was among the first in the new American republic who stressed the need of giving "effectual encouragement" to those able to promote the industrial arts. As early as January 8, 1790, in his first annual address to Congress, he remarked:

> I cannot forbear intimating to you the expediency of giving *effectual encouragement*, as well to the introduction of new and useful inventions from abroad as to the exertion of skill and genius at home.

On April 10, 1790 (1 Stat. L. 109), Congress enacted the first patent law of the United States. The Secretary of State, the Secretary of War, and the Attorney General were appointed to a special board, and any two of them together were authorized to grant patents for any "useful art, manufacture, machine or device, or new improvement

thereon, not before known or used, if they shall deem the same sufficiently useful and important."

Thomas Jefferson, Secretary of State at that time, became keeper of the records and personally examined and decided on all applications. Total fees and charges amounted to approximately $4 per patent. The patent was good for fourteen years and could not be extended. The decisions of the Board were final and obviously had to be based in regard to novelty mainly on the inventor's declarations.

Patent No. 1 was granted to Samuel Hopkins on July 31, 1790, for a process for "Making Pot and Pearl Ashes." [1]

Patent No. 2 was granted to Joseph Stacey Sampson on August 6, 1790, for "Manufacturing Candles." [1]

Today, both would be considered chemical processes.

The patent law was revised in 1793 and was made quite liberal, mainly upon complaints of applicants who objected to the strictness of the Board. The costs of a patent were raised to $30, but the obtaining of a patent was made easier. From 1793 until 1836 the real routine procedure was gradually evolved, and a special office was opened for the "Keeper of Patents" in 1810.

In 1836 Senator Ruggles, chairman of a committee to investigate the activities of the Patent Office, reported that the patent procedure was unsatisfactory. Many patents were useless and void and were infringing upon one another. Frauds, lawsuits, bona fide declarations, and patent monopolies were common.

In order to protect the real inventor a new law was enacted on July 4, 1836 (5 Stat. L. 117), which laid the foundation for the strict rules which now govern American patent procedure. Under the new law, patents had to be examined by unbiased, special officials who were made responsible for passing upon novelty, usefulness, and patentability. A Commissioner of Patents was appointed to head the entire staff.

In 1870 the first complete codification of the Patent Law was attempted (July 8, 1870, 16 Stat. L., 198), and publication of the *Official Gazette* was begun in 1872. In spite of obvious shortcomings which have caused many revisions, this patent law has become the legal foundation upon which rests the economic future of most chemical processes, and thereby the fate of many enterprises and even entire chemical industries. Without patent-right protection, chemical production today, because of the many new discoveries in that field,

[1] "A List of Patents from 1790 to 1836," published by the Commissioner of Patents, Washington, 1872.

would be a most hazardous economic undertaking. As it is, however, the patent law provides at least seventeen years of security, a period which allows time for technical and financial development, and thus provides the initial protection which is needed for new processes and products whose future otherwise would be most uncertain.

THE MAIN RULINGS OF THE U. S. PATENT LAW

Although the complete text of the patent law, including the numerous revisions, and the handling of all patent matters are quite elaborate, those sections of the law which are of prime importance to the chemical inventor or economist are relatively simple and easily remembered. They are compiled in the pamphlet *Patent Laws, Revised, June, 1934*, which is obtainable without charge from the U. S. Patent Office, Washington, D. C. From it the following excerpts are taken:

> Sec. 4883. (U. S. C., title 35, sec. 39.) All patents shall be issued in the name of the United States of America, under the seal of the Patent Office, and shall either be signed by the Commissioner of Patents or have his name printed thereon and attested by an Assistant Commissioner of Patents or by one of the law examiners duly designated by the Commissioner, and shall be recorded, together with the specifications, in the Patent Office in books to be kept for that purpose.
>
> Sec. 4884. (U. S. C., title 35, sec. 40.) Every patent shall contain a short title or description of the invention or discovery, correctly indicating its nature and design and a grant to the patentee, his heirs or assigns, for the term of seventeen years, of the exclusive right to make, use, and vend the invention or discovery . . . throughout the United States and the Territories thereof, referring to the specification for the particulars thereof. A copy of the specification and drawings shall be annexed to the patent and be a part thereof.

Comments. The facts that a U. S. patent is good for seventeen years and affords protection only in the United States and territories are easily understood from the text. Extension of the life of a patent can be granted by Congress, but such a grant is rare. One was obtained, however, by the descendants of Goodyear, for the process of rubber vulcanization.

The finding of a suitable title for the patent should offer no great difficulties, but care should not be neglected in this detail even if it does not essentially affect the patent claim.

Sec. 4886. (U. S. C., title 35, sec. 31.) Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof . . . not known or used by others in this country, before his invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country before his invention or discovery thereof or more than two years prior to his application, and not in public use or on sale in this country for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law, and other due proceedings had, obtain a patent therefor.

Comments. This section contains some of the most important rulings in the entire patent law in so far as it stipulates exactly what is patentable. As the text is involved, and not easily understandable, the following simplification will bring out its full meaning more clearly:

(*a*) Patents can be granted for improvements as well as for original inventions, but in either case the idea must be new *and* useful. These two conditions are inseparable requirements in judging the application for a patent.

(*b*) Rarely is there any doubt in reference to the newness of an idea or invention, because the inventor must swear that the idea is original and new. This he can do only after he has made a thorough search in the old patent files of this and other countries. The search is repeated independently in the Patent Office. In spite of all precautions it happens sometimes that patents are granted in the firm belief of all concerned that an idea was new, in spite of the fact that it was not. If later findings disclose that the idea was not new when the patent was granted, the patent is invalidated and serious losses may result to those who have made investments on the strength of it. No recourse is possible against the patentee or against the Patent Office. Parties interested in the use of a patent but not willing to pay royalties for it sometimes go to great lengths in order to find previous patents that would invalidate the present one. An invention patented fifty years ago in England, even if completely forgotten there by now and never patented in this country, still would invalidate a more recent American patent covering the same invention. Even if no patent were granted fifty years ago, any description of the present invention that can be found in the literature deprives it of the fundamental requirement of newness.

(*c*) The requirement of usefulness is much more open to interpre-

tation by the Patent Office or the Court of Patent Appeals. Profitableness or practicability are not required to prove usefulness. Therefore almost any invention or composition which can be made to serve some purpose has little difficulty in fulfilling this requirement. In case of doubt the Patent Office relies on the advice of experts.

(*d*) The law provides for patents on a new "art" or "manufacture" as well as the "composition of matter." In more practical language this means that either a patent stressing mainly the process, or a patent mainly covering the product, or a patent stressing both may be obtained. Any one of these kinds of patents is desirable to have, but the chemical inventor will be most secure who has protection not only for his new process but for its product as well. Any process can be "improved" or "modified," but if the product is also protected any modification of the process is fairly well forestalled.

(*e*) In reference to the composition of matter, patent practice definitely permits substitution of equivalent materials as a basis for a new patent if the established patents do not preclude the new composition. Experts decide whether the equivalents are really new and unusual substitutions or merely modifications which are not patentable. If the substitution is one known to experts then it is merely modification and not considered as unusual. To be unusual it must be one not quite obvious to a person experienced in the art; its use must be unexpected, and the result produced (product), though it may be similar to some patented one, must be new and must be obtained by a genuine and novel change in production procedure. Mere omission or modification of certain elements or operations would as a rule not create a new patent, but such omissions or modifications in connection with other genuine substitutions or new process operations may well lead to a new patent.

(*f*) The time requirement is most important and should be not only studied but also observed most carefully in actual practice. Fundamentally, the patent law is designed to reward a man who has invented or discovered something by granting him a patent, provided that he originated the idea and asks for the patent within a reasonable time. The purpose of the time stipulation is to discourage the inventor from resorting to such practices as secret application and withholding information on his discovery in order to prolong its period of usefulness to him personally. It is obvious that such procedure does not allow the fullest public benefit from the discovery and is not conducive to progress.

The following precautions in regard to time requirements are im-

portant. The inventor must make sure that: (1) no one in the United States has known or used the same invention before; (2) no one in the United States or foreign countries has received a patent on or has described the invention before the date of discovery, especially during the last two years before making application for a United States patent; and (3) the invention was not in public use or on sale in the United States for more than two years prior to the date of application—with the possible exception that it had been in use and then abandoned.

These time rulings are of special significance because "no patent shall be granted on an application for patent for an invention or discovery or a design which had been patented or described in a printed publication in this or any foreign country more than two years before the date of the actual filing of the application in this country, or which had been in public use or on sale in this country for more than two years prior to such filing" (Sec. 4887).

This clearly forces any inventor to apply for a patent within two years after the first publication here or abroad or after the first public use or sale in the United States.

> Sec. 4887. (U. S. C., title 35, sec. 32.) No person otherwise entitled thereto shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid by reason of its having been first patented or caused to be patented by the inventor or his legal representatives or assigns in a foreign country, unless the application for said foreign patent was filed more than twelve months . . . (four months in cases of designs) prior to the filing of the application in this country, in which case no patent shall be granted in this country.

Comments. This section refers to patent applications made by foreigners who have already obtained foreign patents. They are forced to apply in the United States within twelve months after filing abroad, and furthermore the date of the foreign application becomes automatically the date of the United States application. This has been stipulated to prevent attempts to extend the protection period by delayed application. If the foreign inventor or his assignee does not apply for a United States patent on the invention in due time, the foreign invention can be used in the United States but no patent can be granted.

> Sec. 4888. (U. S. C. title 35, sec. 33.) Before any inventor or discoverer shall receive a patent for his invention or discovery, he shall make application therefor, in writing, to the Commissioner of Patents,

and shall file in the Patent Office a written description of the same, and of the manner and process of making, constructing, compounding, and using it, in such full, clear, concise and exact terms as to enable any person skilled in the art or science to which it appertains, or with which it is most nearly connected, to make, construct, compound, and use the same; and in case of a machine, he shall explain the principle thereof, and the best mode in which he has contemplated applying that principle so as to distinguish it from other inventions; and he shall particularly point out and distinctly claim the part, improvement, or combination which he claims as his invention or discovery. The specification and claim shall be signed by the inventor. . . .

Comments. The form of presentation and the claims, of which there may be any reasonable number, are the essence of a patent. They are vital to its industrial application, and they determine its economic usefulness or failure. No inventor should file his application without having its statement of claims examined by as many different people as possible. The Patent Office may notice technical or legal weaknesses in this part of the application, but it will not directly bring them to the attention of the applicant; it will, in fact, even grant a patent which may have little or no practical economic value because the claims are either too one-sided, too narrow in scope, or too specific. With such a patent any new modification may become the basis either for a new patent or for an improvement patent which in the hands of a third party is usually an undesirable adjunct to the original patent. It hardly can be avoided, however, if the original claims were insufficiently complete or inadequately stated.

Almost invariably, if this part of a patent is weak, the stability of the enterprise using the patent as a basis for its production is greatly endangered. The "Annual Decisions of the Commissioner of Patents," which includes the decisions of the U. S. Court of Customs and Patent Appeals, of all the federal district and circuit courts, and even of the Supreme Court, is full of interesting examples which bear out the need for the greatest care and attention in the formulation and statement of patent claims. Too narrow claims are just as undesirable as too broad claims.

Further presentation of details on the patent law and its regulations would exceed the scope of this study. For more information the reader is referred to the publications of the U. S. Patent Office and to the existing books on the subject.

ECONOMIC MEANING OF PATENTS

From the foregoing it can be seen that patents are not quite readily granted, and that they are not so secure and monopolistic in character, as some modern economists propound. Especially the chemical patent, though it may give to its owner or his licensee a legal "monopolistic right" to produce a certain type of product or to make it in a certain way for a certain time, in reality hardly provides a monopoly in an economic and technical sense.

Chemists and chemical producers seem to be stimulated rather than deterred by seeing another chemist or producer receive a patent which would give to him or to a company seventeen years of monopolistic dominance in a certain field. Sometimes as a matter of professional ambition and in most other cases for sheer self-preservation they try to invent the same product in a new way, or a very similar product, especially if the original patent is of real economic importance. And in this serious rivalry not only the chemical compatriots but also chemists and chemical producers, wherever they are, participate.

Thus competition, even as keen as may be desired by the most modern, competition-minded economist, exists and goes on, long before a chemical product has been made, before it has been marketed, and before it has been sold at a certain price.

This phase of competition is usually fought out in grim silence, and the public and even many theorists who are prone to see economic competition only when prices are flexible, fluctuate frequently, and go down generally, hear only rarely about it and claim that there is no competition when prices remain stable.

Economic competition is not expressed in terms of price or conditions alone. It begins with the desire to create or obtain patents, and in this the chemical producers are probably far in the lead, as compared with other competitive industries.

Furthermore, the many patents upholding the chemical industries are bound to create economic conditions and characteristic operating policies which are entirely different from those prevailing in the commodity trades, that are in no way dependent on patents. The economics of the latter, therefore, must be different from the former, and the highly praised price flexibility can hardly be expected from chemical producers, nor be upheld to them as exemplary economics.

Patents, for centuries recognized by law as well-deserved rewards for special efforts or achievements, by their very nature are bound to

promote at least a certain amount of and desire for stability. Thus, if price steadiness prevails in the chemical industry, this is due much more to the underlying patent structure than to any monopolistic tendencies.

INDUSTRIAL PATENT POLICIES

Chemical patents, then, are not like cards as some people believe, which can be played with as, if, and when one feels so disposed, or can be used for gambling. Genuine inventors and businessmen do not, and cannot, regard them in that way. Neither in applying for a patent, nor in finding a buyer for it, does it pay to try short cuts, tricks, bluffs, or reckless bidding. As patents are not being issued, bought, or put to use without very competent counsel and most thorough scrutiny by friends and foes, modern industry has become very careful about patent matters, technically, legally, and financially.

Each patent has only certain definite possibilities, and, just as good industrial management has learned not to speculate in materials or to buy useless machinery or to cheat customers or competitors, so have the patent departments learned the value of definite patent policies and the necessity of applying them as carefully and systematically as human intelligence and foresight allow.

As a rule, it has been found good practice to follow a basic patent by the acquisition and development of as many *improvement patents* as circumstances permit. This makes possible with a certain degree of protection and stability a continued industrial application of a basic process even after the original patent has expired. Entire industries are founded upon the application of this principle, for instance, the making of photographic films, certain rayons, and most synthetic dyes.

Quite a few companies have also made it a policy to be definitely interested in all those new patents which may represent *new uses for their own products*. They practice vertical rather than horizontal patent integration and have been quite successful with it. But not always have such patents been acquired. In many cases even large enterprises take out only a license and pay royalties rather than try to meet an exorbitant price which might be asked if outright purchase should be contemplated.

Some companies who originally "specialized" in only certain patents and processes have found it highly desirable to "diversify" and reduce their patent risks. Others have expanded their interests to patents covering products competing with their own and even those

not related at all to their original business. As soon and as often as their financial condition permits they round out their patent holdings and production more and more. One organization in particular, whose financial condition remained excellent even in the worst days of the depression, owes its position mainly to the "diversification policy" according to which it obtained its new patents.

The policy of large corporations of *buying patents only after they have been successfully developed* by the original owners is frequently observed in the United States but rarely in Europe. Even the large chemical concerns in Europe, where borrowing from the financial markets is not so easy as it is in the United States, prefer to buy patents *before they have been commercially applied* and to develop production and distribution in accordance with their established practices and facilities.

If utter secrecy is desired, some producers *do not patent their new products,* but rely on their trade mark for protection, especially if they already have patents on at least one essential ingredient.

New patents covering synthetic products are of prime importance not only to their owners, but also to those who are making the same product in the traditional manner. One would expect that the established producers would make special efforts to obtain and exploit the new synthetic patent because they already have been engaged in the business and are familiar with it, but in actual practice it is relatively rare that the synthetic patent is sought by them or that it gets into the hands of a producer already established in a similar line. Very few enterprises have been foresighted enough to plan the acquisition and development of *original and synthetic process patents at the same time.* Those who have carried out this policy have greatly improved their own position and cushioned the disturbance which invariably results within an industry or an enterprise when the market is suddenly upset by competition with a synthetic product.

THE VALUE OF A PATENT

The preceding discussion has demonstrated that patents have not only technical importance but in addition almost as great if not greater economic significance. To determine the total value of a patent is, therefore, a rather difficult problem, but one which must be solved in all cases where acquisition or commercial application is contemplated. A patent necessitates expenditures which have to be covered by capital, and also the value of the patent may have to be shown in the balance

sheet. What is a fair price to pay and to set down among the assets or costs? If merely the use of a patent is purchased, what is a fair royalty to pay?

The fact that a patent is good for seventeen years is of little importance in determining the cash value of a chemical patent because any day a new patent may reduce its value or make it so nearly obsolete that to be on the safe side the patent plus the equipment may have to be written off entirely. Such are the thoughts in the mind of the prospective buyer.

To the hopeful inventor, on the other hand, or to the research department trying to figure out the value of its work, the patent should be worth at least the costs of experimentation, research, and expenses occurred in taking out the patent *plus* the value of the products potentially produced on the basis of the patent during seventeen years to come.

Somewhere between these extremes lies the value of the patent. To name a proper cash price is no mean task. Therefore many patent-transfer contracts state: (*a*) a cash price to compensate the patent owner for his efforts and costs, and/or (*b*) a certain royalty per unit (gallon or pound) or a definite percentage of the value of products actually produced and sold with or without a guaranteed minimum per year.

By determining the value in this manner, which makes the cost of the royalty a current item of the cost of production, the balance-sheet value of the patent is kept relatively low, just as it should be for careful valuation. Usually a quite satisfactory and workable contractual relationship can be established on this basis with the inventor. To prevent an enterprise from submitting false production records, the inventor's counsel may insist upon special clauses in the contract. These should not be objected to by any fair-minded management, whose aim it should be to compensate adequately the inventor from whose efforts and ingenuity the company profits.

Process and equipment patents, which do not create a new product but merely alter some production detail and so change the old per unit cost of production, can be valued with much less difficulty. They are appraised on the basis of annual savings, greater output, or improved quality. Cost comparisons which take into account the value of these improvements and match them against the cost of the new apparatus and obsolescence of the available equipment, along with consideration of the possibility of marketing the excess production, decide either for or against the new invention and fix its value.

As a rule, inventors are very much disappointed with the amounts offered them by prospective buyers, even when the invention is of great technical merit. Usually the inventor does not consider fully his invention's commercial and economic aspects, which may offset its technical advantages. The former may necessitate changes in the distribution and pricing policies and thus involve economic risks which are immediately deducted from the theoretical technical value of the patent.

Chemical discoveries also usually require special pilot-plant development before full commercial production can be undertaken. When they have reached that stage the costs of introducing and marketing the new product begin. This work of market development usually requires the services of specially trained men, and even then it may be fruitless if the improvement or novel features of the new product are not convincing enough to make the consumer prefer it to the "old" product which it is intended to replace. Hardly more than five or ten out of one hundred new chemical patents are real commercial successes, and that explains why the great majority of chemical inventions are difficult to market and only at relatively low rewards to the inventor.

PATENT LICENSING

If the sale of an invention does not appear desirable, inventors and also corporations may attempt to exploit their patents by licensing certain companies to make use of them in return for payment of royalties. Licensing does not transfer ownership and is usually resorted to when application of the invention by many producers appears technically or financially more promising than outright sale to one company or application by a single manufacturer. In actual practice, patent licenses are of various kinds:

Owner's License. The owner of a patent may license other manufacturing enterprises without exploiting the patent himself. He may grant licenses to all takers, or he may grant exclusive licenses to only one company in every country where there is use for the patented process or product. The inventor or patent owner saves all investment and distribution expenses, and, as he does not produce or compete, he can ask a higher royalty. On the other hand, the prospective licensees are reluctant to pay high royalties unless the license is exceptionally valuable to them and the patent owner is in such a strong position that he can dictate his terms.

Holding Company's License. Sometimes special holding companies are formed to carry out the licensing procedures. Just as there are many forms of stock holding companies in finance, so various forms of patent-holding companies have been successfully tried in the chemical field.

Among them the Chemical Foundation, which is described in the preceding chapter, has become the most famous. The Foundation acquired and leased only those patents bought from the Alien Property Custodian. It did not acquire additional patents and so was established to operate for a maximum of only seventeen years. It was mainly a legal institution and was not developed into an institution of economic or technical permanence. It left the acquisition and development of improved patents to the individual licensees and did not invest its royalties in chemical production of its own. By now, all patents originally acquired are public property, and the Foundation, no longer a patent holding company, has turned to other fields.

Probably the oldest patent holding company in the United States that took direct financial interest in chemical enterprises was the Solvay Process Company, incorporated on September 28, 1881, for the purpose of exploiting the Solvay soda-ammonia patents. The company, now owned by the Allied Chemical and Dye Corporation, not only gave out royalties but also invested in plant operations in Syracuse (899,500 tons per year of soda products and other chemicals), Detroit, and Baton Rouge. It also financed the Semet-Solvay Engineering Corporation, which designs and builds Semet-Solvay coke ovens, gas plants, and other equipment and owns the Koller patents and manufacturing rights to gas producers and mechanical grates. Through consolidation of the holding company with other chemical companies the Allied Chemical and Dye Corporation finally emerged.

Probably E. I. du Pont de Nemours and Company owns the greatest number of important patents in the United States, but it is not a holding company proper, nor does it have a special subsidiary company for handling its patents.

The American I. G. Chemical Corporation, however, incorporated on April 26, 1929, is primarily a patent holding company, handling the patent affairs of the Interessen Gemeinschaft der Farbenindustrie A.G., the leading German chemical concern. Quite a surprising number of patents registered by the parent company in Germany and in the United States are leased to American producers. Also it controls the General Aniline Works, Inc., and participates in the Agfa Ansco Corporation, producers of photographic materials.

One of the most remarkable patent-licensing agreements with probably very great future possibilities is based upon the Bergius-Bosch patents for hydrogenation of coals and crude oils. In 1927 the Standard Oil Company (N. J.) and the I. G. Farbenindustrie entered into an agreement to found jointly a number of companies for the exploitation of these patents:

1. The Standard-I.G. Company, which receives all royalties from the process used anywhere outside of Germany.
2. The International Hydrogenation Patents Company, which controls all patents on the process outside of the United States and Germany and pays royalties to the Standard-I.G. Company.
3. The Hydro Patents Company, which controls all hydrogenation patents in the United States. Stock of this company was offered to all oil refiners of sufficient importance who were potential users of the process. Ninety per cent of such companies are now stockholders in the Hydro Patents Company and entitled to use the process.
4. The International Hydro Engineering and Chemical Company, which in all territory outside the United States and Germany acts as consultant on engineering and chemical problems connected with the process.

In the United States, the Standard Oil Company (N. J.) controls 51 per cent of the capital of these enterprises.

Taking into account the fact that the I. G. has similar arrangements with the British and Dutch oil interests, and that a whole series of basic and improvement patents is involved and royalties have to be paid for the use of each, the importance of patents and patent-licensing arrangements becomes obvious. Especially interesting in this case is the fact that the German inventors had the patents but not the raw materials. The formation of patent holding companies furnished the solution to an otherwise difficult problem. Thereby the German patent owners found a profitable use for their patents while the American licensees were enabled to produce at their own decision more, better, and cheaper products from their raw materials. Disputes were avoided, and the whole licensing arrangement can be considered a good example of sound economic reasoning and industrial cooperation.

Manufacturer's License. On rare occasions a manufacturer will offer some of his patents to other companies and by so doing give up the monopoly which he has enjoyed so far. Obviously there must be a reason for his generosity. In all probability there is either some-

thing wrong with the patent or with its commercial possibilities. Perhaps the producer merely does not want to invest more than he already has in the patent, or he wants to put more competitors into the field against one main rival's product which has begun to cause him trouble. Possibly the present owner already has in mind a better patent and merely wants to obtain additional revenue from those who still would be satisfied with the old process. Sometimes a manufacturer's license granted by one company to another is merely the forerunner of closer cooperation and possible merger, and those who closely study the changes within the industry and try to foresee future developments quite often have predicted such events correctly by following patent contracts and manufacturers' licensing agreements.

Generally, patent licensing may be regarded as one of the most effective means of promoting sound economic conditions within each branch of the chemical industries, and rarely is it used for outright selfish reasons.

Some chemical trade associations have acquired certain patents for the benefit of all their members; wider use of this practice would help greatly in creating stability and possibly also better sales conditions in some overcompetitive industries. If chemical trade associations would take up patent-licensing activities the independent inventors would have a better chance than they have had so far in finding a market for their patents, and the association members would gain because no longer would a patent go only to the financially strongest but to all who desired it and could afford a reasonable price. The way has been shown in the oil industry. The automobile industry has its patent cross-licensing agreement and has found it to be one of its most useful institutions; the same or similar arrangement might perhaps well be tried in the insecticide, solvent, and other chemical industries that are unsettled and unstable or are approaching that condition.

PATENT INFRINGEMENTS AND LAWSUITS

A patent or the rightfully obtained manufacturing license gives to the patentee or to his licensees the exclusive right to manufacture the product as described in the patent. Thus the patent during its validity practically creates a legal monopoly, and the law [1] provides for punishment for anyone who violates this right.

> Sec. 48. In suits brought for the infringement of letters patent the district courts of the United States shall have jurisdiction, in law or in

[1] "Patent Laws, Revised, June, 1934, U. S. Patent Office, Washington, D. C."

equity, in the district of which the defendant is an inhabitant or in any district in which the defendant, whether a person, partnership, or corporation, shall have committed acts of infringement and have a regular and established place of business. . . .

Sec. 4920. (U. S. C., title 35, sec. 69.) In any action for infringement the defendant may plead the general issue, and having given notice in writing to the plaintiff or his attorney thirty days before, may prove on trial any one or more of the following special matters:

First. That for the purposes of deceiving the public the description and specification filed by the patentee in the Patent Office was made to contain less than the whole truth relative to his invention or discovery, or more than is necessary to produce the desired effect; or,

Second. That he had surreptitiously or unjustly obtained a patent for that which was in fact invented by another, who was using reasonable diligence in adopting and perfecting the same; or,

Third. That it had been patented or described in some printed publication prior to his supposed invention or discovery thereof, or more than two years prior to his application for a patent therefor; or,

Fourth. That he was not the original and first inventor or discoverer of any material and substantial part of the thing patented; or,

Fifth. That it had been in public use or on sale in this country for more than two years before his application for a patent, or had been abandoned to the public. . . .

Sec. 4921. (U. S. C., title 35, sec 70.) The several courts vested with jurisdiction of cases arising under the patent laws shall have power to grant injunctions according to the course and principles of courts of equity, to prevent violation of any right secured by patent, on such terms as the court may deem reasonable; and upon a decree being rendered in any such case for an infringement the complainant shall be entitled to recover, in addition to the profits to be accounted for by the defendant, the damages the complainant has sustained thereby, and the court shall assess the same or cause the same to be assessed under his direction. . . .

These are the main rulings of the law on infringement, and again the reader is referred for further details to the Patent Office publication *Patent Laws, Revised, June, 1934.*

Although the law may appear to be clear and complete it nevertheless leaves room for much argumentation and often requires very elaborate interpretation in the courts. Once a patent infringement case gets into the hands of lawyers and experts, it becomes a long-drawn-out and costly affair for both the defendant and patentee, and years may pass before satisfactory settlement is reached.

The difficulties begin with finding out where, when, and how a patent has been infringed, and by whom. Those willing to infringe have ways of their own of covering up, and the discovery of patent infringements is just as often merely a matter of chance as it may be the result of greatest watchfulness. However, infringements are frequently enough discovered and brought to court, and then it is up to both the defendant and plaintiff to substantiate their claims.

In chemical cases the technical part of the proceedings is the most difficult, and almost invariably expert testimony is sought by the court. How a case will be decided is usually uncertain until the final verdict has been rendered. The intensified efforts of both parties often unearth very surprising evidence, and no more interesting argumentation can be found than is contained in the *Annual Decisions of the Commissioner of Patents and of the United States Courts in Patent and Trademark and Copyright Cases.* These decisions are a complete annual summary of all findings on patent matters in the United States, and, as they can be obtained from the U. S. Government Printing Office for only $1.50 per year, no chemical enterprise should fail to buy them and circulate them among its employees. The information which they contain, and may have cost thousands of dollars to the parties involved, is invaluable and more than justifies the small amount spent for the book. As this material is so readily available and no definite rules can be given which would help in winning a case for either side, none of the many interesting chemical litigation cases is discussed in this study.

But attention is drawn to the activities of the American Arbitration Association, 521 Fifth Avenue, New York City, which can be called in as arbitrator in all those cases where both parties are willing to settle their disputes through arbitration rather than court action. The procedure is cheaper and takes less time. Hearings can be held in 1,700 different cities of the United States, the arbitrators are all experts rather than professional judges and serve without fees, and the whole organization is backed by a first-rate reputation. The American Drug Manufacturers' Association, the Baltimore Drug Exchange Bureau, the Manufacturing Chemists' Association of the U. S. A., the Industrial Alcohol Institute, the National Association of Dyers and Cleaners, and quite a few others are members.

Besides, there are many experts, chemical engineers, and consultants who are willing to act as referees to whom the companies may refer their disputes.

PATENT OBLIGATIONS OF EMPLOYEES

In view of the classical concept of rewarding an inventor for his inventiveness, the modern patent obligation declarations, which are being required by most chemical enterprises from their employees, somehow must appear not quite as liberal as modern social tendencies would recommend, even if they are legally possible and enforceable. Through the patent obligation, the employees, who must sign it if they want to obtain employment, resign all rights and claims to all and any discoveries while in the employ of the company. Discoveries made by salaried employees are definitely considered the property of their employers. Quite frequently the employees also have to agree not to work in competitive enterprises for a period of years after they have left their present employment. Only the workers not paid on a salary basis are entitled by state laws to claim the right of invention, provided that they can prove they have developed their discovery on their own time. The reason for this distinction lies in the fact that salaried employees are engaged primarily for the invention and development of new processes and products, whereas workmen and operators are not specifically hired for this purpose. Some companies have voluntarily rewarded their employees for usable inventions but with such insignificant amounts that they did not represent fair rewards.

At present the employee who discovers something new has only the following choices if he wants to get the full benefit from his invention:

(*a*) He may keep still about his discovery, quit his job, take out a patent, and put it to use.

(*b*) He may carry on his research in a field which in no way is connected with his job.

(*c*) He may ask for a special exemption from the patent contract for private research work after proving that it has nothing to do with his job.

None of these choices is entirely satisfactory either from the employee's or from the company's point of view, and a clarification and improvement of the contractual employment conditions in the chemical industries appears to be a task that should come up for definite consideration in the future. It is well understood that enterprises need protection, just as it is well known that not all employees are as honest as they might be. But, on the other hand, if real progress is desired for the chemical industry it would seem that the patent obligations in their present form are not entirely satisfactory to all.

TRADE MARKS AND LABELS

Many chemicals look very much alike to the inexperienced eye, and the difference between the "right" and the "wrong" product is not always evident. As the ultimate consumers of drugs, medicinals, oils, rayon, plastics, or photochemicals are usually not in a position to find out for themselves what they really buy, and since even the industrial buyers of chemicals, who can have an analysis made in their own laboratories, want to have at least a first sight identification and guarantee indicating the source of their materials, trade marks and labels are of greater importance in the chemical industries than in most others. For these reasons the producers of chemicals, whose business and good will depend on the quality of their product and on the reputation of their firm, have always been particularly anxious to identify their goods by means of special marks and labels and to protect themselves against the fraudulent use of these trade marks by others.

This protection is guaranteed in the United States by the "Statutes Concerning the Registration of Trade Marks." These laws and their revisions have been published by the Patent Office and can be procured from the U. S. Government Printing Office, Washington, D. C. Also obtainable there are the "Statutes Concerning Registration of Prints and Labels." Together, these regulations represent another useful, means of achieving stability in the chemical industries.

The establishment of trade-mark and label protection was not a simple task. Provision for a trade-mark law was made in the United States for the first time in connection with the codification of the patent law in 1870. The special Trade Mark Act was approved by Congress in that year. However, under the pressure of powerful lobbies it was declared invalid by the Supreme Court in 1879 on the ground that the Constitution of the United States did not authorize federal legislation on trade marks, except in cases where they were already being used in trade with foreign nations and Indian tribes. This decision took protection from all trade marks registered primarily for use within the United States.

A new trade-mark law was adopted by Congress on March 3, 1881 (Rev. Statutes U. S. ss 4937–4947). It remained in effect until February 20, 1905, when it was repealed, again as the result of lobby pressure.

In 1883 the first international agreement was concluded which recognized, for trade marks registered in one country, definite protec-

tion in every other country which became a member of the "First International Convention for the Protection of Industrial Property." The United States was represented at this convention and at all following ones, so Americans now enjoy, upon proper application, the same privileges in regard to trade marks as do citizens in every convention country. The main prerequisite for international registration of trade marks is that they are registered in the applicant's own country when he applies abroad.

After the repeal of 1905, American trade-mark regulations were codified again and approved by Congress in the Trade Mark Act of 1906. For the full text of the regulations the reader is referred to the Patent Office publications previously mentioned, but abbreviated excerpts of the main rulings are offered for first-hand information as follows:

1. Trade-mark registration may be obtained by filing a written application with the Commissioner of Patents, stating all details and including a drawing of the trade mark or label.

2. A check for $15 payable to the U. S. Treasury should be attached. This covers the cost of registration, which if approved is good for twenty years. United States trade marks obtained by foreigners, who must have them registered in their own country also, expire on the date when they expire abroad.

3. "A trade mark must have been actually used in commerce before an application for its registration can be filed in the Patent Office" (sec. 19). This ruling is contrary to patent practice and is provided to prevent swindlers from registering trade marks in advance of those who would legitimately be entitled to registration.

4. The kind of merchandise for which the trade mark may be used is limited to that stated in the application.

5. The trade mark may consist of pictures, drawings, words, or a combination of these.

6. The picture or drawing should not make use of flags, coats of arms, insignia of the United States or foreign nations, or emblems or other characteristic marks of fraternal societies, institutions, organizations, clubs, or societies. No portrait of a living individual may be registered as a trade mark unless with his written consent.

7. With regard to the words the following should be observed:

(*a*) The name of an individual, firm, corporation, or association may be used but should be visibly presented in some particular or distinctive manner.

(*b*) Generic words, such as aspirin, are not suited for trade-mark purposes.

(*c*) Words descriptive of the article also are unsuited. The reason for this was restated in the Annual Decisions of the Commissioner of Patents, 1935, Pillsbury Flour Mills Company, 450, O. G. 3, October, 1934, as follows:

> The reason that registration of descriptive words is not permitted is, because the public and more particularly, the manufacturer or vendor are entitled to the free and untrammeled use of the appropriate and apt terms of the English language in describing merchandise. To give any manufacturer the exclusive right to descriptive language deprives everyone else of just so much.

(*d*) Suggestive words may be used for trade marks; but, in the decision quoted above, the court stated also that it is very difficult to decide whether a word is "descriptive" or "suggestive." Approved as being merely suggestive are: Printacel, InstoKleen, Rokflos, Turfbuilder, Moth-o-rize, Stakild, Prooftex, and similar words.

(*e*) Artificial words, therefore, which are not descriptive are suited and usually chosen for trade-mark use.

8. Trade marks comprising immoral or scandalous matter are definitely refused registration.

As has been stated before, a trade mark must be registered for a definite kind or group of articles, and for that group only may it be used thereafter. If an article is patented and trade-marked at the same time, the trade mark can not be used for a similar article nor for a substitute. Therefore the purchase of a patent without the existing trade mark is as incomplete a transaction as would be the purchase of a trade mark without the patent for the article that it protects.

The use of trade names, in daily conversation, has grown considerably within the chemical industries during the last decade, and therefore the importance of protecting these names, the products, and the enterprise has greatly increased.

CHAPTER 4

COOPERATIVE ACTIONS

Thus far only those means and policies that can be dealt with and handled directly by each individual enterprise have been discussed. Stability and progress for entire industries, however, can be achieved still better if all or at least most enterprises of the same industrial group cooperate and coordinate their legitimate aims in this direction.

In almost every country of continental Europe, in England, in Japan, and in Russia, chemical industries are developed, directed, and steadily enlarged upon the principles of coordination and cooperation. In actual application these principles are being carried out under different names and forms. Thus we hear of cartels or syndicates in Germany, guilds in Italy, trusts in Russia, England, and Japan, but basically all these are forms of industrial cooperation. These organizations are guided by industrial experts and according to the principles which these experts consider necessary and desirable. The governments of these countries either merely permit cooperation or, as in Russia, exercise their influence directly in bringing cooperation about.

American chemical industries, concededly as the result of serious abuses of the cooperative principle by other industries, are subjected to various laws that may prevent monopolistic tendencies but at the same time prevent those cooperative measures which other nations, equally opposed to monopolistic abuses, have not suppressed, because they found "constructive" cooperation useful and necessary for their industries and for their nations. Between "monopolistic abuse" and "cooperative organization" there is a definite difference, which those other countries recognize but which obviously was not taken into consideration when, more than forty years ago, the laws were made to stop monopolistic abuses.

Under existing laws, chemical industries, like all other American industries, are permitted to further their common ends only through trade-association activities. Contrary to legal tradition, however, in 1934 they were forced to accept a peculiar kind of regulation that

would uphold all laws against combinations but at the same time make all industries do collectively and every enterprise individually what the government desired them to do in regard to working hours, wages, and laboring conditions.

The National Recovery Act was regulation of a type that was not only unconstitutional, but was at the same time economically inconsistent and socially one-sided. It aimed in principle at the cartelization of entire industries, and it placed upon these industries important economic obligations without giving them any of the economic benefits which can be realized through proper cartelization. Such reform is incomplete and bound to fail. The mere enforcement of large-scale social improvement programs has nowhere been possible as yet, without giving industry—as the paying group—the chance to operate so that it can carry the social economic burden which it, as a group, is supposed to carry.

Fundamentally the American chemical industries are not cartel-minded, and in view of the established laws no such tendencies are being fostered. Markets always have been large enough to offer sufficient business to all producers, and the same condition probably will prevail for some years to come. Giant chemical plants and grandiose mechanization of all engineering processes, avoidance of wastefulness in distribution together with tariff protection and absence of labor troubles, have so far helped to keep the whole economic structure of the industry in equilibrium.

But suppose that some day there should be another serious economic setback, which is by no means improbable; suppose that some enterprises and even mergered corporations have overinvested and overexpanded, which is definitely the fact; suppose further that one-sided government interference should be revived and social troubles brought upon the industry. Think of other economic or political events that may happen either singly or in combination with any one just mentioned. Is the present state of organization, then, really the best for further general progress and economic welfare?

Quite often we hear that economic action should be planned and that thereby a better economic order should be created, and just as often do we hear that any kind of plan agreed on by producers is taboo, a danger to the common good, monopoly, and "Wousin" (see Jerome Frank, "Save America First," p. 16).

Which form, then, can industrial cooperation choose and still be within the laws?

THE ECONOMIC ROLE OF TRADE ASSOCIATIONS

As the trade association is at present the only form of industrial cooperative action permitted under the law, and since almost every branch of chemical production has some sort of trade association, it is important that there be a clear understanding of what these associations can and what they cannot do in providing greater economic security and stable progress for the industry they represent.

According to the latest report issued by the Department of Commerce,[1] there are 206 chemical trade associations in the United States representing 45 chemical and allied industries or trades. Only twice so far have these trade associations been called upon to cooperate under the leadership of the Chemical Alliance, which is also considered a trade association: during the war, and during the National Recovery Act period.

Although in the event of a national emergency the Chemical Alliance probably would be entrusted again with the task of organizing these various associations into one coordinated group, in "normal" times—if there are such conditions at present—they have to remain apart from each other and without central representation. They, and the industries they represent, have to shift for themselves as well or as badly as their own internal set-up will permit and as effectively or ineffectively as they obtain the support of their members.

In view of the latest developments in the field of social economics where centralization definitely has become a fact recognized by law, the permanent absence of central organization and coordination among enterprises and trade associations must appear as a serious weakness. Still more regrettable are the facts that quite a few chemical enterprises still refuse even to become members of trade associations and that quite often those which are members do not show the interest and cooperation needed by their associations in order to develop into really efficient and useful organizations.

In the United States there are no laws regulating trade-association activities, but the Sherman and Clayton Acts, together with the rulings of the Federal Trade Commission Act, quite definitely determine what these association can and cannot do.

Mr. Nelson B. Gaskill, former Chairman of the Federal Trade Commission and chosen by the Department of Commerce as an expert

[1] "Selected Trade Associations of the United States, 1937 Edition, Supplementing "Commercial Industrial Organizations of the United States, 1931."

to prepare its publication on the "Legal Aspects of Statistical Activities," [1] stated the following in regard to legal and illegal practices:

> There is no distinct or specific list of what may not be done to which one may refer, except that the decisions of the courts contain statements of fact which have been condemned or approved.
>
> The Sherman Law does not state the idea [of the doctrine of general freedom to trade] in positive terms any more than it attempts to prohibit all acts which interfere with the individual freedom of trade. But the idea is implied, for without it there is no reason for the prohibitions The nearest that any law ever came to stating the idea generally is found in the Federal Trade Commission act. . . .
>
> What we are dealing with, then, in the anti-trust laws is not the prohibition of all interferences with the individual or freedom to trade or with conditions of supply and demand, but with some of them only. With exception of the specific declaration of the Clayton law, these prohibitions relate to agreement.
>
> But it is very far from being true that every agreement or concert of action, in a trade association or out of it, is unlawful. The very fact of the existence of a trade association indicates the existence of an agreement and that is why such an association must take care that nothing unlawful is done by it For such an unlawful act will attach to the association agreement and make it completely unlawful. For this reason it is highly necessary that the trade association understands what it can lawfully do Generally speaking, *it can regulate the conduct of its members. It must not restrain their necessary freedom of action.* But it must be very careful as to how it attempts to regulate or restrain the conduct of others.
>
> The law does not attempt to regulate business practices or business conduct except in minor particulars. It confines itself to restricting the diminution of an otherwise unlimited scope of initiative and action. *The business of regulation pertains with peculiar fitness to the trade association as a medium of self-government.* . . .
>
> The basis of this self-imposed regulation [of industries through associations] is agreement on a stated principle of action rather than on a specific form of action. *The agreement must be free from coercion, constraint, or undue pressure of any kind. It must be an uncontrolled assent freely given.* . . .
>
> *This process of voluntary self-regulation has already gone far.* Its official sanction had its beginnings in the Trade Practice Submittals instituted by the Federal Trade Commission, in which the agreement of the industry is supervised by the Commission. There is no authority

[1] Department of Commerce, Trade Association Activities, Domestic Commerce Series 20, 1927, Government Printing Office, Washington, D. C., p. 45 ff.

for this practice in the law, and in last analysis the legal standing of such an agreement must depend upon its quality as a regulation of commerce rather than a restriction upon it. This procedure has been carried to far greater lengths and has developed a far greater usefulness through the work of the division of simplified practice of the Department of Commerce. Here, again, the official contact has no legal authority from which the resultant agreement derives any final sanctity. But this is as clearly a regulatory process and not a restriction as is the agreement of the paint and varnish manufacturers' associations upon the proper use of the terms "shellac" and "shellac compound."

This field must broaden its scope and draw nearer and nearer to the complexities which confuse the lawmaker, because only by this method can governmental intervention be avoided in the regulation of commerce, which the ever-increasing complexity of life demands.

These are the high spots of the comments on the rights and tasks of trade associations, as stated by the Department of Commerce. The various court decisions referred to above definitely exclude agreements on prices or production, sales quotas, and similar actions, which are interpreted as restraint of trade.

For the time being such agreements may not be needed, but some forms of coordinated action will some day become as necessary in the United States as they became necessary in other countries where permission to make such agreements had to be granted by the governments upon request of a great number of small enterprises vitally threatened in their economic existence either by too efficient operating practices of some companies within the industry or by necessary social and economic burdens legally imposed upon all enterprises. From 1926 to 1932 chemical companies rendered 54,112 tax returns, 49.9 per cent of which showed companies losing money in their annual operations. This is a condition which may not be alarming to some, but probably was most painful to those who suffered these losses, and who were supposed to continue competing in an economic and legal order which did not recognize coordinated action for the producers.

So far, most American trade associations, including those of the chemical industries, have therefore concentrated their efforts upon activities definitely permitted under the present laws: collection of statistical data pertaining to the industry and their distribution among members and others; technical research; standardization and setting of norms. Occasionally, but still rather rarely, we find chemical trade associations also engaged in commercial and economic research, a field in which most of them could render much greater and more valuable

service than they are permitted to do at present. Furthermore, only few efforts have been made to prepare special studies on problems of distribution, cost accounting, publicity, advertising, codes of ethics, traffic and transportation, finance, credit and insurance, labor relations and wages, public relations, and other fields in which many of the smaller producers need assistance most.

Hardly any one of the chemical trade associations can carry out an economically effective program under the present laws. Even in reference to the dissemination of statistics, restrictions exist to prevent the restriction of trade. The 80 or 100 large chemical companies can obtain for themselves even in regard to statistics all the help which they require, but not the 6,900 smaller companies, which make up the industry. If real liberalism is desired, improvement in organization, rights, and services of the trade associations is urgently needed for the benefit of the small producers, and should be made one of the primary aims of the industry if it would insure its own future stability and progress as an industrial and economic group.

CARTELS AND TRUSTS

Aside from the laws which forbid the formation of any monopolistic organization among manufacturers, the fear of giving up individual liberties and methods of action has caused many chemical enterprises to take only slight interest in cartels in general and still less in the possibility of establishing them in this country. And yet, a cartel is one of the most effective means to further economic stability and progress for all. Incomplete, incompetent, and probably biased information about cartels, and hearsay knowledge of the practices of such combinations, have caused this aversion which in turn has created a gap in the knowledge of many on this rather important phase of modern chemical economics.

With conditions as they are, however, and in view of the constant propaganda against organized industrial economic activities, everyone should be entitled to know at least whether individualistic business practices combined with merger possibilities are better or worse from a national economic point of view than cooperative and cartel policies of the proper kind. As more than two-thirds of all chemicals throughout the world are produced and marketed under cartel regulations, and since only few American chemicals can be sold abroad or even, probably, at home without competing against them, the reader's attention is directed to the findings of the Committee of Trusts, Combines and

Trade Associations, established in 1918 by the British Ministry of Reconstruction for the purpose of examining the advantages or disadvantages of cartels and the advisability of furthering them within British industry.

England's Company Laws, especially the revision of 1865, had made it possible to create industrial holding companies, and quite a few had been established in the public utilities field. But in industry the desire of the English owners for independence, and their reluctance to cooperate with one another, had prevented any form of industrial combination from taking root. Outright association of manufacturers was still considered equivalent to trade unionism, and both were at that time subjected to close regulation. Industrialists who could afford it, therefore, preferred to buy outright those enterprises which could not carry on, and through merger activities they had created conditions similar to those existing in the American chemical industry today.

Mr. John Hilton was placed in charge of the investigation, and his report was published on April 24, 1919.[1] In this report are some interesting statements that are worth considering:

> Competition has vicious features to offset its virtues, and even its virtues are of limited range. It elevates self-interest into a gospel and makes "Each for himself and the Devil take the hindmost" the first rule of conduct.
>
> There is a point at which the continuance of competition along the old lines is no longer compatible with industrial efficiency and continued progress.
>
> Competitive production often means a wasteful duplication of activity and plants. . . . It may stimulate the will to improve and yet deny the means.
>
> For these reasons, goods produced under a regime of free competition may be dear, even though the competing producers are making less than a living profit.
>
> Most associations [Hilton means cartels] were born of dire necessity; it was seldom, indeed, that an association came into being until the trade was faced with all-round disaster, if it did not combine.
>
> So long as the individual will to survive is stronger than the instinct of common danger, and the hope of coming out on top in the industrial scrimmage counts for more than the sense of common interest, competition will hold the field; but when self-preservation and self-interest are seen to be in line with the general interest, competition is abandoned and cooperation begins

[1] Ministry of Reconstruction, Command 9236, 1919, His Majesty's Stationery Office.

> Legislative action in respect of monopolistic combinations can take one of two directions It can be aimed at preventing combination, with the idea of preserving competition as the natural and proper order of industry, or it can take the tendency to combination for granted and concern itself with preventing and penalizing any use of the power derived from combination, which may prove to be inimical to the public interest. The first may be called "repressive" legislation; the second "policing" action.
>
> Monumental examples of the first kind are in the American anti-trust laws, notably the Sherman Anti-Trust Act of 1890 . . . and the Clayton Anti-Trust Act of 1914.
>
> Sweeping judgments as to the results produced in practice by this kind of legislative action are not lightly made, but the conclusion to which competent critics are forced is, that anti-combination laws have proved thus far worse than futile; by making combination of independent manufacturers criminal conspiracies, they have encouraged the fusion of firms into great amalgamations, and they have driven combination underground, where its worst qualities have thriven and its best qualities declined. . . It has prevented the realization of the beneficial possibilities which above-board combination holds.

Even though Mr. Hilton is perhaps too critical of the American way of doing things, there is undoubtedly some truth in his findings, and though not much credit was given him by the British government, it approved, on December 23, 1920, "An Act to Regulate the Importation of Dyestuffs" (10 and 11 Geo. 5, C. 77) and on August 19, 1921, the so-called "Safeguarding of Industries Act," whereupon some chemical enterprises proceeded to form with the consent of the government one of the most formidable and successful chemical cartels, Imperial Chemical Industries. The combination was officially announced in 1926 and now includes almost every branch of the British chemical industries.

What has been found useful to the British chemical industries may some day become advisable for chemical industry in the United States and supply the solution for some of the economic and social difficulties which beset a good half of the chemical industry. The history of every industrial nation clearly shows that organization of workers cannot achieve permanent improvements for this group without conceding organization rights to the employers. To the same extent as social conditions have been improved for the workers of England, France, Germany, and Russia the governments of these countries simply had to permit industry to agree on more than statistics, standardization, and special studies.

Such agreements need not have the undesirable features of the old-

time monopolistic trusts, but could be restricted to only absolutely necessary points and be made open to all. Instead of exploiting the workers or consumers they might benefit them in a manner similar to that in which chemical cartels have benefited the workers and users of chemicals in other countries.

The economic benefits in the form of savings to the consumers and investors and the social stability resulting from well-considered agreements are bound to be much greater than can be obtained by the stimulation of maximum competition, excess capacity, profitless operation, and similar methods.

As we are no longer living in an age of old "legal concepts" and the American people has now become accustomed to support "realistic and progressive government" and industrial legislation, it would seem that the days are not so far off when chemical leaders together with the government could and should consider a truly realistic and progressive economic organization of their industries for their own benefit and future stable evolution and for the advantage of workers and consumers alike.

THE GOVERNMENT AND CHEMICAL INDUSTRIES

The preceding statements clearly demonstrate the important influence of *legislation* in the development of an industry. Wise legislation can help, just as unwise regulation can prevent an industry from reaching its most useful stage. Therefore, in any consideration of the means that possibly might create further progress and stability in the chemical industries, the various institutions of the government and their practices and policies cannot be overlooked.

There can be no doubt but that, from the day when President Jefferson invited Mr. E. I. du Pont to make powder for the U. S. Army, the American government has been aware of the importance of chemical production. Throughout the following decades the members of Congress as well as the officials of the government have, therefore, steadily applied the Jeffersonian principle of fostering and protecting the various infant chemical industries as they came into being and grew into full-fledged producers.

This should not mean that American chemical production is based exclusively on *protection*. At no time have the chemical branches been "pampered" unduly. In view of all available tariff hearings, however, there can be no denying the fact that a considerable portion of chemical production in the United States is dependent upon tariff

protection and therefore any change in the established tariff policy would have a vital effect on the industry.

The *Tariff Commission*, mentioned before, has ever since its inception examined any potential threat to American industry, especially to its chemical branches, and has collected in each instance pertinent facts and figures. It has compiled an amazing wealth of information by extending its investigations into American as well as foreign operating methods and conditions and has made these studies available through a large number of publications.[1] It has advocated necessary protective measures, but not even the most careful scrutiny will find it ever in favor of unnecessary protection. It is truly one of the most objective agencies of the government.

For various reasons not quite the same objectiveness can be observed at the *tariff hearings* held by both Houses of Congress, whenever a change in tariff is under consideration. At these hearings business men and representatives of associations can voice their ideas on desired changes, and often enough they ask for protection far exceeding their real needs.

Especially when such attempts are "supported" by voluminous propaganda rather than convincing evidence is their outcome doubtful and an indication of poor industrial policy. Applications for tariff revisions should be requests that can stand careful and thorough scrutiny from all angles.

The policy should be similar when new regulations or changes relative to the *Interstate Commerce Act* are desired. This act regulates all interstate commodity traffic and covers such particulars as through routes, "just and reasonable rates, fares and charges," operating facilities and terminals, restrictions concerning transportation of certain articles, car service, and car-service rules and regulations. In any case where carriers refuse to consider fair requests of any applicant, the applicant has the right to complain to the *Interstate Commerce Commission*, whose task it is, either directly or through appointed agents, to see to it that proper service is provided.

The Interstate Commerce Commission is also the authority which deals with "undue or unreasonable preference or advantage granted by the carrier to any particular person, company, firm, corporation, or locality, or any particular description of traffic." It also regulates compensation for damages and the procedure to be observed in changing freight rates.

[1] U. S. Tariff Commission, Subject Index of Tariff Commission Publications, Revised, December, 1935.

As freight charges for raw material may account for as much as 15 per cent of the cost of chemical production, and outgoing freight equalization alone may absorb as much as one-third of all distribution expenses, the Act and the Interstate Commerce Commission are directly of great importance to the industry. This importance is further increased by the fact that many chemical producers ship products of a special and dangerous kind and must watch not only a great number of special freight rates but many special rulings as well.

The *Federal Trade Commission* [1] was established for the purpose of determining and eliminating "unfair methods of competition in commerce." Its functions are indicated in the following excerpts from the Federal Trade Commission Act:

> Whenever the commission shall have reason to believe that any such person, partnership, or corporation has been or is using any unfair method of competition in commerce, and if it shall appear to the commission that a proceeding by it in respect thereof would be to the interest of the public, it shall issue and serve upon such person, partnership, or corporation a complaint stating its charges in this respect, and containing a notice of a hearing upon a day and at a place therein fixed at least thirty days after the service of said complaint. . . .
>
> If upon such hearing the commission shall be of the opinion that the method of competition in question is prohibited by this Act, it shall make a report in writing in which it shall state its findings as to the facts, and shall issue and cause to be served on such person, partnership, or corporation an order requiring such person, partnership, or corporation to cease and desist from using such method of competition. Until a transcript of the record in such hearing shall have been filed in a Circuit Court of Appeals of the United States, as hereinafter provided, the commission may at any time, upon such notice and in such manner as it shall deem proper, modify or set aside, in whole or in part, any report or any order made or issued by it under this section. . . .
>
> The judgment and decree of the court shall be final, except that the same shall be subject to review by the Supreme Court upon certiorari as provided in section two hundred and forty of the Judicial Code.

As elimination of "unfair competition" is of prime importance in obtaining stability within an industry, it should be of interest to know what the law considers as such. The meaning of the term is set forth in the following annotation to the statute:

> The words "unfair method of competition" are not defined by the

[1] Federal Trade Commission Act, 63rd Congress, Public Document 203, Approved September 26, 1914.

> statute and their exact meaning is in dispute. It is for the courts, not the Commission, ultimately to determine as a matter of law what they include. They are clearly inapplicable to practices never heretofore regarded as opposed to good morals, because characterized by deception, bad faith, fraud, or oppression, or as against public policy, because of their dangerous tendency unduly to hinder competition or create monopoly. The Act was certainly not intended to fetter free and fair competition as commonly understood and practiced by honorable opponents in trade.

Some of the more common unfair practices are: commercial bribery, conspiracies or combinations to punish or coerce, false or misleading advertising, free goods as inducement to purchase, full line forcing, misbranding or mislabeling, monopolistic tendencies, resale price maintenance, tied or exclusive contracts, or leases, gratuities, misrepresentation of prices, and violation of just compensation.

The regulations of the Federal Trade Commission pertain only to interstate commerce and to corporations involved in such trade. Local trade and control of "unfair methods of competition" are governed by the laws of the individual states.

In order to strengthen control of business methods, many special bills have been submitted to Congress, for example, the Robinson-Patman Bill on price maintenance. All of them have affected the chemical industries, but none have been of such great help as the activities of the various government departments that are concerning themselves directly or indirectly with chemical economics.

Outstanding among these are the *Department of Commerce* and its *Chemical Division*, the *Department of Labor*, the *Bureau of the Census*, and the *National Bureau of Standards*, the *Patent Office*, the *Bureau of Mines*, the *Department of Agriculture*, and many others whose main task it is to supply industry and public with definite information and reliable data. Comparison of the wealth of information which emanates from these sources with the material supplied by similar institutions of other countries leaves no doubt in regard to their superior work and efforts. It is regrettable that within the industry so little use is as yet being made of this material, which may stand improvement here and there but is definitely indispensable to anyone dealing with chemical economic matters.

Relations between the chemical industries and the government have been and are as good as can be, and are endangered seriously only when the government attempts to "go into business" in chemical production. With the large capacities of private enterprises in every

branch of chemical industry and their competitive willingness to furnish all the chemicals that possibly might be needed, there is no need for the government to attempt to do the same. The experience gathered at Muscle Shoals should definitely discourage any further attempts.

It is an old but well-tested theory that a government should do only what nobody else can do better, more cheaply, or more advantageously than the government. Making and selling of chemicals are not in this category, and therefore it will be in the best interest of all if the government will restrict its activities to assisting and controlling the industry's own efforts rather than try to guide it, force it, or compete with it. Self-determination of the chemical producers and cooperation with the government in various forms have built up the industry to where it is today, and observation of the same policies will be the best for the future.

CHAPTER 5

ECONOMIC REQUIREMENTS FOR CHEMICAL PRODUCTION

At the beginning of industrial production is *planning.*

Proper planning enables the smaller enterprises to stay in business, just as the lack of proper planning may rob even large companies of their position and may make them fall prey to their own negligence or daring.

Chemical economic planning covers a much wider range of problems than those encountered in other industries, and, as it must begin with a consideration of the fundamental requirements for the development of chemical industrial enterprises, these requirements are discussed in their assumed order of importance and then from various national viewpoints.

THE BASIC ECONOMIC REQUIREMENTS FOR CHEMICAL ENTERPRISES AND INDUSTRIES

1. *Chemical and Engineering Knowledge* is a prerequisite without which no chemical enterprise can come into being and still less survive in the competitive struggle for economic existence. This operating knowledge differs from laboratory knowledge and is required especially in the men who actually carry out the large-scale manufacture of chemical products. It is a quite common belief that with modern machinery almost everything can be done in a mechanical way; in chemical production, however, in spite of its far-reaching mechanization, the human element must be of the highest caliber, if trouble is to be avoided. Will power, persistence, and practical resourcefulness must complement a thorough and up-to-date knowledge of chemical engineering. In spite of all modern improvements in chemical equipment, neglect of certain details or ignorance of technique may cause serious defects in the product or danger to the men.

2. *Economic Knowledge.* Although industrial planning without a thorough consideration of all economic factors may seem well-nigh unthinkable, such consideration is nevertheless still too often over-

looked. It is quite customary to have even minor technical jobs most carefully planned and organized according to drawings, operating sheets, chemical analyses, and tests, but when it comes to economic problems, even simple but vital investigations are sometimes omitted. It is rather interesting to note that those enterprises and chemical associations which would need careful economic and business research most are often among those which do not care to make proper provisions for it, whereas those companies and chemical branches that are most successful do the most careful and thorough work in economic research. Undoubtedly there is a relationship between the fulfillment of this basic requirement and final success.

If cost accounting, financial control, and budgeting are actually established, what additional economic knowledge should be systematically gathered and used for forming the management policies of the enterprise or industry?

Obviously a great variety of economic phenomena and an almost endless number of economic factors influence the conditions to which the enterprise must adjust its course. To find out those which are of special significance on account of their bearing upon the supply and demand for the chemicals made is the first step in gathering economic knowledge.

Every chemical periodical offers general reports on markets and business conditions, references covering chemicals-consuming industries, and at least some notes on current events in the various branches of chemical production. Thereby they attempt to fill at least some of the need for economic knowledge.

But these data are not quite enough. Additional statistics must complement this information, and there is the point where difficulties are encountered. What every management really needs are detail data, "fine" statistics, on all products that are to be made. How much chromic acid, for instance, potentially can be sold per year is not really difficult to determine because sufficient data are available to show how much has been produced and sold, to which industries, and at what price. Thus definite information is available which shows the statistical history of this product and its economic potentialities. But when it comes to getting such facts on paradichlorobenzene, dimethylaniline, copper sulphocyanide, or cerium oxide and even carbon tetrachloride, to mention only five of many thousands of not regularly reported chemicals, the real research work begins. And yet this work has to be done because, without the knowledge of existing markets, consumer industries, characteristics of demand, price trends and estab-

lished competition, industrial production of such chemicals would be—to put it mildly—economic guessing. Many enterprises that have tried to do this have suffered most costly disappointment.

Quite often one is told that economic research is not being undertaken because it does not pay. Similar objections were adduced when engineers began to build machines on paper and chemists started to compound new products by means of symbols and calculations. The fact that a good deal of patient work is necessary to get all economic facts together and into workable form should not prevent attempts in this direction, and just as engineering knowledge "pays" today, so economic research will be considered worth its price in the future.

3. *Raw Materials.* It is an often-repeated saying that the abundance of raw materials has made large-scale chemical production possible in the United States. To some extent this is true, and almost all the groups of raw-material suppliers have found in the chemical industries good and steady consumers. But at the same time the availability of raw materials as a prerequisite for chemical production has been overemphasized. Chemical industries have been developed also in countries that were not so well endowed with raw materials (Germany, Switzerland, Holland). Chemical producers are usually the first to look for substitute raw materials and synthetic processes when the prices for raw materials are raised to a point where the costs of the chemicals produced from them become uneconomical.

Raw-material producers have often overlooked this in the past and thus have lost permanently valuable chemical outlets for their products. Wood pulp was resorted to for making paper and rayon when the prices for rags and cotton cellulose became too high. Recovery processes for sulphur dioxide and sulphuric acid were improved whenever the prices for sulphur and pyrites rose. Synthetic dyes were made in large-scale quantities when natural indigo and other dyestuffs had become too expensive to be used for the dyeing of textiles turned out by mass-production methods. Hundreds of other examples could be cited, all demonstrating the same experience in another form.

Thus in the low prices of raw materials as much as in their physical availability we find a prerequisite that must be fulfilled in order to make and keep them suitable for industrial chemical use.

This tendency to change raw materials is again noticeable since raising the price of commodities (including raw materials for the chemical industries) became the vogue in 1933 not only in the United States but also in the British Empire and other parts of the world.

For some materials the higher prices are being paid, but others are now being or will be replaced by others that are cheaper.

4. *Power.* The increasing use of electricity instead of coal is merely another example to prove the foregoing. For decades coal was the only fuel used in chemical plants, and no one thought of wanting something else for this purpose until coal prices became too high and supply uncertain owing to strikes. Commercial-scale electrochemical processes first brought electricity into the foreground as a new power for chemical plants. Since then there has been an increasing substitution of white coal for the black varieties. Today most chemical producers are still increasing their use of electricity in preference to coal, and lower rates for electric power will bring about an even more definite trend in this direction.

But in spite of the increasing trend toward the use of electricity and the improvements in fuel and heat economy, chemical plants are still among the largest customers of the coal industries, and as ample supplies of coal and electricity are available neither the industry as a whole nor individual enterprises have difficulty in fulfilling the requirement for cheap power.

5. *Markets.* The question of whether or not a chemical industry or enterprise can develop its own market, or whether the existence of a market for its products must be a prerequisite to production, has been and still is a recurring problem for all those who intend to start a new chemical enterprise or want to promote a new line of chemical products.

The history of chemical production of this and other countries shows clearly three things: (*a*) that, to begin with, non-chemical consumer groups, and especially industries, must be in need of chemicals in order to make their commercial production worth while; (*b*) that through these developments and the ensuing general progress a demand is created which provides a sufficiently large market for other chemical products; and (*c*) that only those chemical products are not dependent on the existence of an industrial market which can be directly sold to ultimate consumers.

Brazil, for instance, a country which could undoubtedly fulfill all economic requirements for chemical production discussed so far, has no such industry because there are no other industries to speak of and only very few consumer groups which are in need of chemical products. Whatever they need can easily be imported. Russia had no well-developed chemical industry before the World War and has

begun to develop it only in recent years, after steel, textile, oil, and other industries had created the economic and technical foundation for it.

A well-organized and highly developed industrial consumer market thus appears as a definite prerequisite for successful chemical production, and disregard for this economic truth is bound to bring trouble. In this fact we have the reason why most countries at least for some time must go through a period of importation of chemicals, followed by another period of small-scale production, until the market is ripe to absorb industrial production.

6. *Money.* Money and capital, essential requirements for any kind of industrial enterprise, are rather difficult to obtain for first chemical ventures—a statement which most inventors who ever tried to get funds are able to confirm. Financing of new chemical enterprises through private individuals or groups (partnerships) was part of the early tradition and still is often necessary in this country despite the fact that nowadays many chemical corporations are financed on borrowed capital.

As no new chemical process is undertaken on a large scale from the start, the funds required for a pilot-plant range anywhere from $5,000 to $250,000, which are amounts not handled by the large banks. The borrower, therefore, has to interest small banking houses in his new project, and as they have little knowledge of it they are, of course, hesitant about advancing funds.

Well-tested and proved chemical lines, however, have little trouble in obtaining funds for further expansion, either through the big banks or issues of stocks or bonds. One almost is led to believe that greater carefulness in large-scale financing of chemical operations would be advisable in many cases and that less restraint might be exercised in helping smaller companies.

THE AMERICAN NATIONAL VIEWPOINT ON THE ESSENTIAL CONDITIONS GOVERNING THE DEVELOPMENT OF THE INDUSTRY

As the American chemical industries have no permanent common representation, the question of which factors from a national point of view they would consider the most essential ones either to be developed or to be guarded against has been answered by many outstanding persons in different ways. To the statements of Francis P. Garvin, Pierre du Pont, and other leaders could be added those of a hundred

others, and yet they would represent only individual opinions and not the basic needs or national policy of the industry.

As that nearest to expressing American policy, however, we have the resolutions adopted at the second annual meeting of the Chemical Alliance, Inc., in New York on January 23, 1919. The meeting resolved "that irrespective of what course may seem best when the war emergency has ceased, the Chemical Alliance, Inc., should and will be continued until further action by its members."

The Board of Directors then defined the main reasons for the continuance of the organization:

"1. England, France, Germany, and many other powerful nations have such organizations representing the various industries as a whole and known as their boards of trade, etc., which are recognized by the Government and act in almost a quasi-governmental way whenever there are questions up for consideration by the Government affecting those industries. The United States certainly must be equipped with the same type of organizations having the facilities to deal with similar subjects as related to this country."

2. Cooperation with Government Departments was considered as necessary and part of the future plans.

"3. An organization such as this will undoubtedly prove to be a very valuable medium in furnishing to the members information, with reference to patents, both foreign and domestic and, as a body, to confer with the Patent Office as to the best methods for handling foreign and enemy alien patents both now and in the future."

"4. If Congress itself is desirous of obtaining complete information bearing on the chemical industry, such an organization as this would be the best possible instrumentality to furnish the facts from an unbiased standpoint."

5. Systematic organization of contacts with other industries was considered as desirable in order to arrive at certain technical standards, methods of accounting, and relationships in general best suited for all participants.

6. The compilation of statistics on domestic and foreign chemical developments and the gathering of information on foreign trade were contemplated.

7. The last point of the program stressed the need for an organization through which the interests of all could be furthered on the basis of confidence created through continual contacts.[1]

The Alliance did not state any detail policies which it would recommend for general observation.

[1] Chemical Alliance, *Historical Review*, pp. 66 ff.

THE BRITISH NATIONAL VIEWPOINT ON THE ESSENTIAL CONDITIONS GOVERNING THE DEVELOPMENT OF THE INDUSTRY

A British opinion on policies which were considered as most useful for the development of a strong chemical industry was expressed by Sir Arthur Balfour in a memorandum submitted to the Economic Conference held in Geneva in 1927. The author, writing on behalf of the Association of British Chemical Manufacturers, in his memorandum: [1]

(*a*) Stressed the importance of synthetic production of chemicals.
(*b*) Complained about taxes on spirits for technical purposes.
(*c*) Objected for the time being against international price agreements on synthetic nitrogen in order to possibly increase demand and thereby production.
(*d*) Advocated research, but with discrimination.
(*e*) Desired national independence.
(*f*) Recommended especially the training of young chemical engineers.

In this national program are incorporated several very important points, and the British chemical manufacturers have pretty well adhered to it during the last ten years.

THE GERMAN NATIONAL VIEWPOINT ON THE ESSENTIAL CONDITIONS GOVERNING THE DEVELOPMENT OF THE INDUSTRY

The monograph prepared by Dr. C. Ungewitter, Secretary-General of the Chemical Group of the Reichs Association of the German Industry, contained less of a national program but made the following interesting statements:

(*a*) Like other branches of industry, chemical production can develop only in proportion to the demand which exists or can be created for its product.
(*b*) It is a sign of progress that the scientific orientation of chemical technique is coming more and more to pervade the whole domain of chemical production. . . . The future development of the chemical industry largely depends on how far it proves possible to maintain and develop this scientific character of chemical technique.

[1] League of Nations, Economic Conference 1927, Documentation, The Chemical Industry, Geneva, 1927. Same source contains the full text of the German and French memoranda referred to in the following.

(*c*) The promotion of scientific research and scientific teaching is an important duty of the public authorities. . . .

(*d*) The capital expenditure required by activity of this kind (research, technical development of product, introduction, testing, etc.), can be met only if the producers in question can reckon on a corresponding return in case of success.

(*e*) The characteristic feature of chemical production is, therefore, that it is gradually making the human economic system independent of the natural distribution of the supply of raw materials.

Actually the German chemical industries, greatly handicapped by many adverse factors, have mainly aimed at savings through production economies and improved scientific methods.

THE FRENCH NATIONAL VIEWPOINT ON THE ESSENTIAL CONDITIONS GOVERNING THE DEVELOPMENT OF THE INDUSTRY

Monsieur M. Duchemin, President of the Union des Industries Chimiques, tendered the French opinions and suggestions.

He stated and proposed:

Governments have observed that the industrial concentration brought about by the war and the ever more powerful processes placed at the disposal of the chemical industry lead to an increasingly rapid progress and the practical application of such progress.

Before the war, there was justification for a powerful chemical industry in a country which possessed in each of its territories the three elements of a healthy and rational economy, namely:

(*a*) An assured supply of raw materials under favorable conditions.

(*b*) Powerful financial, scientific and technical resources combined with a plentiful supply of labor.

(*c*) A home market large enough to justify production on an economic scale.

If disregarding frontiers, similar industries get in touch and conclude mutual agreements for the rationing of their products, in conformity with national and international requirements, taking into account the new situations which have arisen; if they succeed, first by national agreements and then by international agreements, in diminishing general expenses, improving output and eliminating second-rate factories or factories whose geographical situation is unsuitable; if they co-operate in organizing their sales; then they will obtain a diminution of cost prices and greater regularity in production to all and which would engender a mentality favorable to a long reign of peace.

In short, the first step is not to conclude inter-state agreements but

agreements between the industries themselves which would render the subsequent conclusion of inter-state agreements possible.

It therefore seems that the Economic Conference, whose task it should be to enlighten public opinion throughout the world regarding the present conditions of production and consumption, should draw the attention of States

1. To the dangers involved, at a time of latent overproduction, in the creation of new undertakings which would not be likely to meet new demands.
2. To the desirability of preventing the expected creation of such undertakings by enabling their nationals, by means of commercial treaties, to obtain on easy and advantageous terms the products of which they forego the manufacture.

The French manufacturers actually practiced what they proposed, concluding agreements not only among themselves but also with German producers and others in neighboring countries.

Not only do these samples of various national viewpoints demonstrate the difference of opinion that prevails on the essential economic requirements for chemical production; they also bring out those fundamental ones that should not be overlooked.

CHAPTER 6

CHOOSING THE CHEMICALS TO BE MADE

After consideration of the fundamental requirements of production, the selection of the products to be made should be the next step in economic planning. Naturally, when there is a demand for a certain chemical product, that product is worth making, and it is sometimes surprising how soon every such demand finds its suppliers.

GENERAL POLICIES

To find out what chemicals are in demand but are not yet offered in quantities exceeding this demand is the first step in the process of selection. *How* to obtain this information is something which cannot be put into a definite formula, however. In general it may be said that close contact with the consumer groups through systematic personal interviews furnishes the most valuable leads.

Obviously, those companies already established and operating with a staff of field men or sales engineers have a definite advantage over newcomers in finding out favorable market conditions or demands for new chemicals. Nevertheless, it is not uncommon that, as a result or greater determination, persistence, and practical alertness, a new company often meets with greater success in a new field than does an older one already comfortably established in other lines.

Usually, a thorough *product analysis* combined with a careful investigation of the possibilities of *marketing* the considered product will be as necessary as it is helpful in arriving at a decision whether or not to make a certain chemical in large-scale production.

In order to assist their readers in making such investigations the editors of *Chemical and Metallurgical Engineering* prepared two check lists,[1] which represent perhaps the most complete guides in new-product development. These check lists are reproduced, with the consent of the publishers, in Tables 5 and 6. The tables show the many

[1] *Chemical and Metallurgical Engineering*, Editorial Supplement to Vol. 43, No. 2, February, 1936.

questions that might be investigated when selecting or trying to find a new chemical for production. They also indicate the departments possibly involved and thus reveal how all-important the problem of product selection really is.

ECONOMIC CLASSIFICATION OF CHEMICALS

In view of the thoroughness displayed in these check lists it may seem almost contrary to scientific procedure to attempt an economic classification of chemicals which would be simple and yet would help, at least in a general way, to reveal the inherent economic potentialities of a chemical. Although very scientific attempts have been made to classify chemicals according to their technical properties, it appears that so far no systematic method of economic appraisal has been attempted. And yet it seems that such a procedure would have its merits, because it should help to determine definite product policies, not on the basis of technical considerations alone, but on economic principles as well.

Careful study of the product policies of leading chemical producers and of the results obtained has served to formulate the following groups and to predict at least tentatively the probable economic success of the products falling into each group.

CLASS I

CHEMICAL PRODUCTS FOR USE BY FINAL CONSUMERS

Such products would be, for instance: rayons, synthetic ethyl alcohol, perfumeries, patent medicines, plastics, etc.

They seem to have the best chance to succeed; their market is expandable according to the merits of the product and can be influenced considerably by advertising and similar forms of promotion. Price considerations are important but by no means as predominant as in the following groups. Distribution is not limited to strictly chemical outlets and can be developed without great difficulties. Therefore the enterprise favoring such products is bound to succeed with them provided that it is able to develop its distribution system properly and if possible on a national scale.

CLASS II

Chemical Products for Use by Non-Chemical Industries

Non-chemical industries include agriculture, forestry, mining, transportation, textiles, paper, oil-refining, tanning, etc.
Chemicals falling into this group would be dyes, fertilizers, soaps, solvents, bleaching agents, greases, etc.

Chemicals for non-chemical industrial consumers comprise the group with the second-best chance to succeed. Industrial buyers are more difficult to please than the general public. They know what they want and need, and quality means a good deal to them. They also are able to test and judge what they get. But they are definitely in need of chemicals and also willing to pay a good price for the product which they have learned to appreciate. This group contains the most steady consumers of chemicals, and that seems to be the reason why many of the larger chemical companies are concentrating their attention on products in this field.

Very keen competition is the main obstacle of success, but if quality is really a feature of the new product it may safely be considered for production.

CLASS III

Choosing Chemicals

Chemicals which are the starting-point for new chemicals or other products comprise the group which is considered third most likely to succeed.
Alcohols, glycols, aldehydes, phenols, and many other, mostly organic, compounds could be cited as examples.

The producer who decides to make intermediates foregoes the economic opportunities which lie in carrying production through to the final end, but he just as likely saves himself from too extensive technical diversification. His success rests in the concentrated demands created by the various final production processes. From these he is assured of a large enough market to make the sale of a good intermediate more profitable than the sale of various final products undertaken at high cost and with expensive capital investment.

CLASS IV

FINAL CHEMICALS OF REALLY NEW CHARACTER

Those who may wonder why such chemicals are not ranked as Class I will find that actually it is very rare that something of a fully new character is discovered which does not have an already established competitor in the form of some similar product.

Really new chemicals are very rarely immediately successful because they are not generally known, tested, and vouched for. Production has to be developed, consumers have to be found, convinced, and kept satisfied, and all this is so costly that the economic success quite often is preceded by many failures and losses. Although clearly involving greater economic risk at the outset and considerable loss of time, a new product, if it does become established, often brings a greater degree of success than an old one. Witness, for example, the records of plastics, Cellophane, tetraethyl lead, and certain photographic and rubber chemicals. These, however, are exceptions rather than the rule.

CLASS V

CHEMICALS ROUNDING OUT ESTABLISHED LINES

If a company chooses to complement its lines, either by grades or varieties for which there is a real need or by chemicals used in connection with its own products, a fair chance of success is assured.

This chance is improved if the selection is made after careful consultation with prospective users. On the other hand, however, the process of rounding out lines can easily be overdone. Too many varieties of the same product are undesirable because the additional cost of producing them cannot be shifted to the consumers.

DIVERSIFICATION OF PRODUCTS

The principle of product diversification, though different from the principles of product selection thus far discussed, also aims toward economic success through special planning and choice of products.

A glance at the product lists of chemical companies shows that most of them tend to produce not one or two special lines but a

variety of products, which quite often are not systematically integrated or produced from each other. Heavy chemicals can be found complemented by fine chemicals, tanning materials, pigments, and other non-related products, and recent observation shows an amplification of such trends.

It is usually taught that specialization is the mode of operation which produces the best operating results. Why then do chemical enterprises make product diversification an important point in their permanent production programs? This mode of operation necessitates larger investment, more equipment, and a greater staff, and it generally increases operating expenses and reduces profits. When many enterprises indulge in this practice an oversupply of certain products is created, thus putting the buyer in an advantageous position, reducing prices unduly, and finally creating a totally undesirable economic situation. Diversification has been recognized as a policy of overdone competition and has had to be remedied in other countries by cartelization, centralization, and restriction of production to actual demand.

In the United States, where cartel agreements are still impossible, diversification of production is and must be considered as a costly but at the same time as one of the most effective forms of self-insurance. In spite of its shortcomings it protects the enterprise against: (*a*) Unforeseen discoveries and their commercial application by competitors. If one or even more lines should become unprofitable for this reason, the others would carry the enterprise or at least help to keep it in operation. (*b*) Variations and changes in general business conditions. These changes do not affect all consumer groups alike or at the same time, and, therefore, diversification of the production program smoothes the economic risks to some extent. (*c*) Changes in raw-material supplies. When raw materials for one line are becoming scarce and consequently too expensive, the other lines help financially until these conditions have been overcome.

Therefore, diversification of products has come into great favor with progressive managements and, if applied with due regard for the limitations of the enterprise, it is undoubtedly a good policy to have in mind when planning the selection of products to be made.

BY-PRODUCTS

As there are few chemical processes which yield only one product, early consideration should be given to those products which commonly are called "by-products."

It rarely occurs that the manufacture of a main product is undertaken in order to obtain primarily one or all possible by-products, but in the coal-distilling industry we have definitely a case where the by-products have become more important than the original main product, coke.

Engineers have brought the production of by-products to such perfection that in most processes only small fractions of the raw materials need be wasted. Fumes, liquors, scraps, gases, sludges, and other substances created during the main process can now be turned into something useful—if this is worth doing. The question of whether some or all possible by-products should be produced should be considered on the same basis as the selection of main products.

As the prices at which the main and by-products can be sold are prime factors for consideration and the potentially available market depends on competition, cost and profit calculations should not be segregated for the various products and used as production criteria. Production of a by-product should be undertaken if the sale of all products combined promises sufficient revenue to cover the combined costs of production and provide a desirable profit. This method of determining the economic potentialities of products as a group appears more reliable and desirable than judging each one separately upon the basis of an individual cost record. To follow an often-heard suggestion that the main product should be charged with full costs for material appears to be a rather arbitrary and undesirable rule especially when the revenue from the by-products would be able to sustain a proper share of the production costs. The suggestion to investigate the combined possibilities of the products seems to be safer, offer more reliable information, and eliminate the labor and error probability connected with cost and income allocation.

SYNTHETIC PRODUCTS AND SUBSTITUTES

Synthetic chemicals have economic possibilities, greater perhaps than any other class, but success depends also on proper consideration of the peculiar economic characteristics of the group.

To begin with, clear distinction between synthetic products and substitutes is necessary. Synthetic chemicals are those built up from substances in which they are not naturally contained. Their chemical properties are exactly the same as those of the corresponding natural products. Acetic acid, for example, can be made from many kinds of trees and is recovered by distillation of the wood. Synthetic

acetic acid, exactly the same in all respects as that recovered from wood, is produced chemically from acetylene gas or from the propylene contained in cracking still gases. Economically, these two acetic acids compete with each other on even terms in an open market.

A substitute is a chemical which gives the same desired effect as some other chemical, and so can be substituted for it, but is not identical with it in chemical properties.

It has been claimed that synthetic chemical production was brought about by the World War, especially in Germany, which has become famous for its synthetic and "Ersatz" products. However, this is not correct. The war demonstrated the usefulness of synthetic processes but was not wholly responsible for them. The desire to substitute artificially made products for those either difficult to obtain or too high in price, or to make better chemical products than those available in natural form, was prevalent among chemists for many decades before the war. Those looking for reasons for synthetic production will find in the higher prices which the British Indigo Company charged for its products one of the earliest inducements for the production of a substitute for natural indigo blue. As inducements for making other synthetic products could be added the scarcity of cochineal, the high prices for madder, the poor dyeing qualities of European natural blues, the high monopoly prices for camphor instituted by the Japanese in 1899, the extremely high prices for silk, and a general shortage of fine leather, and other natural products like fertilizers, white phosphor, and quinine. Synthetic substitute production of all these was attempted long before the war.

Among all the synthetic chemicals those replacing natural products used by the public and industrial consumers were the most successful. Consider, for example:

Natural perfumes	and	the many synthetic perfumes made today.
Natural dyes	and	the innumerable synthetic dyes.
Natural rosins	and	their countless synthetic equivalents.
Natural leather	and	the many kinds of artificial leather.
Natural guano	and	the large quantities of synthetic nitrogenous fertilizers.
Natural silks	and	the vast rayon industries.
Natural alcohol	and	the tremendous demand for synthetic solvents.

Clearly, synthetic chemical production has tremendous possibilities if the synthetic product replaces a natural product. To the list just compiled could easily be added many other products (hydro-

genated oil products, polymer gasoline, synthetic wool, etc.). Nor would this represent the limit. High prices for industrial and edible fats and oil, for instance, some day will bring about their synthetic production. The first attempts in this direction have already been made in Germany and are well on their way in the United States. The fond dream of many housewives, however, that chemists will make the ideal food in the form of pills and tablets and that humanity will be fed synthetically to save the trouble of cooking and washing dishes, will remain what it is. The human body is so created that it needs certain kinds of foods and would degenerate if we should try to go very far in trying to better nature with the aid of synthetic chemistry.

Thus, there are limits to the economic possibilities of this apparently boundless field, and before deciding to produce a synthetic chemical or substitute it will be of advantage to consider the following points:

1. The synthetic product should have all the characteristic or required features of the natural article; the substitute, at least most of them.

2. The use of either should offer special advantages or simplifications in processing.

3. The cost of producing a synthetic or substitute product should be lower per unit. It should not exceed 70 or 75 per cent of the cost of the natural product if the use of the new product is to be permanently attractive. This does not mean that synthetic products must be sold at a correspondingly lower price to start with, but observation shows that considerable price concession is required for permanent success.

4. The synthetic product should never be offered as the natural product or in connection or combination with it. The quality and property specifications of the new product should be made known and maintained.

5. Most synthetic processes mean big volume production and therefore are costly. Small-scale production is usually not profitable and cannot withstand the defensive measures of the original producers, even if there are occasional exceptions.

6. Provided that all these requirements are fulfilled, the selling of synthetic products or substitutes is not particularly difficult, but it must be planned to acquire a good portion of the present market and new markets besides.

7. It has been stated by Dr. Whitby, Fellow of the Canadian Institute of Chemists (*Chemical Markets*, June 30, 1930), that synthetic production causes, or at least leads, to mergers or cartels. There can be no doubt that the sudden appearance of a strongly financed synthetic producer upsets the established enterprises and may bring them closer together. It also is true that rarely can synthetic processes be carried out without obtaining auxiliary patent privileges from other, usually equally strong, producers. But, on the other hand, the owner of a genuinely new synthetic process need not combine with anyone. The synthetic-ammonia producers did not merge, nor did the big synthetic-dye producers buy each other out, although they are all large holding companies and have already bought a large number of minor companies.

WASTE PRODUCTS

Waste is an unavoidable by-product of chemical processing, and its disposal or utilization offers many technical and economic difficulties in which not only the producer is involved but also local, state, and even federal authorities if the disposal endangers human or animal life.

Great technical progress has been made in the utilization of gases which in previous decades simply were vented to the atmosphere. Out of the flue gases of cement ovens, potash is now being recovered; petroleum cracking gases are now converted into isopropyl alcohol, acetic acid, solvents, and other products; solid residues are carefully investigated for their potential suitability as tiles, bricks, fillers, or composites for other products. To find some possible use for waste, to make it suited for disposal, and finally to eliminate that which is utterly useless are mainly engineering projects but have great bearing upon economic planning and product selection.

The economic aspects of waste utilization have received especially careful attention wherever waste products of one enterprise could be used by another, and every so often, waste-exchange plans are offered to the industry based on the principle of cooperation. As waste disposal may cost considerable money, these plans suggest that wastes should be exchanged among plants and without charge if possible, transportation costs to be paid by the taker. Thereby waste products would become useful and savings would result for both parties. In addition, the sponsors of such exchange plans always stress the great national savings which would result from a wide application of their systems.

In theory, and especially as seen from the consumer's angle, these exchange plans often sound quite attractive and some have even been tried. In actuality, however, the waste-exchange idea has not stood up well. The company which is supposed to give something away free of charge or at an especially low price because it has no use for it—at present—is bound to watch the takers. As soon as they begin to get some extra profits from the gift, the giver asks a price for sending over the waste and then those who have made their calculations on the basis that they would always get the waste free, or at low costs, are bound to find themselves in trouble. Unless a contract can be made to cover the exchange transaction so that no surprises can be injected for years to come, the exchange plans are not as good as they may seem.

The tendency, therefore, should be to make of waste what can be made *within* one's enterprise, or sell it straight for what it brings in the market. This should not mean that waste sales agreements should be avoided if suitable contracts can be made. But they should be definite business contracts, not plans based on theoretical assumptions. The losses due to waste are great, but so far waste-exchange plans have not solved this problem, and they never will unless they are accompanied by some form of definite coordination of the business interests of all enterprises affected.

CONCLUSIONS

All these remarks on selecting the chemicals to be made clearly demonstrate the complexity of the problem. The intent of making a chemical not only involves technical and engineering problems, but it also requires many careful economic considerations if the undertaking is to be successful.

Appraising the potentialities of a chemical product does not as yet furnish definite and measurable information, but at least it helps in forming a substantiated opinion, which in turn is absolutely needed when it comes to forecasting the potential demand for the product and expressing it in definite figures. No "sales estimate" can be or should be made without a thorough basic economic reasoning on the product, to back it up.

CHAPTER 7

FORECASTING CHEMICAL DEMAND

Industrial production of chemicals would be sheer folly without at least tentative answers, before production is begun, to the questions: *How much* shall we *make*? *How much* can we *sell*? *Who* will take our products? And *when*?

The salesman, the dealer, the district manager, the regional manager, the vice-president in charge of sales, the man who buys, the man who makes, the man who keeps the books, the president in charge—all must have some definite concept of the results before they can carry out their respective jobs.

And so it is that the forecasting of demand and sales becomes the most important step in planning chemical production.

THE VARIOUS KINDS OF FORECASTING

Appraising future business and expressing the appraisal in definite figures is forecasting. A forecast for a given company should always include a prediction of the total demand for the products made, existing within the whole industrial body, and that portion of it which may be expected to be filled by the company in the form of sales. A short-term forecast is of use only if it turns out to be accurate within approximately plus or minus 5 per cent. A lesser degree of accuracy is undesirable, because upon the forecast have to be based the sales program, production schedule, advertising campaigns, the entire operating budget including equipment appropriations, raw-material purchasing, major financial transactions, and many other items of minor importance. A short-term forecast usually covers a period of four, six, or twelve months. A long-term forecast may be attempted for five or ten years ahead, but for obvious reasons a much lesser degree of accuracy should be expected. Most important of all is the "forecast for next year," which is usually made in October or November.

Forecasting is not, and never will be, an exact science like mathematics and physics. Each individual who practices it uses his own

style. Hence quite a variety of forecasting methods are in vogue, most of which fall under one of the following four general headings:

(*a*) Guessing.
(*b*) Chart forecasting.
(*c*) Speculative forecasting.
(*d*) Systematic forecasting.

(*a*) *Guessing.* Little need to be said about the usefulness and desirability of a forecast which is mainly based on hopes and expectations, has been prepared with only a quick reference to past sales records and a few discussions, and is mainly supported by the experience and special familiarity of the forecaster with conditions determining the demand and sales for the chemicals to be forecast. Though one may not approve of the method, those really familiar with their customers often enough make surprisingly accurate forecasts in this manner.

(*b*) *Chart Forecasting.* Our experience of 1929 pretty well established the fact that economic charts or graphic presentations on sales do not give a reliable clue to the business future. Nevertheless the chartists are still with us. They are more thorough than the guessers and "plot" the various facts which they think hold the key to the future. They study the "past behavior of the curve" and then draw a pattern that either repeats the past or merely continues the general trend.

There is no doubt that charts can play a very important part in revealing facts, causes, and effects, and that they can be used with great advantage as auxiliary means for obtaining information on the interrelationship of economic and business factors. But when it comes to forecasting, the last known point on the curve is still the last *known* point. From there the curve will go up or down not according to principles of engineering or geometry but according to economic, social, and political influences.

(*c*) *Speculative Forecasting.* In 1885, when oil refiners still had trouble in removing sulphur from crude oil, skunk oil found no takers because of its high sulphur content and terrible odor. Predicting that "some day some American genius will refine the sulphur out of it . . ." E. T. Bedford bought all the skunk oil he could get, until he had $24,000,000 worth of it. He had no reason to justify his doings other than the firm conviction that it could be done. Actually, Herman Frasch discovered the necessary process and both he and Bedford reaped fortunes.

Speculation upon technical as well as economic developments is not altogether desirable but sometimes almost unavoidable—and quite often richly rewarded, not in the well-established standard chemical lines but in the special-product groups. Speculative forecasting usually must be resorted to when business conditions are too uncertain or so upset by interference that the normal economic probabilities cannot be forecast.

Speculation can perhaps be defined as a process of thinking on the basis of some but not all facts. A forecaster can *consider* in his appraisal, for instance, the future occurrence of strikes, inflation, devaluation, adverse or favorable legislation upon all or part of his business, but he rarely will be able to *state definitely* and reliably why he does it and what effect these occurrences will have. Any estimate must of necessity contain a certain amount of speculation. But by applying to it the best available knowledge of practical economics and business practice such speculation can be turned into that valuable kind of reasoning which anticipates future events at least closely enough so that its findings can be used for definite planning.

(*d*) *Systematic Forecasting.* The word "systematic" has been chosen deliberately and in preference to the often-abused word "scientific." A forecast which by necessity of circumstances must rest upon the deliberate and at the same time considerate blending of speculation, wishfulness, and facts cannot be called scientific.

The main thing is that the forecast be as accurate as possible, and that will more likely be achieved if the forecaster follows a systematic pattern of practical procedure rather than any scientific theory or logarithmic formula.

In principle, systematic forecasting is forecasting on the basis of as many accurate facts as can be mustered. To get the necessary facts takes time and preparation, but once a good record system has been started it gains in value year after year. Which are the essential facts that should be used and collected depends on the business to be forecast, but it is certain that a mere multitude of data and charts is more likely to be a handicap than an advantage. The facts that are to be considered must be essential and have a bearing upon the business at hand. Far-fetched correlations, geometric means, and adjusted curves are not necessary. But definite knowledge must be available about the *causes and reasons* which have made the figures in the records what they are, and the more information of this kind a forecaster has at his disposal and uses, the better he will be.

In order to demonstrate a pattern of procedure which might be

followed, the various phases of systematic forecasting are presented in detail.

FIRST STEP: KNOWING THE BUSINESS CHARACTERISTICS

The first knowledge which a forecaster needs is definite information on the characteristic *economic behavior* of his industry, on the activities of his company, and on the consumers of the products.

The chemical industries react *quickly, but not abruptly,* to all and any changes of business conditions. They do not overact. They have adjusted themselves almost perfectly to business conditions in the past and will show the same tendencies to increase or decline as the respective consumer industries and industrial conditions increase or decline as a whole. Thus if one knows that building and construction work is going at an excellent rate and will be good for eighteen months to come because that many contracts have been signed, then the tar, paint and varnish, rosin, and pigment makers should be doing well, and later on their business should be in line with building contracts.

Careful study of *statistical data pertaining to the industry and to the company in particular* furnishes a good deal of the basic information needed for real forecasting. In the interpretation and analysis of these data strictest neutrality of thought and careful scrutiny of facts and circumstances are most essential.

The ascertaining of the characteristic *features in the demands of the consumer groups* is usually much more difficult. Considerable patience and careful research are usually required before only the previous economic and technical characteristics of the demands of all actual or potential consumer groups are ascertained for all products to be forecast and before the information is expressed in fairly reliable figures which are scrutinized and checked sufficiently often to be used in the actual forecasting process.

Prices change in the chemical industries as well as in others, but, as a good portion of chemical sales and purchases of raw materials are made on contracts, price surprises are pretty well avoided. Price changes that may occur can be forecasted fairly reliably on the basis of future delivery prices for raw materials, for which quotations can be asked before the sales forecast is made. Also, price changes which may be caused by new processes are not really impossible to forecast because any application of a new process is made known and then it is possible to calculate at least approximately how much it may affect the price. Deliberate unsettlements of the established price

structure have become rare, and often even such events can be anticipated. Thus prices do not offer great difficulties in forecasting.

To foresee and forecast the *special developments and changes which should be expected* to occur during the forecast period is definitely difficult but can be achieved, at least with reservations, by scrutinizing most carefully and in detail every fact that is known and any sign of future developments. The latest information on business conditions, industrial and agricultural developments, employment trends, price changes, and many other details may have to be investigated over and over again: "straws" and "indications" may have to be interpreted; a bill submitted to Congress may have to be appraised for its possibilities of passing; public statements of government and business authorities may have to be studied most carefully; federal, state, and municipal legislative activities may have to be scanned for adverse or favorable future developments; union activities and wage changes may have to be anticipated, and the favorable effect of many other events may have to be determined.

At first it may seem hopeless, but it can be done and must be done, if planning is desired.

It is a peculiar fact that data on chemical activities are valuable *business indexes* for general and special business conditions, but few, if any, of the common business barometers are suited to help in forecasting chemical business. Stock prices, bond prices, savings deposits, carloadings, consumption of electricity, retail prices, chain-store sales, are all quite useful for diagnosing economic conditions in general, but they have no indicative relationship to chemical events.

In order to fill the need for barometric information, trade magazines offer *current data on industrial consumption* (cotton, silk, explosives, paint, varnish and lacquer) and *production* (denatured alcohol, automobiles, ammonia, benzol, by-product coke, cellulose acetate plastics, nitrocellulose plastics, glass containers, plate glass, methanol, rosin, turpentine, and steel barrels). But even if a forecaster keeps in close touch with these and other statistics he still will have to be constantly on the lookout for those peculiar signs and indications which foretell a change for the better or worse *before* that change really happens. The more economic knowledge and experience the forecaster has, the better he will be able to spot these important signs and draw his conclusions for the future.

As no one can expect a forecaster to be more than human, it is common practice to make up forecasts for business purposes on the

basis of "conditions presently known" and to consider changes as soon as definite knowledge on impending events becomes available.

SECOND STEP: GETTING THE ESSENTIAL FACTS

Often one sees records made only in *quantity units* (pounds, tons, gallons) and just as often others made only in *dollar values*. Many enterprises have no fixed rule on this.

Production men are usually satisfied with quantity records; the accounting department needs mainly values; but the company forecaster who has to serve all departments needs three facts—*quantity, price per unit,* and *dollar value*—for each and every item which he expects to forecast. Nor can he do a reliable job if he leaves out of his forecast any one of the following essentials:

1. Total value of production (sales) of all manufactures in the United States.
2. Total value of production (sales) obtained by the particular chemical branch to which the company belongs. Only those product groups should be included in which the company is interested.
3. Breakdown of this total value of production (sales) of the particular chemical branch by product groups; this breakdown is reported in the Census of Manufactures for quite a few industries.
4. Total value of production (sales) of the company.
5. Breakdown of total by product groups.
6. Total stocks-on-hand of the company, branches, and dealers, also broken down by product groups.

All data should be available in annual figures for as many years as possible. Company data on production and sales should be available also by months. For a complete budget considerably more figures are needed, but for a forecast these data will suffice.

THIRD STEP: CHOOSING THE SOURCES OF INFORMATION

The best sources of information on chemical data are:

(*a*) The *Biennial Census of Manufactures* (U. S. Bureau of the Census), which reports on all chemical industries and on many chemical products in quantities and values so that the forecaster can easily calculate the third element, viz., average value per unit for the industry as a whole.

(*b*) The *Monthly Surveys of Current Business* (U. S. Department of Commerce) which contain current statistics on so many chemicals and allied products that recent trends can be ascertained on a monthly

basis for many kinds of chemicals. These figures can be used to bring the census figures up to date.

(*c*) The *Weekly Supplements* to *Survey of Current Business* and the summary supplements issued in 1932 and 1936 which contain complete monthly statistics since 1923.

(*d*) Trade magazines, which publish prices of chemicals and frequently contain statistical material obtained from various trade associations and other sources. These sources also report legislative action pertaining to the industry.

(*e*) Trade association reports of chemical and consuming industries, if available.

(*f*) Quite a few Wall Street information services contain occasional analyses of certain chemical or consumer industries. (Standard Statistics Trade Information Service, etc.).

(*g*) For special purposes the Minerals Yearbook and other publications of the U. S. Bureau of Mines, the reports of the U. S. Tariff Commission, and those of most other government agencies furnish valuable statistical and other data.

From these sources and properly compiled internal records anyone should be able to obtain sufficient statistical material and other information to make systematic forecasting possible. It should be done monthly for three or four months in advance in order to plan current production details, and at least once a year, in October or November, for the entire year to come.

FOURTH STEP: PUTTING DOWN THE PAST RECORD

Some managements have elaborate monthly reports prepared, and meetings are conducted in which the current events are presented and future plans discussed. Others have to go to the bookkeeping department for every bit of statistical information about their business. However well these procedures may be suited for local use, forecasting can be done only if the data are arranged in a suitable manner. The layout may be changed, but the facts should be there.

A recommended arrangement of data is offered in the following record of a pigment company. To simplify matters, data for some years have been omitted.

The purpose of compiling the record in this form is to bring to light those relationships which exist: (1) between the total industrial production of the United States and that part of the chemical industry in which the enterprise participates; and (2) between that part of the

chemical industry and the various product groups of the enterprise itself.

The trick in systematic forecasting lies in determining those relationships for a number of years, expressing them in definite percentages, which indicate trends, and using these trends for further planning. If the sheet is laid out as indicated, all percentage figures can be easily calculated and presented in a clear and easily comprehended manner. Also the average unit prices can be easily determined and the whole price history be shown in definite and clean-cut figures. The writing of long reports becomes superfluous. The whole presentation is a complete and at the same time definite figure-picture which shows each element in its economic environment and the relationships of each to the group as a whole.

Those accustomed to forecasting without setting the forecast elements in any relationships to others should consider that by omitting this they are not able to tell where they really stand, whether they progress with the industry and total economic conditions in general, or in reality stay behind the trend. A company may double its output and still lose ground to its competitors if they find it possible to treble their production and sales. For example:

	1936	1937	
Company: Value of products	$ 50,000	$100,000	100% increase,
Industry: Value of products	$200,000	$600,000	but note the
Ratio, company to industry	25%	17%	decline in ratio!

The forecaster who attempted to guide his company only on its own sales records or production figures without continuously measuring its position would be a poor navigator and certainly would not be telling a complete story. The same applies to the salesman who did not take the trouble to know in definite figures what his competitors were doing, or to the production manager who did not think beyond his own shop. In modern economic life every activity is related to some other, and to determine those activities which are of importance, and to measure the company's own activities against them, are requirements of survival and success.

FIFTH STEP: ANALYZING THE PAST RECORD

The analysis of the record presented above furnishes some interesting findings and conclusions and is offered mainly to demonstrate how the sheet was constructed and what it tells.

1. The total values of the United States production and of the considered white pigments produced and sold by all pigment makers (industry) have been taken from the Biennial Census reports. The ratios (percentages) show pigment sales in fairly steady relation to the total value of the United States industrial production. The changes were never spectacular, and continuation of this trend can be assumed with a fair degree of certainty.

Therefore, the forecaster who assumed for 1937 a slightly higher percentage than was obtained in 1935 and applied it to the total value of the United States production, which he also assumed better than that reported in the Census for 1935, would thus determine at least tentatively what the pigment group might amount to in 1937. This first approach should be considered merely as a first estimate, not as a final choice.

Difficulty in this procedure will be encountered only in estimating the total value of the United States production in advance. But taking into account that previous years, for instance 1929, can well be used as a basis for measuring present and future conditions, and that the latest available statistics (November, 1936) reported current conditions at about 85 per cent of 1929, the forecaster might readily assume a percentage for 1937. In this case 90 per cent was chosen because improvement was assumed. The total value of the United States production for 1937 was calculated as follows: $70,435,000,000 (1929) × 90 per cent = $63,000,000,000. The total value of the considered pigments produced was estimated at slightly more than 0.10 per cent of $63,000,000,000 or $65,318,500. From that figure company sales were determined.

Many forecasters follow a reverse procedure in the preparation of their forecasts. They begin with a study of details and attempt to build up a forecast from them, but then, tired from all the work that this method involves, they stop there without ever trying to tie the company forecast into its environment. As a cross check, independently undertaken by the sales department, for instance, the "detail forecast" is highly desirable, but it should not be taken as a satisfactory substitute for the complete story needed for successful management. The management forecaster or company economist should begin his job by "building the economic frame" first, in other words by appraising and establishing the general background. He can then better judge the economic possibilities for the company.

Practical experience demonstrates that it is easier and more likely to be correct to sketch the main features of a forecast first, instead

of spending weeks in working out hundreds of detail forecasts, which probably will not furnish a reliable or desirable total for the company when they are finally summarized. Detail thinking is more likely to lead one astray than concentration upon the big features, for which useful information usually is more readily available.

2. The pigment groups in which the company is interested are white leads dry, lead oxides, zinc oxides, and dry lithopones. In order to visualize the economic behavior of each product within the scope of activities followed by the company, the various group values have been expressed as percentages of their total value. The percentages show white lead in almost every reported year at about 15 per cent of the total; lead oxide losing ground; zinc oxide leading steadily at slightly more than 33 per cent; lithopone varying, with probable improvement in its 1937 position if previous data are of any significance.

In these percentage findings the forecaster has not only a record, but also definite leads for the future, which he can temper with his own knowledge of probable technical developments. He may receive reports that consumers are turning more to lithopone, or he may have reason to expect a further decline in lead oxides. If a forecast is to be made for any other chemical products, oils, acids, etc., the details will be different but the principles of procedure and reasoning will be very much the same. For the sample forecast it was assumed that some but no considerable changes in 1937 conditions would occur in the relationships of the products to one another.

3. Company sales, shown in pounds and dollars, are also expressed as percentages of industry sales. The slight differences between volume per cent and value per cent are due to the difference between company line average price and the average price for the industry.

As soon as all the percentages are calculated the real inside story begins to show: The company has lost position in most of its lines, except lithopones, and does not appear any too strong in recent years. For the forecast year definite improvements may be assumed if careful consideration warrants.

4. Prices, calculated by dividing sales values by the corresponding numbers of pounds, seem to be the undoing of the company. More often than desirable its prices were higher than those of competitors, and the sales ratios show the effects. Again the management will have to decide whether it wants to continue selling at higher prices or "buy volume by lower prices." For the forecast year the latter policy might be assumed.

SIXTH STEP: COMPLETION OF THE FORECAST

Like in many other undertakings, the completion of a forecast is not really difficult if the ground work has been carefully done. In big concerns where hundreds of chemicals are being made, subgroup forecasts established on the same principles may have to be worked out by or for the various divisions and consolidated only after careful consideration and reconsideration by various members of the company. But in all cases the outcome of the forecast should be shown in the form of ratios for individual products and in total, and, if not satisfactory, the forecast must be reworked on the basis of revised policies or plans.

If circumstances warrant and sufficiently accurate consumption figures are available *special forecasts* may be made *by consumer groups,* but rarely are the premises fulfilled. Until industrial statistics will supply *demand data* regularly, forecasts by consumer groups can be made only on a very tentative basis and will be more of the nature of cross checks than real forecasts.

Also good for cross checking but rarely for planning are *district and regional forecasts,* made up by the sales department and its district offices. Forecasts originating from the sales department may sometimes be very reliable, but as a rule sales staffs tend to be very conservative when it comes to making forecasts because they consider them as commitments or promises, and therefore make them as low as possible. This is a poor policy, but a common one.

No forecast should be considered as final until its desirability has been tested at least roughly from a *financial angle.* A thorough investigation of all financial aspects is usually made in connection with the budget. But as it takes time to make up a complete budget, and the budget must be based on a sales forecast, it is desirable to determine in advance whether or not the forecast will be desirable from a financial angle.

In good years, when a satisfactory sales volume can be anticipated and no special financial plans are involved, financial cross checking may be only a routine matter. In years of economic uncertainty, however, or when special plans increase financial requirements, the sales forecast must be sufficiently high to furnish net income for reserves, regular dividends and interest, taxes, surplus, *and* the additional burden.

The study undertaken to determine this can be made a very elaborate affair, but in many instances it will be sufficient to determine all

financial requirements and to apply the usual net income percentage to net sales. If the net income expectable at the regular rate is large enough to meet the financial plans, the forecast may be considered final. If net income falls short of requirements, lengthy meetings may be necessary to find the best way of bringing all plans in line with the forecast or to modify the forecast and subsequent actions according to new plans. Until the sales forecast has been brought in line and agreed to by all, the budget should be held in abeyance in order to save time and useless work.

FORECASTING THE DEMAND FOR NEW PRODUCTS

"How can I forecast the demand for an entirely new product?" This is a problem which every forecaster or industrial economist has to face, and often it is an embarrassing one. Although at all times managements have made attempts to find out the sales and financial possibilities of their new lines, often enough new products have been made, and selling has been attempted on mere "initiative and business acumen." If the launching was successful the new line was developed further; if the product failed sometimes serious losses had to be taken.

Nowadays, chemical managements do not care to have too many such failures because they do not help the reputation of the enterprise or its profits, and therefore they are just as anxious to make correct business forecasts for their new products as they are to estimate the future business of their well-established lines. If a product appears technically good but uncertain as to its economic possibilities, it usually is relegated for a few years to laboratory production and tentative selling. This period of probation furnishes some clues, and it delays for a while the necessity of making a definite decision on large-scale production. But some day the new product has to be forecast for commercial purposes and then the problem is up again: How much can we sell of that new shade of brown? Who knows what next year's favorite color will be? How much of the new toilet water can we sell in competition with all the one thousand and one different lotions already crowding the market? Will it pay to buy the new equipment to make the new intermediate? How much can we sell? To whom? And when? These are the well-known questions applied now to unknown products as well as to standard lines.

There are, however, ways and means of determining the business future of new products, and here is a suggested procedure of investigation:

1. It should be determined whether products similar to the new one are already on the market. They need not necessarily be the same in appearance, but may be used for the same purpose, as the new product.

2. If there are one or more such products, as many details as possible should be obtained on qualifications, consumers, volume of sales, methods of distribution.

3. Definite prices should be ascertained for each product: (*a*) list prices to consumers; (*b*) net prices to retailers; (*c*) wholesale prices f.o.b. factory.

4. The definite cost per unit of the new product should be calculated at one-fourth, one-third, one-half, and the same volume of sales of the most similar products already established.

5. These various costs per unit should be compared with the competitive net prices which will reveal whether it can be sold at the prices asked for the established products.

6. A thorough technical comparison of all competitive products with the new one should be made in order to appraise its true comparative value.

7. A tentative price should be chosen at which the new product might possibly be sold in competition with all the advantages of the competing products.

8. A special study should be made in order to determine whether the demand for the competitive products extends over entire consumer industries or is limited to only some enterprises, and whether the new product would be suited for those who do not buy the competitive products.

9. In this as yet uncovered demand one has the first known potential market to which can be added a very small portion of the users now buying competitive products and any other new fields of application which may be discovered as time goes on.

10. Never should the "total potential market" be used as representative of the possible future business. Only that percentage of the "total potential" business should be hoped for at this stage as the company has been getting so far within its established group.

11. Too many inquiries for opinions should be avoided. The more one asks, the greater variety of answers he gets, most of which are more confusing than helpful. The best method is to get reliable figures and concrete facts.

FORECASTING SEASONAL VARIATIONS

After the annual forecast has been completed it has to be broken down by months in order to furnish the basis for the production program. When shall we sell? When should we make how much? Do we sell all our products at the same rate throughout the year? Are there definite peaks for which we have to get ready in time? Can we plan to use our equipment for making other chemicals when our main products have off seasons? These are questions which have to be answered in advance and, therefore, bring up the problem of forecasting the monthly variations.

It is true that in actuality one sequence of twelve months is not exactly the same as any other. Economic evolution does not repeat itself in exactly the same manner, and there are differences in the monthly progress of business in various industries.

Thus forecasting monthly developments for an entire year may appear absurd, and yet it can be done if one considers the undeniable fact that industrial activities proceed year after year not in exactly the same but in very similar *characteristic patterns*. Some industries have to operate with "peaks and valleys" recurring fairly steadily in the same months every year; others actually proceed at a fairly even rate throughout the year.

Only very few chemical industries have characteristic patterns of their own. Most of them operate as consumer demand varies. They adjust their monthly activities to the operating patterns of their consumers, and thus their variations are *reflex patterns* rather than *typical* of chemical operation.

Thanks to the intensive efforts of the Department of Commerce and many trade associations, the monthly operating patterns of most industries and consumer groups are known by now, and if, besides, the monthly sales figures of the company are considered, it is not really difficult to forecast with a fair degree of accuracy the monthly changes in the demand for chemicals. Valuable basic information on actual monthly variations in chemical and consumer industries are contained in the *Annual* and *Weekly Supplements* to the *Survey of Current Business* (1932 and 1936, and then weekly) which report monthly data on production and/or sales since 1923. All the forecaster has to do is study the annual series generally and select a few years in particular which he considers in economic character with what he visions the forecast year to be: a year of boom or near boom, decline or depression

or steady progress. The years 1928 or 1929, 1932, and 1935 have been considered representative of these types. In the following tables the monthly variations in business are shown for some chemical and consumer industries.

TABLE 7

SULPHURIC ACID CONSUMED IN FERTILIZER PRODUCTION

Month	1929		1932		1935	
	Short Tons	%	Short Tons	%	Short Tons	%
Jan.....	241,047	9.86	95,681	12.42	162,658	12.11
Feb.....	198,787	8.13	79,975	10.38	133,319	9.92
Mar.....	200,641	8 20	67,061	8.70	104,041	7.75
Apr.....	197,609	8.08	52,516	6 82	93,873	6.99
May.....	185,418	7 58	30,266	3 93	87,944	6.55
June.....	195,444	7.99	29,658	3.85	75,690	5.63
July.....	188,442	7.71	32,590	4.23	94,980	7.07
Aug.....	206,645	8.45	52,272	6.78	99,673	7.43
Sept.....	179,826	7.35	53,259	6.91	101,708	7.57
Oct.....	219,590	8 98	74,813	9.70	131,441	9.78
Nov.....	209,008	8.55	99,615	12.93	125,496	9 34
Dec	223,124	9 12	102,886	13.35	132,508	9.86
Total...	2,445,581	100 00	770,592	100.00	1,343,331	100.00

These series are offered first because sulphuric acid is considered to be one of the most important chemical products. Unfortunately no figures are available for the total monthly consumption of sulphuric acid in the United States, and the presented data show only those variations in consumption which are caused by fertilizer production. Even so, however, it should be interesting to see in the following table how closely monthly production is adjusted to monthly demand.

TABLE 8

SULPHURIC ACID PRODUCED BY FERTILIZER PRODUCERS

Month	1929		1932		1935	
	Short Tons	%	Short Tons	%	Short Tons	%
Jan	214,130	9 46	117,613	12.35	169,301	10 23
Feb	204,288	9 03	104,573	10 98	154,359	9 33
Mar	193,032	8 53	89,964	9 44	141,352	8 54
Apr	176,030	7 78	60,416	6 34	139,333	8 42
May	173,822	7 68	50,690	5 32	111,102	6 73
June	169,591	7 49	44,930	4 72	99,176	5 99
July	150,810	6 66	45,393	4 77	110,249	6 66
Aug	183,443	8 12	58,345	6 12	123,209	7 45
Sept	178,698	7 90	61,152	6 42	130,260	7 87
Oct	213,443	9 43	84,471	8 87	149,729	9 05
Nov	204,355	9 03	115,684	12 14	153,792	9 29
Dec	201,142	8 89	119,350	12 53	172,823	10 44
Total	2,262,784	100 00	952,581	100 00	1,654,685	100 00

The percentages indicating the monthly sulphuric acid production by fertilizer producers show clearly peak production during the winter months and fairly gradual reductions to about 50 per cent during the summer months. Even in 1929, when the demand for fertilizers was exceptionally good, we find this pattern not quite so pronounced as in more recent years but nevertheless in evidence.

The peculiar sulphuric acid cycle is not original, however. It is caused by the demand for fertilizers, shown in Table 9.

TABLE 9

FERTILIZER TAG SALES IN SOUTHERN STATES

Month	1929		1932		1935	
	Short Tons	%	Short Tons	%	Short Tons	%
Jan... ..	452,550	8.25	171,473	6.56	319,675	8.09
Feb.. ..	817,489	14.91	359,595	13 75	697,744	17.65
Mar.... .	2,118,689	38 64	639,386	24 46	1,412,922	35 74
Apr.....	1,292,330	23.57	865,217	33.09	704,348	17 82
May ...	219,763	4.00	155,643	5 95	236,665	5.99
June.... .	99,407	1 81	41,819	1 60	65,824	1.67
July.... .	18,759	0.34	14,245	0 54	16,722	0.42
Aug.....	46,930	0 86	37,653	1 44	43,975	1.11
Sept.....	174,397	3 18	88,600	3 39	94,653	2.39
Oct	101,295	1 85	96,080	3 68	151,020	3 82
Nov..	60,392	1.10	59,559	2 28	85,632	2.17
Dec..	81,637	1 49	85,150	3.26	123,807	3 13
Total..	5,483,638	100 00	2,614,420	100 00	3,952,987	100.00

Every ton of fertilizer sold has to be "tagged" with stamps bought from the government. The sale of these stamps is easily controlled and recorded and is almost identical with actual sales. The monthly cycle of fertilizer sales repeats itself with great similarity year after year, and there is little the fertilizer producers can do to smooth it. Of all fertilizer sales, 75 to 80 per cent are made in the first four months of the year. Any fertilizer made thereafter has only limited sales possibilities.

This explains why sulphuric acid is made by the fertilizer producers mainly during the winter months.

TABLE 10

DENATURED ALCOHOL SHIPMENTS TO BONDED DEALERS; TOTAL INDUSTRY

Month	1929		1932		1935	
	Thousands of Gallons	%	Thousands of Gallons	%	Thousands of Gallons	%
Jan.....	8,021	7.01	5,033	7.86	5,897	6 09
Feb.....	6,688	5.85	3,800	5.93	4,482	4.63
Mar.....	7,708	6.74	5,025	7.84	7,500	7.75
Apr.....	7,220	6.31	3,960	6.18	5,215	5.39
May.....	8,055	7.04	4,296	6.72	5,781	5.97
June.....	7,211	6.30	3,041	4 75	5,597	5 78
July.....	8,438	7.38	5,253	8.20	7,213	7.45
Aug.....	10,654	9 32	8,458	13 20	8,359	8 63
Sept.....	11,238	9 83	7,264	11 34	10,064	10.39
Oct.....	14,038	12.27	6,920	10.80	17,947	18.54
Nov.....	12,793	11 19	6,241	9 74	10,816	11.17
Dec.....	12,307	10 76	4,767	7 44	7,950	8.21
Total...	114,371	100.00	64,058	100.00	96,821	100 00

Denatured alcohol is used throughout the year by many industries and therefore one might expect much less variation in the cycle than actually takes place. The temporary declines in February, April, and June, and the steady improvement in demand from June until the peak is reached, probably in October, are characteristic. This peak in the latter part of the year is a result of the use of alcohol in anti-freezes.

*

TABLE 11

SYNTHETIC METHANOL—PRODUCTION BY ENTIRE INDUSTRY

Month	1930		1932		1935	
	Gallons	%	Gallons	%	Gallons	%
Jan	470,749	6 20	585,880	7.67	1,303,171	7.22
Feb	445,418	5 87	546,086	7.15	1,126,799	6.24
Mar.	629,575	8 30	514,119	6 73	1,303,230	7.22
Apr	534,876	7 05	501,759	6 57	1,167,282	6.47
May	583,486	7 69	742,826	9 73	1,203,143	6 67
June	561,646	7 40	712,537	9.33	1,198,186	6.64
July	412,214	5 43	793,639	10 43	1,278,505	7.08
Aug	434,886	5 73	792,641	10 38	1,389,812	7.70
Sept	545,350	7 19	697,890	9 14	1,539,554	8.54
Oct	966,469	12 73	571,372	7 48	2,508,978	13 90
Nov	1,087,268	14 33	531,635	6 96	2,373,475	13 15
Dec	917,290	12 08	643,598	8 43	1,654,794	9.17
Total	7,589,227	100 00	7,633,982	100 00	18,046,929	100 00

Synthetic methanol shows in absolute figures the tremendous forward movement which this industry has made, compared with denatured alcohol. But nevertheless the monthly cycle patterns of the two are almost identical.

TABLE 12

PAINTS, VARNISHES, LACQUERS, FILLERS—SALES BY ENTIRE INDUSTRY

Month	1929		1932		1935	
	Thousands of Dollars	%	Thousands of Dollars	%	Thousands of Dollars	%
Jan.....	30,844	7.09	15,889	7.83	20,836	6.23
Feb.....	30,864	7.09	16,263	8 01	21,229	6.35
Mar.....	39,779	9.14	19,080	9.40	26,544	7.94
Apr.....	43,069	9.90	22,602	11.14	32,851	9.83
May.....	46,225	10.65	24,973	12 32	36,160	10.82
June.....	41,393	9.51	19,625	9 67	32,326	9.67
July.....	38,032	8.74	14,376	7 08	28,975	8.67
Aug.....	42,095	9.67	15,975	7.87	28,502	8.53
Sept.....	36,514	8.39	16,751	8.25	28,536	8.54
Oct.....	35,916	8.25	15,537	7 66	32,853	9.83
Nov.....	28,166	6.47	12,424	6.12	25,427	7.60
Dec	22,205	5.10	9,426	4.65	20,039	5.99
Total..	435,102	100 00	202,921	100.00	334,278	100.00

The paint and varnish industry is often cited as a typical chemical industry. It is chemical in character, but its rather uniform monthly cycle pattern does not prove anything typical, except that Americans demonstrate an increasing urge to beautify and paint their environment from January until May, thereafter seeming to get more pleasure from enjoying the effects than from creating new ones. There are definite technical and common-sense reasons for such behavior, and only the steady industrial demand for paint products prevents the cycle from becoming more pronounced than it is.

TABLE 13

PRINTED COTTON CLOTH—PRODUCTION OF TOTAL INDUSTRY

Month	1929		1931		1935	
	1,000 yd.	%	1,000 yd.	%	1,000 yd.	%
Jan.....	82,259	9.12	68,380	8 39	120,180	10 34
Feb.....	78,307	8 68	76,847	9 43	117,757	10 13
Mar.....	92,544	10 25	87,318	10.72	122,524	10.54
Apr.....	88,635	9.82	86,612	10.63	104,576	9.00
May.....	85,894	9 52	67,704	8.31	100,245	8 62
June.....	72,808	8.07	57,412	7.05	70,368	6.05
July.....	60,902	6.75	56,153	6.89	61,830	5.32
Aug.....	69,315	7.68	65,983	8 10	77,898	6.70
Sept	66,766	7.40	70,138	8 60	86,931	7.48
Oct.....	82,724	9 17	63,014	7.73	97,953	8 43
Nov.....	64,727	7.16	59,501	7.30	97,312	8 37
Dec..	57,548	6.38	55,791	6.85	104,702	9 02
Total...	902,429	100.00	814,853	100.00	1,162,276	100 00

These data are offered to demonstrate the cycle patterns of an important chemicals-consuming industry. The post-depression figures show a definite increase in the use of prints, but they also show how the producers of such merchandise have adopted a different production policy. In order to meet the spring rush better they have concentrated production much more than before into the earliest months of the year, and July production has been reduced to a much more pronounced low. There are definite reasons for such a change, and the chemical economist should try to find them out.

TABLE 14

ARTIFICIAL LEATHER—TOTAL PYROXYLIN USED FOR SPREADING

Month	1928		1931		1935	
	1,000 lb.	%	1,000 lb.	%	1,000 lb.	%
Jan.....	4,093	6.70	2,565	7 06	4,214	8 17
Feb.....	4,767	7.80	3,044	8 38	4,444	8 62
Mar.....	5,715	9 35	4,081	11 24	4,829	9 37
Apr.....	4,629	7 57	4,273	11 77	4,600	8 92
May.....	5,459	8 93	4,060	11 18	4,280	8 30
June.....	5,150	8 43	4,001	11 02	3,274	6 35
July.....	5,040	8.24	2,621	7 22	3,587	6 96
Aug.....	5,596	9 15	2,667	7 35	4,471	8.67
Sept.....	4,844	7 92	2,822	7.77	4,692	9 10
Oct.....	5,712	9 34	2,333	6 43	5,125	9 94
Nov.....	5,366	8 78	1,759	4 84	4,152	8 05
Dec.....	4,763	7 79	2,083	5 74	3,895	7 55
Total...	61,134	100.00	36,309	100.00	51,563	100 00

Pyroxylin is spread mechanically upon textile and other bases to make so-called artificial leather. The production of such materials is carried out at a surprisingly even rate throughout the year, and the plastics industries are fortunate in having such a well-developed and steady outlet for their products. There was some nervousness in 1931, but otherwise the steadiness of the artificial-leather industry has greatly contributed to the safe and successful promotion of the pyroxylin group.

TABLE 15

SOLE AND BELTING LEATHER—PRODUCTION OF TOTAL INDUSTRY

Month	1929		1932		1935	
	1,000 lb.	%	1,000 hides	%	1,000 hides	%
Jan.....	23,891	8.39	1,278	8.76	1,842	8.40
Feb.....	20,989	7.37	1,270	8.72	1,740	7.93
Mar.....	22,191	7.79	1,383	9.48	1,794	8.18
Apr.....	23,119	8.12	1,193	8.18	1,815	8.28
May.....	22,879	8.03	1,049	7.19	1,865	8.50
June....	25,103	8 82	1,060	7.27	1,659	7.56
July.....	24,161	8 48	1,030	7 06	1,722	7.85
Aug.....	25,501	8 96	1,082	7.42	1,829	8.34
Sept.....	23,460	8.24	1,272	8.72	1,723	7.86
Oct.....	25,665	9 02	1,325	9.09	2,062	9.40
Nov.....	23,901	8.39	1,330	9 12	1,957	8.93
Dec.....	23,894	8 39	1,311	8 99	1,924	8.77
Total...	284,754	100 00	14,583	100.00	21,932	100.00

The indexes of this real leather group indicate not exactly ideal continuity of the monthly demand for tanning, dyeing, oiling, and other chemicals used in hide tanning, but a sufficient steadiness to place tanning enterprises among the more-coveted chemical consumers.

Producers supplying chemicals to the paper industries can rely upon a monthly demand which is even steadier than that just shown and approaches almost ideal conditions year after year. Thus it is not surprising that there is keen competition for orders and contracts from such sources.

TABLE 16

PAPER, PAPERBOARD AND NEWSPRINT—PRODUCTION OF TOTAL INDUSTRY

Month	1929		1931		1935	
	Short Tons	%	Short Tons	%	Short Tons	%
Jan. .	757,605	8 67	621,259	8 65	765,906	8 36
Feb	683,970	7 83	583,748	8 13	709,055	7.74
Mar...	747,944	8 56	629,233	8 76	757,348	8.26
Apr... .	750,800	8 60	643,056	8 95	736,459	8.04
May.....	775,156	8 87	638,510	8 89	786,334	8 58
June.....	702,915	8 05	621,411	8 65	721,908	7 88
July.....	706,831	8 09	607,700	8 46	700,349	7.64
Aug.....	760,392	8.71	591,414	8 23	815,630	8.90
Sept.. .	703,266	8 05	587,543	8 18	756,573	8.26
Oct . ..	790,591	9 05	596,459	8 32	914,297	9 98
Nov.. .	723,663	8.25	544,136	7 58	783,341	8 55
Dec.... ..	631,568	7 23	517,271	7 20	717,604	7 81
Total...	8,734,701	100.00	7,181,740	100 00	9,164,804	100 00

Rubber industries are commonly considered as unsteady customers, and while the 1935 record may show a definite steadying of their demand, the previous cycles shown above and those not shown seem to confirm the consensus of opinion of chemical producers supplying these industries. But there is where the chemical economist through his studies of consumer industries can furnish very valuable information to the sales department. He can help that department in concentrating upon a selected variety of consumer industries in order to blend the demands so that in spite of individual variations a fairly steady chemical sales and production plan can be developed for the company.

TABLE 17

RUBBER INDUSTRIES—CONSUMPTION OF CRUDE RUBBER

Month	1929		1932		1935	
	Long Tons	%	Long Tons	%	Long Tons	%
Jan	38,702	9 15	29,648	8 93	46,571	9 47
Feb	37,435	8 85	31,821	9 58	42,699	8 69
Mar	40,257	9.52	29,506	8 89	42,138	8 57
Apr	42,769	10 12	27,518	8 29	44,209	8 99
May	44,310	10 48	30,957	9 32	41 098	8 36
June	38,905	9 20	41,475	12 49	36,209	7 37
July	37,373	8 84	29,976	9 03	35,973	7.33
Aug	34,447	8 15	23,721	7 14	38,799	7 89
Sept	31,236	7 39	23,847	7.18	37,129	7 55
Oct	31,320	7.40	22,286	6 72	41,956	8 54
Nov	24,893	5 89	23,231	7 00	42,295	8 60
Dec	21,178	5 01	18,015	5.43	42,457	8 64
Total	422,825	100 00	332,001	100 00	491,533	100 00

CONCLUSIONS

It has been the purpose of this chapter to demonstrate that economic "crystal gazing" is possible, that accurate forecasting can be done and therefore should be carried out in chemical enterprises as a part of the regular routine.

Any forecast, be it for the next twelve months or only three or four months, is a plan and sets a definite pace for the entire company as well as for each individual member. Forecasts can be made the means of coordinating the economic thinking of the entire staff toward the achievement of results which are better than those obtainable without such planning. The mere process of forecasting brings economic facts to the attention of the management which otherwise may remain overlooked and buried under the many technical operating details which are so characteristic of chemical enterprises.

To forecast, then, or not to forecast is in effect the question which determines whether a company will work according to a well-considered systematic plan or to a haphazard one. The choice is up to the management.

CHAPTER 8

SELLING CHEMICALS

According to the census of 1929 the total factory wholesale value of chemical and allied products made in the United States amounted to $3,759,404,640. If alcohol and other chemical products are added, this value is increased to $3,892,633,196. Either amount is staggering and is the more remarkable when it is considered that these figures cover more than 250,000 different chemical products made in commercial quantities and that they represent a volume of probably close to 300,000,000,000 pounds.

FACTORY DISTRIBUTION

Only a minor portion of this tremendous volume is used by the enterprises that made it. By far the greater part, probably 90 per cent of the entire production, is sold. In good years at least 10,000 sales managers, approximately 30,000 sales representatives, and nearly 60,000 clerks, the total representing one-fourth of all chemical employees, are needed to perform this task.

The Distribution Censuses of 1929 and 1935 also show to which groups of buyers these sales were made:

CHANNELS OF PRIMARY DISTRIBUTION

Census	1929	1935
Net sales (excluding internal transfers)	100%	100%
To company wholesale branches	12.2	29.7
To company retail stores	0.5	0.6
Direct to industrial users	33.5	28.1
Direct to household consumers	2.0	1.9
Percentage of final sales made by company staffs	48.2	60.3
To wholesalers and jobbers	23.0	19.2
To retailers	12.7	10.8
To agents, brokers, etc.	16.1	9.7
Percentage of final sales made by traders	51.8	39.7

Although these data are taken from official sources (Bureau of Census, Distribution of Manufacturers' Sales, 1929 and 1935), they are probably none too complete, nor are they absolutely correct as to classifications. However, these percentages bear out convincingly enough that direct selling has increased, while selling through independent trade outlets has been considerably reduced. In following this practice the chemical industry has acted in distinct contrast to other leading American industries, such as automobiles, foods and textiles, which sell mainly through non-factory outlets.

The technical character of chemical products has caused this peculiar condition, but economic thinking has raised factory selling to its predominant position and will probably develop it still further. As the industry grew to produce not only large but enormous quantities of products, close control of sales and price policies prove to be a definite necessity in some chemical branches, while in others selling through traders still prevails. Tables 18 and 19 reflect the distribution policies applied during 1935 in the various industries.

(See pages 122–124)

TABLE

UNITED STATES CHEMICAL INDUSTRIES. DISTRIBUTION

Values in

Number of Plants	Industry	Total Sales Reported	Own Wholesale Branches	Industrial and Other Users	Wholesalers and Jobbers
7,269	TOTAL CHEMICALS and Allied Products	2,863,246	848,318	805,379	548,813
555	Chemicals not elsewhere classified	623,674	203,249	216,591	83,964
391	Cleaning and polishing preparations	45,975	5,271	10,384	18,392
14	Ammunition	26,375	3,852	1,331	18,432
46	Baking powder	36,097	16,245	566	15,980
168	Blackings and stains	18,151	in Wh. & Job.	4,834	9,047
13	Bluings	920			811
55	Bone black	17,768		12,456	5,312
23	Candles	4,675		1,665	989
323	Compressed and liquefied gases	52,025	15,535	27,341	1,598
19	Drug grinding	6,269	in Ind. Users	5,604	629
74	Explosives	42,841	32,033	4,799	1,177
52	Fireworks	7,112	636	1,585	4,542
74	Glue and gelatine	29,411	4,792	10,832	5,320
255	Grease and tallow	49,045		35,730	9,633
1,034	Patent medicines and druggists' preparations	292,681	73,826	16,212	106,828
660	Fertilizers	154,108	20,682	18,228	19,496
518	Chemical compounds	58,748	7,122	21,919	15,648
176	Ink, printing	38,638	14,835	12,639	1,427
22	Ink, writing	2,844	in Wh. & Job.	166	1,647
65	Mucilage and paste	3,700		1,699	1,644
459	Oil, cake and meal, cottonseed	193,051	3,275	73,881	57,170
24	Oil, cake and meal, linseed	54,895	5,112	19,124	27,254
13	Oils, essential	4,931		3,937	994
102	Oils, not elsewhere classified	45,463	6,739	21,505	11,062
46	Salt	33,064	16,719	5,102	7,191
232	Soap	238,063	179,030	15,139	20,608
142	Tanning materials	35,954	1,742	29,019	2,743
61	Wood distillation	17,172	7,940	4,289	3,546
1,063	Paints, pigments and varnishes	426,352	137,669	129,317	49,967
558	Perfumes, cosmetics, etc	117,520	9,349	1,893	44,158
32	Rayon and allied products	185,724	82,665	97,665	97,592
89	Coke-oven products	188,639	43,303	41,983	19,725

18

OF MANUFACTURERS' SALES IN 1935

Thousands of Dollars

Own Retail Stores	Retailers	Household Consumers	Total Distributed	Transfers within Organization	Sales Not Allocated	Sales through Brokers, Agents, Commission Houses
17,644	308,520	54,500	2,583,174	204,320	75,752	277,941
. . . . .	6,635	532	510,971	86,879	25,824	44,755
. . . . .	10,758	348	45,153	413	409	3,302
. . . .	1,067	. . . . .	24,682	. . . . .	1,693	1,076
in Own Br.	2,283	. . . . .	35,074	in Ind. Users	1,023	3,611
. . . . .	1,858	15	15,754	2,232	165	851
. . . . .	109	. . . . .	920	. . . . .	. . . . .	. . . . .
. . . .	. . . . .	. . . . .	17,768	in Ind. Users	in Ind. Users	10,359
. . . . .	1,596	. . . . .	4,250	. . . . .	425	1,808
. . . . .	330	. . . . .	44,804	7,221	. . . . .	1,710
. . . .	36	. . . . .	6,269	in Ind. Users	in Ind. Users	401
. . . . .	230	. . . . .	38,239	4,602	. . . .	. . . .
. . . .	243	43	7,049	in Ind Users	63	478
. . . .	843	. . . . .	21,787	7,337	287	1,740
in Retailers	1,949	245	47,557	1,132	356	12,413
1,535	69,206	6,078	273,685	11,663	7,333	19,004
1,609	57,459	23,165	140,639	6,219	7,253	36,885
221	5,273	916	51,099	3,849	3,800	4,200
. . . . .	1,780	. . . . .	30,681	7,363	594	368
. . . . .	1,031	. . . . .	2,844	. . . . .	in Retailers	. . . . .
. . . . .	293	. . . . .	3,636	. . . . .	64	34
in Own Br.	16,616	10,833	161,775	22,890	8,386	55,009
in Retailers	2,602	. . . . .	54,092	in. Not Alloc.	803	10,907
. . . . .	in Wh. & Job.	. . . . .	4,931	. . . . .	in Ind. Users	. . . . .
in Retailers	2,274	105	41,685	3,579	199	18,491
. . . . .	1,780	91	30,883	86	2,095	2,775
. . . . .	17,087	821	232,685	4,451	927	10,670
. . . . .	in Wh. & Job	in Ind. Users	33,504	1,772	678	1,853
. . . . .	226	in Ind. Users	16,001	22,627	in Ind. Users	7,388
12,369	59,237	4,886	393,445	5,088	10,280	16,118
1,910	45,719	6,422	109,451	3,749	2,981	4,656
. . . .	. . . . .	. . . . .	181,861	67,608	114	7,079
. . . . .	10,230	5,790	121,031	67,608	. . . . .	25,453

TABLE 19

UNITED STATES CHEMICAL INDUSTRIES. DISTRIBUTION OF MANUFACTURERS' SALES IN 1935

Total Sales = 100.0. Values sold through various channels expressed as percentage of total sales

Industry	Own Wholesale Branches	Industrial and Other Users	Wholesalers and Jobbers	Own Retail Stores	Retailers	Household Consumers	Total Distributed	Transfers within Organization	Sales Not Allocated	Sales through Brokers, Agents, Commission Houses
TOTAL CHEMICALS and Allied Products	29 7	28.1	19.2	0 6	10.8	1.9	90 3	7 1	2 6	9.7
Chemicals not elsewhere classified	32.6	34.7	13.5		1.1	0.1	82 0	13 9	4.1	7.2
Cleaning and polishing prep.	11 5	22.6	39.9		23 4	0 8	98 2	0 9	0.9	7.2
Ammunition	14.6	5.0	70 0		4.0		93.6		6 4	4.1
Baking powder	45 0	1.6	44.3		6 3		97 2		2.8	10 0
Blackings and stains		26.6	49 9		10 2	0.1	86 8	12 3	0.9	4 7
Bluings			88.2		11.8		100.0			
Bone black	70.1	29.9					100.0			58 3
Candles		35.6	21.2		34 1		90 9		9.1	38.7
Compressed and liquified gases	29.9	52.5	3.1		0 6		86.1	13.9		3.3
Drug grinding		89.4	10.0		0 6		100 0			6 4
Explosives	74.9	11.2	2.7		0.5		89 3	10.7		
Fireworks	8 9	22.2	64.0		3.4	0.6	99.1		0.9	6.7
Glue and gelatine	16.3	36 8	18.1		2 9		74.1	24.9	1.0	5.9
Grease and tallow		72.9	19.6		4.0	0 5	97.0	2.3	0.7	25.3
Patent medicines and druggists' preparations	25 2	5.5	36 6	0.5	23.6	2.1	93 5	4 0	2 5	6 5
Fertilizers	13.4	11.8	12.7	1.0	37.4	15.0	91.3	4.0	4.7	23 9
Chemical compounds	12.1	37 2	26.6	0.4	9.0	1.6	86 9	6 6	6.5	7.1
Ink, printing	38.4	32.7	3.7		4.6		79.4	19.1	1.5	1.0
Ink, writing		5.8	57.9		36 3		100 0			
Mucilage and paste		45 9	44 5		7 9		98 3		1 7	0 9
Oil, cake and meal, cottonseed	1.7	38 3	29.6		8.6	5 6	83.8	11.9	4.3	28.5
Oil, cake and meal, linseed	9.3	34.8	49.7		4.7		98 5		1.5	19.9
Oils, essential		79.8	20.2				100 0			
Oils, not elsewhere classified	14.8	47.4	24.3		5 0	0 2	91 7	7.9	0.4	40.7
Salt	50.6	15 4	21 7		5 4	0 3	93 4	0.3	6 3	8.4
Soap	75.1	6.4	8 7		7.2	0 3	97.7	1.9	0.4	4.5
Tanning materials	4.8	80.8	7.6				93 2	4.9	1.9	5.2
Wood distillation	46.3	25.0	20.6		1.3		93.2	6.8		43.0
Paints, pigments and varnishes	32.3	30.4	11.7	2.9	13.9	1.1	92.3	5.3	2.4	3.8
Perfumes, cosmetics, etc	8 0	1.6	37.6	1.6	38 9	5.5	93.2	4.3	2.5	4.0
Rayon and allied products	44 5	52.5	0 9				97.9	2.0	0 1	3.8
Coke-oven products	22 9	22 3	10 5		5 4	3 1	64 2	35.8		13 5

WHOLESALE TRADE SALES

The trend toward factory selling was caused in part also by the large-quantity consumers who invariably prefer to obtain chemicals from the manufacturer as soon as their demands warrant direct shipments. But, in spite of this, there are still enough chemical products not sold direct by the factories to provide business for a surprising variety of trading establishments.

Unfortunately the Wholesale Distribution Census is not established upon the same classifications as the Census of Manufactures, and probably in quite a few of the subgroups chemical wholesalers are reported among the unrecognizable "others." By proper regrouping, however, a fairly complete picture of the chemical wholesale trade can be obtained as shown in Table 20 and analyzed in Table 21.

THE STATUS OF THE CHEMICAL WHOLESALER

The preceding analysis bears out the fact that the chemical wholesaler has not exactly ideal operating conditions to contend with. More but smaller enterprises sold less in 1935 than fewer but bigger enterprises sold in 1929. There appear to be 476 wholesale outlets added since 1929, but sales per employee appear smaller and are below the national average. Operating expenses and payroll requirements are high in relation to sales, and rather large stocks had to be carried by the wholesalers as reflected in their stock turnover, which is lower than the national average.

In order to help, if possible, the wholesaler group in its struggle for economic existence and at the same time reconcile the often conflicting views on the necessity of middlemen in chemical industries, the various pros and cons of the problem are presented here for careful consideration.

Those *against* wholesalers and chemical middlemen in general contend that middlemen cannot sell at prices which the factory could grant in direct selling; that the middleman has to make a profit in addition to covering his expenses and that therefore the consumer has to pay not only for the chemicals but for the middleman as well; that if middlemen aim to sell, or are expected to sell, at prices which would be as low as the prices for direct delivery, they can do it only by getting higher than usual trade discounts, and this too is considered as definitely undesirable. Thus some trade experts do not see much good in having chemical middlemen at all, and they advocate direct factory selling as the most desirable and forthright solution.

TABLE 20

UNITED STATES CHEMICAL INDUSTRIES. WHOLESALE DISTRIBUTORS

Census 1935

Kind of Business	Number of Establishments	Owners	Employees, Year's Average	Net Sales, Thousands of Dollars	Operating Expenses, Thousands of Dollars	Payroll, Thousands of Dollars	Stocks Dec. 31, Thousands of Dollars
Total U. S. wholesale distributors	176,756	97,225	1,260,553	42,808,913	4,163,480	2,022,262	3,106,609
Chemical industries, wholesale distributors	4,949	2,048	58,890	1,892,519	257,442	111,638	162,736
Percentage of total	2.80	2.11	4.67	4.42	6.18	5.52	5.24
1935 Chemical wholesale distributors	4,949	2,048	58,890	1,892,519	257,442	111,638	162,736
Wholesale merchants	2,877	1,414	32,125	673,163	106,427	52,521	93,804
Exporters	30	9	216	21,869	2,099	500	2,443
Importers	133	46	1,189	66,302	7,668	3,157	8,934
Mail-order wholesalers	40	31	237	2,847	556	249	199
Cooperative warehouses	31	.....	1,133	26,085	2,555	1,413	3,838
Wagon distributors	14	9	25	172	48	31	13
Manufacturers' sales branches	899	23	18,931	614,051	103,606	41,055	51,460
Manufacturers' sales offices	246	9	3,035	206,610	21,162	8,318	.....
Brokers	85	59	223	152,277	1,332	694	46
Commission merchants	38	24	167	16,371	694	399	132
Export agents	24	15	78	10,115	1,680	274	42
Import agents	32	14	135	18,783	4,426	430	43
Manufacturers' agents	437	368	920	54,451	2,952	1,621	746
Selling agents	63	27	476	29,423	2,236	976	1,036
Assemblers	?	?	?	?	?	?	?
Cooperative market associations	?	?	?	?	?	?	?
1929 Chemical wholesale distributors	4,473	.....	71,297	2,563,195	325,097	152,224	259,438
Chemicals, paints, drugs, etc	4,023	.....	65,432	2,058,934	297,273	140,059	232,757
Fertilizers	279	.....	4,473	187,470	19,239	8,188	19,218
Oils and greases	171	.....	1,392	316,791	8,585	3,977	7,463

TABLE 21

UNITED STATES CHEMICAL INDUSTRIES. WHOLESALE DISTRIBUTORS

Analysis of Operations. Census 1935

Kind of Business	Net Sales		Operating Expenses, % of N. S.	Payroll		Stock Turnover, Approximate
	Per Establishment	Per Employee		% of N. S.	Per Employee	
	$	$			$	
Total U. S. wholesale distributors	242,192	33,960	9 73	4.72	1,604	10.34
Chemical industries, wholesale distributors	382,404	32,137	13.60	5.90	1,896	8.73
1935 Chemical wholesale distributors	382,404	32,137	13 60	5.90	1,896	8.73
Wholesale merchants	233,981	20,954	11 58	7.80	1,635	
Exporters	728,967	101,245	9 60	2.28	2,315	
Importers	498,511	55,763	11.57	4.76	2,655	
Mail-order wholesalers	71,175	12,013	19.53	8.75	1,051	
Cooperative warehouses	841,452	23,023	9 79	5.42	1,247	
Wagon distributors	12 286	6,880	27.91	18.02	1,240	
Manufacturers' sales branches	683,038	32,436	16.87	6.69	2,169	
Manufacturers' sales offices	839,878	68,076	10.24	4.03	2,741	
Brokers	179,149	68,286	8.75	4.56	3,112	
Commission merchants	430,816	98,030	4 24	2.44	2,389	
Export agents	421,458	129,679	16 61	2.71	3,513	
Import agents	586,969	139,133	23.56	2.29	3,185	
Manufacturers' agents	124,602	59,186	5 42	2.98	1,762	
Selling agents	467,032	61,813	7.60	3.32	2,050	
Assemblers	?	?				
Cooperative market associations	?	?				
1929 Chemical wholesale distributors	573,037	35,951	12.68	5.93	2,135	7.41
Chemicals, paints, drugs, etc	511,791	31,467	14.44	6.93	2,141	
Fertilizers	671,935	41,911	10.29	4.37	1,831	
Oils and greases	1,852,579	227,580	2 71	1.26	2,857	

Those *for* wholesalers and chemical middlemen in general point out that no factory can have direct wholesale—and still less retail—outlets everywhere; as no factory outlet can carry the variety of products which the middleman is willing to deal in, he creates conveniences for the consumers of small quantities of chemicals in his own locality; some kinds of wholesalers can operate and stay in business at expense rates which no factory branch could survive; the middleman gets his business, not by following a sales manual, but through his definite and ever-alert efforts and knowledge of the locally available business. Thus most chemical middlemen, it is contended, handle that part of the business which from the standpoint of volume or expense could not be handled successfully by the factory, and thereby they well justify their existence and deserve all the assistance they need to carry on their trade. To the factory sales department the small-town jobber may be only "one of those little fellows," but at home he probably is the one and only man genuinely interested in selling the company's products for mutual benefit!

The solution of the middleman problem seems to lie in the observation of certain rules which appear to be equally fair to both sides:

1. The national, state, or big-territory middleman is undesirable, because his position gives him advantages which he may easily turn into disadvantages for the producer. It has frequently been found that general agents for large territories tended to abuse their exclusive rights by overcharging consumers and subdealers and not passing on lower prices granted to them, and that they caused serious trouble when their contracts were not renewed. For big territories with intensive but small volume trade the factory sales office, and for sufficient volume trade the factory branch carrying stocks, are the most satisfactory forms of representation.

2. The local middlemen, on the other hand, serving secondary markets consisting of a great variety of small enterprises, are highly desirable. There they should be protected and their contract conditions be upheld even if customers should feel inclined to order direct from the factory.

3. In certain lines (fine chemicals, drugs, paints, etc.), calling for a great variety of stocks-on-hand and numerous sales in small quantities, the local middleman is a definite necessity.

4. Lack of consideration, as displayed by the factory trying to prey on the business of its own middlemen, is petty policy and should

be avoided. Competition among the many chemical wholesalers in any community is so serious that the factories should not aggravate conditions further by customer snatching and similar practices. An unsatisfactory representative should be dropped and replaced by a better one, but his business should not be purposely strangled. Even the worst of them probably has on some occasions during his affiliation done his best to serve the company.

THE EVOLUTION OF CHEMICAL DISTRIBUTION

In the earliest days of chemical manufacturing the producers sold their goods directly to the consumers. A few import houses traded in drugs, medicines, acids, and other chemicals not made as yet in the United States, but the main bulk of selling was then, as it is now, factory selling.

Middlemen began to appear in greater numbers after 1850 when the country had been opened up and settlements began to flourish in faraway places. More chemicals had to be imported, and also those domestic producers who were not located near the chemical markets gladly availed themselves of local distributors and agents. Most of these early middlemen merely undertook to sell, and did not always carry stocks. Naval stores, borax, paints, oils, and a few other products were at first marketed by brokers, but many of these became either agents or independent wholesalers as business increased. Then they began to carry stocks and make deliveries, and, as they could handle the relatively small volume of business satisfactorily, the producers, still struggling with production problems, left the real marketing pretty well to these "agents," who usually asked for and obtained exclusive wholesale rights in their districts.

The idea of making factory selling a more definite policy was not adopted until 1914, when industrial production policies were generally reorganized on the principle of more direct industrial relationships. During the war the real weaknesses of middleman activities were definitely brought to light, and soon many factories began to cancel middleman contracts and establish instead their own branches and sales offices, trusting them with the appointment of small local dealers. The trend against the big broker and district agent began.

From 1921 on, competition among chemical producers became very keen, and this stimulated factory distribution and elimination of more agents. Factory salesmen were sent out whenever the middlemen failed to obtain volume in line with the general progress, and quite

often the factory men achieved what the local men had failed to do. Many brokers and agents who still did not carry stocks finally had to become real dealers or give up their contracts.

The process of reorganizing the chemical distribution system brought hardship to many who had spent years in the trade but had not adjusted themselves to quantity production and to the new industrial conditions thereby created. The factory sales policy and its various manifestations are not outgrowths of commercial greed or selfishness. They are definitely caused by the intensification of modern industrial activities, which in turn have created distribution problems for the chemical industries of such peculiar character that only the most direct and active selling can cope with them.

THE PECULIARITIES OF CHEMICAL DISTRIBUTION

People buy because they want to fill some need, or to derive some pleasure, but any purchase also involves some sort of sacrifice on the part of the buyer. In choosing to use his money for the purchase of a certain article, a buyer probably has to forego some other purchase or pleasure. The "consumer's dilemma," therefore, is the best point of attack in competitive selling. The secret of success in sales approach lies in *convincing* the prospect that the pleasure or advantage which he would get from buying what is offered to him right now is relatively greater than some other pleasure or use derived from something that somebody else might offer him.

To "convince by proving" is, therefore, the essence of selling. Various sales methods stress psychology, manners, appearance, method of presentation; but the fact remains that industries and most individuals buy from each other and sell to each other not on the basis of psychological appeals but on the strength of facts.

No Pleasure Appeal. When it comes to selling chemicals, only very few lines can be retailed on the strength of outward appeal. Perfumes, drugs and patent medicines, soaps, some specialties, and to a lesser degree paints, dyes, and rayons, are among the few chemical products which possibly can be sold through psychological appeal. But in industrial buying there does not seem to be a customer, and still less a purchasing agent, alive, who could be induced to buy "these pretty" or "beautiful" soda crystals when he wants soda-ash, to buy more than he thinks he should buy, to buy in off seasons without concessions in price, or who would accept any statement about the quality of chemi-

cals on psychological grounds. There can be no doubt that chemicals are sold on the basis of facts.

The Chemical Market a Consumer's Market. That the chemical market is a consumer's market is probably among the first truths that the chemical sales rooky finds out for himself. Selling chemicals means living up to the whims and wants, fancies and specifications of the consumers. There is no oversight which will be excused, no error that will not be detected and claimed, no delay in delivery that will not lead to complaints and, if repeated, to "no more orders." The chemical consumer is as exacting and strict as his chemical formula. Sales philosophy is for naught, and even the most winning sales personality is of little use if it is not backed by delivery as, or better than, the customer had prescribed. Success in competitive selling under such conditions depends mainly on how much better one competitor is actually able to fulfill the customer's wishes than his rivals, and not on how much better he can talk.

Increasing Sales Is Difficult. For many goods the demand effective at any given time is limited but can be genuinely expanded by intensifying sales efforts, by putting on more salesmen, making more outlets to contact more prospects, and, most effective of all, by lowering prices. Additional buyers can be found and business increased. Chemical sales can also be increased by these same means, but only to a limited extent. As has been stated before, chemical demand depends primarily on economic conditions and increases as conditions improve, but these increases are not permanent expansions. They dwindle just as soon as the underlying conditions are reversed.

Besides, the additional business created through economic conditions is so strenuously competed for that only the lowest price, the best delivery conditions, and the granting of a maximum of benefits to the consumer leads to success in increasing the sales of one's own company. The sad part is that, when business recedes again, the company which has increased its sales by granting maximum concessions no longer gets additional sales but has new customers who do not forget that they have been granted special favors and who expect them to continue. Reliance on increasing chemical sales and their promotion by commercial methods alone has its drawbacks and pitfalls, which do not come to light until the temporary rush is over.

Finding New Uses, the Best Method of Expanding Sales. Chemical industries, therefore, have tried for some time genuinely to expand

their sales by finding new uses for their products. A good deal of the striking progress made in chemical manufacture is due to this policy. The finding of new uses was, and in many companies still is, the exclusive task of their research departments. Many sales forces were concerned with new developments only after all technical facts had been definitely and carefully established. Since the depression of 1930 to 1934, however, not only the propagandizing of new uses but also the finding of new uses and sales possibilities have been made more definitely functions of selling. Any new use discovered adds new and permanent volume to the regular sales and therefore is considered the most desirable and permanently effective method of really expanding sales. Thus selling chemicals means getting the old and as many new kinds of sales as possibly can be thought of or otherwise discovered, and in this task we have a peculiarity of distribution which is not quite so evident in other industries.

"Service," Another Method of Sales Promotion. The spreading of new technical information through special men and to some extent through the entire sales force, together with a few minor informative functions, is called "service." These minor functions consist of giving advice to old and prospective customers on the use of the company's chemicals, keeping them informed about technical changes and improvements made in the products or in their applications, and rendering practical and theoretical assistance in the development of processes. All this is done in the hope of promoting sales. Some service always will be rendered free, but if elaborate investigations or research work are necessary, if blueprints, equipment, and operating instructions have to be worked out, or if service men have to stay with the customer for several days to assist him, a moderate service charge is made, at cost.

Service can be as much overdone as it can be neglected. Too much service, too many visits, too many inquiries, too much counseling, is not only costly for the company but is bound to be resented by the customers and their own technical staffs, who, after all, do not get their salaries for knowing nothing. Service properly rendered states the new facts and asks if further assistance is desired; it does not try to press itself upon the consumer. The customer of today probably is in a position to choose among the services of various competitors, and he is bound to ask further assistance from those whose presentation of the underlying facts impresses him most. This phase of service thus is the real door-opener, and from it can be derived more business than

from any undesired or halfheartedly conceded three days' stay of a service man, who may or may not know as much about processing as the customer's own chemists and engineers.

To rely upon service and service men as a means of getting new ideas for selling one's own products is neither ethical nor wise, because no customer wants to have his special methods passed on to others by a company which has learned about them through its service men. There is the limit of service. It should be genuine help, honestly originated in the company and rendered for the benefit of the customers. If service is of this kind the customer will not hesitate in buying it as well as the products thereafter.

No Sales, Owing to Affiliations. The problem of selling chemicals and getting additional business is made still more difficult because not all potential customers are open for actual selling. Quite a few chemical consumers are definitely affiliated with chemical producers. Also many non-chemical consumers and chemical producers have special supply relationships which no outside sales effort can overcome. This considerably limits potential market and sales possibilities right from the start, and nothing can be done about it because the established arrangements carefully avoid monopolistic features. Purchasing contracts can be legally deeded for any length of time, and, if they involve two companies operating under different names but both owned by the same holding company, the companies are legally one. Exclusive supply agreements between them, therefore, are just as legal as exclusive supply-arrangements between two manufacturing divisions under the same company's roof. More likely than not the consuming company has been acquired for the very purpose of obtaining a steady consumer for the products of the parent company, or vice versa. The outsider salesman may tender his bid and may even get an order for some special product, but the main business still will be solicited in vain. Therefore it is part of the chemical sales job to know which companies are and which ones are not probable prospects, and the "inside story" cannot be overlooked as playing a peculiar and important part in selling chemicals.

Freight Equalization, a Help and a Handicap in Selling. In order to alleviate some of the difficulties in selling and to allow all producers to compete for a consumer on equal terms, freight equalization has been adopted by some chemical trades and is considered as legal by the Federal Trade Commission. What is freight equalization?

Suppose that a consumer needs sodium chlorate in large quantities throughout the year. His most likely sources of supply are two companies, both furnishing the same acceptable grade and quoting the same basic price. The only difference in the suppliers is in their location. Supplier A is located 100 miles away; supplier B, 80 miles distant. The freight charges for 100 miles of transportation are higher than those for 80 miles, and therefore supplier A would never get an order. Supplier A, however, may need the business just as badly as supplier B, and to put him into the same freight position, trade custom permits him to offer freight equalization, which is payment of the difference in freight, if he cares to and can afford to do it. The freight differential is usually not paid but treated as a special allowance from the total price of each shipment or as a credit and thus in effect puts both sellers on the same basis as far as the buyer is concerned.

Freight equalization is not common to all chemical industries, but it is found in all heavy chemical lines. The possibility of offering freight equalization helps in making a company competitive, but it also causes expenses which are difficult to determine in advance and often grow unexpectedly into high amounts. To appraise the annual requirements for freight equalization correctly, and the actual management of policies pertaining to it, requires definite knowledge of facts and much experience because mistakes lead to the establishment of too low or too high prices, either of which may result in serious losses or have other undesired influences upon sales.

Containers, Returnables, and Troubles. Practically all chemicals have to be sold in containers carefully prepared for special requirements, and in the obligation to provide the best, most durable, and most practical containers we have another costly feature of chemical distribution. The feature becomes the more typical when one considers the fact that the chemical industries are among the few industries permitting the returning of containers and putting up with all the trials and tribulations connected with the practice.

Most food industries, equally beset with the package problem, and the majority of other industries simply pack their products as best they can, charge for the containers or deliver in bulk, and avoid container problems. Steel cylinders for gases under pressure, however, carboys and crates for acids, tank cars and drums for all kinds of liquors, and barrels, pails, cases, and bags, some especially lined and seamed, are too costly to be simply charged and forgotten. Charges are made when the merchandise is shipped, but they have to be cancelled when

the containers come back. There is no compensation for loss in interest while the containers are on their way back and forth and in the hands of the users. No special bill can be sent for cleaning or repairing and reconditioning the containers that have been returned. The chemical producer has to carry these expenses.

Generally, the original costs of containers are considered as material cost and thus are classified among the costs of production, not as distribution expenses. But just as often the handling of containers has to be done by and is charged to the sales department, and the sales manager is thus made responsible for another considerable expense which trade custom considers as part of his job. Even when the sales department is not charged with the containers it still has to use part of its time in keeping records, handling correspondence, and straightening out consumers, who often delay the returning of containers or send them back "freight collect." Containers are an important, costly, and cumbersome feature of the chemical business.

Product and Consumer Variety Greater Than in Other Industries. The man who sells automobiles handles, at the most, ten or fifteen models of one or two lines of the same make. He sells the same machine, and all his sales talks can be pretty much alike. Those who buy from him all want his kind of transportation, and, though there are differences in detail, one deal is fundamentally the same as another. The man selling chemicals has to sell standard lines, companion lines, specified and special chemicals, main products, by-products and waste products; he has to be familiar with any number of industries, know their different demands and ways of doing business, technical peculiarities, production and trade habits, and seasonal requirements not only in a general way but by company, department, and personalities. He has to plan not *one* sales campaign but as many as the products he carries and for as many different kinds of consumers as he has or wants to get. If he wants to be sales manager he has to be able to make *one* sales organization suit all these needs and organize all the various units of the sales apparatus into *one* efficient organization, not bigger but better than his best competitor's. The man who can do all this finally will be appointed sales manager, provided he is also a first-class chemist, production man, economist, cost and price expert, promotion genius, and a likable fellow to boot.

The prerequisites for selling chemicals are definitely high, but in this multitude of requirements and fulfillments are advantage and progress. They keep out the unfit and the fakers, force the men doing

the job to preserve the most simple, straightforward, and at the same time most effective methods of salesmanship and sales organization. The usual ballyhoo is avoided, and costly but futile experiments in distribution remain untried. In spite of its complexities, chemical distribution, as compared with distribution systems for other products, is today a most methodical and economically effective procedure. The often-heard reprimand that distribution has remained behind production does not apply, nor can it be charged generally that chemical distribution is wasteful or too costly. It costs more than other distribution systems, but that is due to its inherent character and is not the result of extravagance or supersalesmanship. Of these, chemical distribution is still almost free and, let us hope, will remain so for some time to come.

SETTING UP THE SALES ORGANIZATION

A sales organization that will function efficiently under the conditions peculiar to chemical selling must be established from the start upon well-considered principles. The old saying, "Just start it and then let it grow," has often worked out well enough in the past, but it seems that miracles do not happen any longer on the commercial side of the chemical business. Nowadays, careful and deliberate sales planning seems to be necessary if an undertaking is to withstand the vicissitudes of competition and show progress.

Extent of Distribution. The sales organization can be planned from the start to fit various operating plans. It can purposely be restricted to a mere local or neighborhood business; it can be limited to a certain district or region, say East Coast only, or primarily Middle West; it can be planned to be ultimately a national distribution system, disregarding exports; or it can be conceived from the start as an all-embracing enterprise carrying on local, district, regional, national, and international sales activities. "What a man thinketh he will achieve!"

No ambitious program can be put into practice all at once, but a definite aim and final goal are very important because the man organizing only for neighborhood business may pass up or neglect many steps which the company organizing ultimately for a complete East Coast distribution simply cannot afford to miss if it finally wants to achieve such a position.

The common belief that only a "big" company can afford a far-flung distribution system should not be applied to chemical lines.

Their distribution possibilities are determined almost entirely by the characteristic features of the products. If they have "special" features that are protected either by patents, or if for other reasons these products cannot be made by everybody everywhere, the products have, from the start, possibilities for nation-wide and even international application. In such a case there is no reason why even a "small" company should not plan from the beginning for such ultimate distribution.

On the other hand, there is some truth in the statements that the sales radius of chemicals is in inverse ratio to their weight and in direct ratio to their value. In everyday language these statements mean that heavy, low-priced chemicals can be sold only in a limited area, whereas selling of low-weight, high-value chemicals (dyes) is possible in a geographically much larger market. In actual practice these theories are being greatly invalidated by the establishment of subsidiary factories and branches in various parts of the country, but nevertheless they prove that a chemical sales organization that markets all its products according to the same scheme, and within the same scope and territory, does not make use of the full extent of possibilities offered by the character of its products.

In order to determine the optimal extent of the distribution system all products should be carefully grouped on the basis of their various degrees of "special features" which determine their suitability for near-by or wider distribution, and definite distribution plans should be worked out accordingly.

Size of Sales Force. How big the factory sales force should be, how many men it should use, how many for travel, how many at home, how many for demonstration, how large a territory each man should cover, how many sales each salesman should make, how long each one should stay on the road—these are only a few of the questions which have to be answered when organizing the distribution system. An overstaffed organization is just as undesirable as one which is expected to obtain maximum sales with a minimum of men. The problem is to bring both in line with each other.

There are no comparative data for all chemical industries on sales per man which, if available, possibly could offer some guidance in this matter. Nor has much been written as yet on the subject.

There are no rules, but there are some practical pointers that probably will be helpful:

1. Volume of chemical sales is not determined by the number of people on the staff.

2. Not all salesmen can produce alike. Their results depend on customers, sales conditions, experience, and length of contact with the same territory.

3. Two salesmen do not produce double volume, twenty salesmen do not obtain twenty times the volume of one. Therefore the sales force should be established in line with potential volume, and volume should not be expected in line with the size of the force.

4. A salesman should see every customer at regular intervals but not more often than really necessary.

5. He should spend most of his time in contact work and only as much in the home office as necessary to straighten out his affairs and prepare for the next trip. Field work and returns to the factory should be alternated as well as circumstances permit. Definite itineraries should be worked out, providing time for new contacts, and the size of each sales territory should be determined by the number of visits a man can properly make without undue haste or delay.

Thus the size of the outside sales force can be properly determined by the number of calls that are necessary to do business and to look for new prospects. In making these studies "average times" for visits and traveling should be avoided and actual conditions considered as much as possible. For home-office purposes as many additional people should be employed as are necessary to handle all orders in a thorough and efficient manner.

Sales Volume versus Salesman's Pay. In connection with the size of the sales forces the question arises how much sales volume a sales representative should produce and how much he should be paid. For both the company and the individuals these are important problems, and yet there are no standards by which they can be solved. Therefore most sales managers set sales quotas for each man and territory and at the same time fix more or less arbitrarily certain amounts which they are willing to pay to salesmen able to fulfill these quotas. In order to adjust the salesman's pay in line with his achievements some companies pay a relatively small salary, corresponding to a minimum sales quota, and for any sales in excess thereof they give either commission or bonus or both.

In other companies the salesmen receive straight salaries and possibly a bonus at the end of the year, without any quotas being especially mentioned. Although this may appear more attractive, the total earnings even of the best salesman will probably be lower because in this instance usually more men are employed. So long as sales come up to expectations either method will be found satisfactory. When, however, a sales representative does not obtain sales enough to fill his

quota, it becomes a matter of argument whether the quota was set too high or the man did not live up to expectations and salary paid. As an arbitrary decision is undesirable for all concerned it is definitely worth while to establish at least the relationships between the minimum sales volume to be obtained and the income paid to salesmen on a better than arbitrary basis.

Obviously the amount of sales cannot be the only measuring stick for a sales representative's usefulness to the company. A large sales volume that yields no net income or profit to the company is much less desirable than a smaller volume that covers its costs and furnishes income for the company besides. Therefore, in setting minimum quotas corresponding to certain salaries, the net income content of such volumes canot be overlooked. If a salesman in his volume produces no income for the company his salary and whatever else was paid him may not have been justified. He will, however, justify his employment if he at least produces sufficient sales so that the net income to the company from these sales is equal to the net income paid to the salesman by the company. Good salesmen produce considerably more net income than they receive. The following figures will serve to demonstrate the simplicity of these tests:

Sales representative		Johnson		Smith		Sullivan
Net sales obtained		$70,000		$50,000		$30,000
Total cost	95%	66,500	90%	45,000	91%	27,300
Net income to company		$ 3,500		$ 5,000		$ 2,700
Income paid to salesman		$ 4,000		$ 3,000		$ 2,700

On the basis of sales alone Johnson would be best, Smith second, and Sullivan third. But a comparison of the incomes paid to these men with those they produced for the company places Smith in the lead, shows Sullivan just obtaining minimum sales, and Johnson receiving more income for himself than he has contributed to the company. His volume was obtained by concessions; the others obtained their sales by real selling. It is worth noting that in this instance Sullivan, in order to produce the desirable minimum sales volume, had to sell 11 times as much as he earned, Smith sold 17 times and Johnson 18 times their respective salaries. For wholesale distributors, in 1935, the relationship between average sales and salary per employee was: net sales, $32,137; payroll, $1,895; or approximately 17 : 1. As the average salary also includes clerks and other non-selling employees, those doing the real selling probably had to sell products at least 25 to 30 times their earnings.

Choosing Wholesale Outlets. If some products deserve national distribution or even export consideration, but direct factory sales efforts do not seem likely to produce satisfactory results, wholesale outlets should be appointed. Different sales managers follow different policies in making their choice, and mostly base it on good or bad experiences with various kinds of outlets. But in addition to the rules given above the following are points that really seem to be worth considering:

Factory branches, carrying stocks and acting as direct representatives of the factory, are the most desirable faraway outlets. But their establishment is justified only when sufficient volume is available. Branches are not exactly cheap, and stocks should be kept only when quick availability renders competitive advantages.

Factory sales offices are probably the most effective type of representation for markets not too far remote. Through these offices the factory acts as its own broker, carries no local stocks, merely gets orders and fills them all from the same source. The costs and inconveniences of special stock storage are saved. The market can be thoroughly covered and good business can be done by the right kind of man at a minimum of operating expense. Factory sales offices are successful only if factory deliveries can be arranged without much delay and the factory is properly equipped to fill special and less than carload orders to the satisfaction of the buyers.

Local distributors, especially those who are well established and are willing to buy in carload quantities, are usually chosen when the market is not sufficiently large to support factory wholesale outlets but needs thorough canvassing and trading in many different lines with the smallest retailers or consumers.

Local dealers are the most steadfast and loyal of all middlemen. They buy in relatively small quantities but take care of minor and even major emergencies from their own stocks as best they can. They are glad to be in business, are proud of every transaction, and act carefully and quite shrewdly. Business mortality among local chemical dealers during the last depression was low, and today they are doing well everywhere.

Local agents and brokers. An agent is a business man representing and acting for another. If a business man acts in his own name but merely brings buyer and seller together, he is called a broker. Both functions are necessary under certain conditions, viz.: when there is only sporadic and occasional business, or if the carrying of local stocks is not warranted. Then agents or brokers are the only

sort of middlemen who, owing to their small investment, can be satisfied with the small commission which alone makes possible their deals.

Exporters and export agents. It is regrettable that so few middlemen are finding it possible to carry out chemical exports and that there is so little interest on the part of the producers in supporting this difficult trade by better cooperation. American patent medicines, toilet preparations, and package dyes have become world famous through the services of these traders, and quite a few other products deserve to be added to their lists.

The Costs of Distribution. The costs of distribution are the deciding factor in all matters of representations and are of prime importance in organizing the distribution system. In order to keep their selling expenses low, some companies, whose products would well justify a wider distribution, prefer to operate in a limited area with a limited force. Other companies, however, desire to be represented just as and where their main competitors are represented, and then perhaps they go further in appointing representatives than they might otherwise. Their policy has created a somewhat overcrowded concentration of representatives in certain cities, which is not really serious, but does not benefit anyone either.

The right kind of sales organization should be developed not on the basis of what competitors do, but by means of thorough studies of the company's products, their sales possibilities, and the costs of distribution, assuming various kinds of distribution systems. A company which neglects to make these studies is bound either to remain stagnant or to overlook many opportunities of improving its operating conditions, sales, and net profits.

The costs of distribution include many more items than most people realize, and in the constant control of these items rests part of the administrative success of the sales department. Mere monthly, quarterly, or annual comparison of percentages expressing the total distribution expenses in relation to net sales, or comparison of the company's own sales expense percentages with those of other companies, is hardly sufficient to determine whether distribution expenses are adequate or out of line. Nor is it possible to spot in this manner the very item in which the expenses are either too high or too low to produce satisfactory results. Detail information must be compiled and studied; in order to show at least which items should be covered the following summary is offered. It reveals the complexities of a modern sales organization probably better than a long write-up.

TABLE 22

Summary of Distribution Expenses

.....19..

Account		Factory Sales Dept.	New York Sales Office	Chicago Branch	Agents and Others	Total Distribution Expenses
No.	Name	Acct 105A	Acct 105B	Acct 105C	Acct 105D, E	Acct. 105
5110	Manager and staff					
5120	Clerical					
5130	Field engineers					
5140	Salesmen					
5150	Commissions					
5160	Bonuses					
5170	Other salaries (foremen, etc.)					
5180	Wages					
5190	Counsel					
5100	Total Salaries and Wages					
5210	Social insurance					
5220	Sickness compensation					
5230	Accident insurance					
5240	Liability insurance					
5250	Welfare contributions					
5260	Gratuities					
5200	Total Social Welfare					
5310	Incoming freight, express and cartage					
5315	Receiving and unloading					
5320	Storing and warehousing					
5325	Losses due to leakage, etc					
5330	Provision for shortages and defaults					
5335	Provision for inventory adjustment					
5340	Analyses and records					
5345	Packing for shipment					
5350	Loading and shipping					
5355	Delivery expenses					
5360	Demurrage and similar					
5365	Use of trucks					
5300	Total Receiving, Handling, Shipping					
5410	Special price reductions					
5420	Special allowances					
5430						
5440	Freight equalization					
5400	Total Special Allowances					
×	Transfers					

TABLE 22—(*Continued*)

SUMMARY OF DISTRIBUTION EXPENSES

.....19..

Account		Factory Sales Dept.	New York Sales Office	Chicago Branch	Agents and Others	Total Distribution Expenses
No.	Name	Acct 105A	Acct. 105B	Acct. 105C	Acct 105D, E	Acct. 105
×	Transfers					
5510	Regular traveling and expenses					
5520	Special traveling and expenses					
5530	Use of company cars					
5540	Entertainment					
5500	Total Traveling and Entertainment					
5610	Stationery and office supplies					
5620	Price lists and change notices					
5630	Technical information					
5640	Telephone, telegraph, cables					
5650	Postage					
5660	Messenger service					
5670	Collection expenses					
5680	Memberships, dues					
5690	Subscriptions					
5600	Total General Expenses					
5710	General sales promotion					
5720	Special indices and reports					
5730	Educational campaigns					
5740	Internal training					
5750	Service traveling and expenses					
5790	Credits for service sales					
5700	Total Promotion and Service					
5810	Magazine advertising					
5815	Newspaper "					
5820	Letter campaign advertising					
5825	Outdoor "					
5830	Radio "					
5835	Film "					
5840	Shows and exhibitions "					
5845	Other "					
5850	Fees to advertising agencies					
5890	Credits for adv. mat. sales					
5800	Total Advertising Media					
×	Transfers					

TABLE 22—(*Continued*)

SUMMARY OF DISTRIBUTION EXPENSES

.....19..

Account		Factory Sales Dept.	New York Sales Office	Chicago Branch	Agents and Others	Total Distribution Expenses
No.	Name	Acct. 105A	Acct. 105B	Acct. 105C	Acct. 105D, E	Acct. 105
×	Transfers					
5910	Land improvements.. ..					
5915	Buildings... . ..					
5920	Machinery and equipment.					
5925	Tools					
5930	Furniture and fixtures . .					
5935	Company cars (maintenance)					
5940	Other maintenance...					
5900	Total Maintenance and Replacement					
5951	Rent and house service .					
5952	Electric current, light, heat, water....					
5953	Fire insurance.....					
5954	Other insurance					
5961	Local taxes, property . ..					
5962	Local taxes, sales.. . .					
5963	Local taxes, income, etc. .					
5966	State taxes, property.					
5967	State taxes, sales..... ...					
5968	State taxes, income, etc....					
5970	Automobile registrations ...					
5980	Amortization of leaseholds.					
5981	Amortization, others.. .					
5983	Depreciation of land improvement...					
5984	Depreciation of buildings...					
5985	Depreciation of machinery and equipment.. .					
5986	Depreciation of furniture and fixtures.....					
5987	Depreciation of automobiles					
5990	Share of general administration....					
5991	Share of general financial burden.....					
5950	Total Fixed Charges.... ..					
5000	*Total Distribution Expenses*..					

THE VARIOUS METHODS OF SELLING

Selling is the activity which creates business transactions and sees them through to their final fulfillment. Even the most humble chemical sales job requires a peculiar combination of chemical and business knowledge, common-sense thinking, research ability, willingness to do routine, getting on with people, and a good deal of that most valuable talent which gets things done quickly, quietly, and in a pleasant manner. Chemical industries have and need excellent salesmen, but there is no place for supersalesmen, machinegun talkers, slogan slingers, impressionists, or sales magicians. These kinds of sales performers probably succeed better in other fields.

Similarly, only some of the many possible and elsewhere practiced sales methods have found real acceptance in the industry. This does not mean that there is lack of variety and that the sales managers have no special tricks up their sleeves, but all in all, the methods which they use are pretty much the same.

Big Account Selling. Selling in large quantities to industrial consumers is the favorite hobby of chemical sales managers, even if they declare that it is golfing, stamp collecting, music, or other activities. Big account selling they relish and enjoy. To be honest about it, getting the big accounts it not merely a matter of selling the product on technical merits. These accounts are obtained through concessions made to the consumer companies. Obviously, a company using 100,000 tons of soda per year would not be managed properly if it did not attempt to obtain its whole supply from one or only a few sources, and did not give the order to the producer making the best offer. The lowest offer or the largest discount is, besides, not always the only desired objective in such negotiations. Reliability of delivery, promptness on short calls, flexible price arrangements, special freight stipulations—almost any clause in the contract may have to be strengthened or modified to obtain the big orders.

Special arrangements can be made, provided they are not exclusive and the same conditions are open to all. But that is quite often impossible, and there is the point where economic actions begin and mergers are considered, not for financial reasons but to protect sales conditions which can be granted to one or two but not to a greater number of big consumers. If no suitable arrangement can be made compatible with all established rules and laws, it often happens that the big account simply cannot be taken. But these are the cases where the experience, skill, and intelligence of the sales manager really begin

to show. It is his job to make suitable arrangements to get such accounts.

Carload Selling provides the bread and butter for the industry, and in most sales meetings the sales force is reminded that carload orders should be aimed for. There are reasons for this. For some products a carload corresponds to a convenient batch size; for others, only the lower carload freight makes shipments profitable; almost always the internal cost of handling less than carload shipments is considerably higher than carload handling. Finally, the principle of quantity production, upon which modern chemical manufacture rests, really needs quantity selling, not retailing. For these reasons the preference is for carload business.

Less than Carload Selling is rarely desired in the factory but usually cannot be avoided. Selling in lcl quantities means rendering the services of a distributor, and for some companies this problem means a basic decision of either being willing to do the more complicated routine or to sacrifice part of the potential sales volume. This will be done if it is not profitable or practical, or if there are sufficient middlemen to handle this business. It is strange that factory lcl costs always should be higher than they are in independent wholesale outlets doing the same business, but the fact remains that factory selling is more expensive. It is cut to a different pattern of distribution, and therefore will render lcl distribution always at a higher cost than an organization especially prepared for it. The biggest chemical producers, who are as much interested in less than carload as in carload business, therefore are solving the problem by building up not one distribution system but two, a factory sales organization and a wholesale-retail distribution system. Each is operated by a different staff according to a procedure best adapted to that type of distribution, thus obtaining maximum efficiency in each.

Merchandising Chemicals. "Merchandising" is so definitely a modern term and indicates such an up-to-date method of selling that even the unabridged Webster does not provide an adequate definition for it. Usually the term is used to indicate most intensified retailing, and therefore one can speak properly of merchandising only in reference to those chemical lines that are being retailed.

If attempted, merchandising is carried out by means of special sales campaigns, fancy containers, intensified advertising, special advertising copy, posters, display, and lower prices, and often enough it is undertaken on the basis of or in connection with a general expansion of the entire distribution system of the company. The out-

come of "merchandising campaigns" seems to depend as much on the suitability of the product for such selling as on the organization of the campaign proper. Most chemical products, however, must be "sold," sold in the good old way of showing, praising, proving, and proper pricing. Cellophane, drugs, package dyes, patent medicines can be merchandised; soda, acetic acid, turpentine, ammonia must be sold. Merchandising and the amounts spent for it (they can be high indeed) presuppose the existence of a readily expandable market; selling is aware of the need for more substantial efforts.

Sales Points—Strong and Weak. In choosing the sales approach which should be followed more or less closely by the entire staff in their everyday contacts, it is essential to find out just those features which will promote a chemical sale. A product can be presented to a prospective buyer in many ways. Some buyers must be approached differently from others, depending on personality, temperament, company circumstances, and other special considerations. But in the actual procedure of selling, after the product has been described there must be something said which makes the prospect decide for that offer and for no other one. What are those vital points upon which a chemical sale depends?

TECHNICAL ARGUMENTS

1. *Absolute fulfillment of quality* in line with user's specifications. Obviously it is better sales strategy to broach a sale on this basis than offering something different, better, more powerful, or cheaper. Materials or grades, meeting fully the requirements asked for, avoid production complications, and that is what most users desire more than anything else.

2. *Maintenance of uniform quality.* No one wants to buy a product if he is not assured of getting more of it if and when he wants it. Therefore he will be receptive to an assurance which tells him that he will have no trouble on this score.

3. *Savings* from the use of improved chemicals are always an attraction, but they will be closely checked by the customer and should be stressed only when they can be accompanied by a complete and honest report on the process and equipment changes which will be involved. This creates more confidence than mere claims.

4. *Better performance* of new or "improved" chemicals does not always find immediate enthusiastic reception. Quicker reactions often cause losses in appearance or quality of the final product and therefore it will alleviate suspicion if such facts are not considered in the presentation. The famous knock-out combination of more output, better appearance, less waste, and less cost is ten times

true, but ninety times sheer ballyhoo. Most buyers know this and act accordingly.

5. *Assistance* in form of service, laboratory facilities, and direct cooperation is only as strong a sales point as the prospect's need for such help. The acid test of assistance is usefulness. If the service which can be rendered is really useful, it should be recommended and, if it is good, the offer of service should be repeated.

COMMERCIAL AND GENERAL ARGUMENTS

6. *Price and conditions* are the first commercial information a buyer of chemicals usually asks for, and therefore they may be considered as perhaps the most important sales points, including technical qualities. A product that is not priced in line with competitive materials is of no interest to the technical buyer. Even for a patented product no fancy prices can be asked or it will lose out to a substitute or "next best" product. Similarly a sales policy which refuses freight equalization, returning of containers, and special discounts for cash payment and quantity orders is bound to lead to disappointment, regardless of how justified it may be.

7. *Reputation* of the company, its record, and its chemical achievements are more important than in other lines but not quite important enough to procure orders in themselves. Background and past achievements help only in combination with steadily maintained present performance.

8. *Quickness in response* and *thoroughness of action* in every kind of contact furnish probably the most convincing general proof to the consumer that his business is being given every attention. They inspire confidence and cooperation and have procured many a deal and new account for the more alert company.

Consumer Research is being used successfully by some of the producers of chemicals to investigate systematically the buying habits of actual or potential consumers and thus provide a basis for determining sales policies and practices. General information and details on the consumers and their various industries can be obtained through salesmen's reports, sales data from billings and statistical sources, and financial facts from the credit department. The mechanical end of consumer research consists of bringing the data together in the form of statistical tabulations. The facts can be compiled for each customer individually, by district and regional totals, by consumer industries, by product group totals, and finally they can be worked into overall summaries. The findings usually are extremely valuable and justify the expense of carrying out such a system, especially if cooperation from all salesmen and representatives is obtained by making the findings available to them.

The data can be used not only for obtaining information on the consumers, but on the sales force as well and on its performance in various lines and districts. By means of a few simple, well-chosen indexes, comparisons of efficiency can be made, and thus the judging of the staff can be put on a factual instead of a "personal impression" basis. Thereby great improvement in the relationship between sales manager and sales force can be obtained and also the management can get a better insight into the activities of selling, which otherwise is not possible. Driving and desk-pounding become superfluous. The hustling and bustling can be transformed into systematic, aim-conscious distribution, and by careful control of the results obtained its weaknesses can be determined and remedied as, where, and when necessary. Consumer research in combination with sales control is part of the modern, so-called scientific method of selling.

THE SALES CONTRACT AND ITS STIPULATIONS

When a sale has been concluded it is expressed in the form of an order. The order is confirmed and executed. If a sale has to be executed over a period of time, a sales agreement or contract is drawn up between the seller and the buyer. Salesmen know all the stipulations of a contract and what can and cannot be done under the conditions of their companies and of their industries in general. The newcomer to the industry, however, and a great number of those not connected with sales, are not familiar with contracts and the full meaning of contract terms, and it is for their benefit that a contract form is shown here. This form is actually being used by a leading chemical company.

Immediately noticeable in this contract is the absence of any standardized text for the main points: articles, quantities, duration, and prices. There are too many different possibilities that have to be provided for, and, to make the same contract form serve them all, the spaces are left blank to be filled out as circumstances require. The conditions deserve careful reading. They are representative of excellent standard practice and are neither too lenient nor too strict. In order to describe also the various stipulations which are customary in chemical selling and their economic meaning, the following comments are offered.

QUANTITY STIPULATIONS

In chemical selling quantities are always stated in those units which are customary in the trade. Deviations from this rule should be avoided unless important circumstances require it. Custom, tradi-

tion, and convenience are responsible for maintaining a great variety of units of measure, the most important of which are shown in the Appendix (Exhibit A).

The sender's weights govern, but it is up to the receiver of a shipment to verify the quantities delivered and to claim any differences against the shipping papers or his order. The quantities should be checked and differences reported within forty-eight hours or earlier if trouble is to be avoided. In serious cases differences should be attested by a neutral witness (railroad employee, shipping agent, or special representative of the Chamber of Commerce officially appointed for such tasks). On the other hand, petty claims should be avoided. It is easy enough to order 10,000 pounds of soda ash, but it is practically impossible always to ship this exact quantity. Therefore a shipment cannot be refused acceptance on the claim of incorrect weight as long as the differential is within reasonable limits (1 or 2 per cent). Unfortunately no definite regulation covers the matter of weight differences, and in case of dispute the respective trade association is the most likely agency for arbitration or advice.

QUALITY STIPULATIONS

Chemicals are bought as a rule for definite purposes which determine their quality requirements. Therefore most orders contain quality specifications which should be most carefully observed. Nevertheless, practical economy of production sets limits to the desire of meeting specifications, and even in the most carefully manufactured standard products no absolute uniformity of quality can be achieved year after year, batch after batch. In the regular business routine concessions as to quality fulfillment, therefore, must be made and are recognized as necessary. Without such practice quantity production would be impossible.

As a rule, satisfactory fulfillment of an order is constituted by any shipment which serves the stipulated purpose or is so close to the quality specified that its use does not cause inconvenience or extra costs to the user. If a shipment will cause inconvenience but not extra costs, delivery may be attempted without price concession, but efforts should be made to improve the quality in order to eliminate the inconvenience the next time. If extra costs are involved, the buyer either may refuse acceptance or ask for a price concession in line with his extra costs. Special compensation for damages, actual or imaginary, cannot

THE CONTRACT FORM

CONTRACT - DUPLICATE

THE SELLER

THE BUYER

The Buyer agrees to purchase from the Seller and the Seller agrees to sell to the Buyer upon the following terms and conditions:

ARTICLES

QUANTITIES AND DURATION

PRICES

PACKAGES

Packages to be invoiced at Seller's prevailing charge at the time of shipment as a deposit against the return of such packages; but credited same as charged when returned and received in good order, freight prepaid, F. O. B._____

TERMS

If the Buyer does not pay the Seller's invoices when due, the Seller shall have the option to refuse to make further shipments under this contract. Failure on the part of the Seller to exercise this option in case one or more invoices are not paid when due, shall not affect the Seller's right to subsequently exercise this option.

Should the Seller have any doubt at any time as to the Buyer's financial responsibility, the Seller may decline to make any [illegible] except on receipt of cash, satisfactory security, or sufficient credit information to satisfy the Seller of the Buyer's responsibility.

SHIPMENTS

CONDITIONS

The prices and terms incorporated in this contract are to apply on shipments up to , 193 , and it is hereby mutually agreed that the prices and terms herein quoted are subject to adjustment during the last 15 days of , 193 , covering shipments during the next succeeding quarterly period. In the absence of written notice from the Seller to the Buyer during the last 15 days of , 193 , regarding any contemplated adjustment of prices and terms for the ensuing quarter, it is understood that the prices and terms then in effect shall continue in effect for the next quarter. Failure of Buyer and Seller to agree on any proposed change in prices and terms releases the Seller of obligation to deliver and allows the Buyer to purchase elsewhere the required quantities for consumption during the quarter in question.

If the material covered by this contract is shipped in tank cars furnished by the Seller, the Buyer agrees that such tank cars will be unloaded within 48 hours (Sundays and holidays excepted) after receipt thereof.

Seller's weights to govern.

In case of failure of Buyer to furnish shipping instructions for any installment or quota, the Seller may consider such quantity as free from any obligation of subsequent shipment.

Such of Seller's returnable packages as are charged to Buyer shall be paid for without discount when the invoice for the merchandise is paid. Buyer shall use such packages only for storage of Seller's material originally shipped therein and shall return them promptly. Prompt package return is dependent upon the facts in each case and may be ten days or more; but in any event Seller reserves the option of refusing to accept packages retained for longer than six months from date they leave Seller's possession.

Any taxes, excises, or other charges which the Seller may be required to pay to any Government (National, State or Municipal), upon the sale, production or transportation of the commodities sold hereunder during the term of this contract, shall be added to the price specified herein.

The Seller guarantees that the merchandise is produced and sold free of valid infringement claims, but does not guarantee that the use thereof by the Buyer in conjunction with other materials will not infringe a patent.

There are no understandings or agreements relative to this contract that are not fully expressed herein and no Agent or Salesman has any authority to obligate Seller by any terms, stipulations or conditions not herein expressed. This agreement may be altered only by the written consent of both parties hereto.

Wars, fires, accidents, strikes, inability to secure crude materials necessary for the manufacture of the articles herein mentioned, or causes beyond the control of either Seller or the Buyer, or on transportation lines, rendering the Buyer unable to receive or the Seller to ship, may make this contract inoperative during the necessary repairs, rebuilding or continuance of difficulties.

This contract is not transferable or assignable by the Buyer, but shall be binding on and inure to the benefit of the parties hereto and their respective successors.

THIS CONTRACT SIGNED IN DUPLICATE
NOT VALID UNLESS COUNTERSIGNED

ACCEPTED BY

_____

_____ _____

_____ 19 _____ 19

COUNTERSIGNED BY_____

To face page 150.

be expected by the customer if the product was otherwise suited for the desired purpose.

Acceptance, however, can be refused if wrong, defective, or grossly impure merchandise has been shipped. For chemicals, no definite "tolerances" have as yet been established, which stipulate in simple percentages the allowable deviations. But many trade associations have established definite rules on standard qualities and methods of analysis which usually govern both parties. A complete summary and reference on standard practices for chemical products has been published by the U. S. Department of Commerce.[1] The publications of the U. S. Pharmacopœial Convention, Inc., the organization which publishes the Pharmacopœia of the United States, are almost indispensable to many chemical producers.

C. P. (chemically pure) chemicals are really non-existent. Every chemical contains some substances that are not the chemical proper, but the term C. P. is used to indicate the highest commercially achievable degree of pureness. C. P. specifications for all chemicals are described either in the Pharmacopœia or in one of the references cited by the National Directory.

Fulfillment of quality standards is one of the prime obligations of the seller, and to avoid trouble almost all chemical manufacturers analyze carefully every lot or batch that has been produced and record its number on the container when the material is shipped. The buyer can more or less assume the attitude of having "bought in good faith," but quite a few consumers have adopted also the policy of testing every incoming shipment as soon as possible after arrival and keeping the analysis records for reference purposes. There is no time limit for making quality claims, except for fats and oils traded under Commodity Exchange rules. These must be claimed within forty-eight hours.

In order to simplify the quality problems and make the buyer familiar with the product as he will receive it, many sales are made on the basis of samples drawn from the regular stock. These are furnished to the prospective buyer either free or at a nominal charge and are accompanied by an analysis and a description of the physical properties of the product. Provided that the delivery is from the same or a very similar batch, no dispute on quality fulfillment can arise.

In stipulating quality clauses and in seeing to it that they are fulfilled, the sales forces not only handle a vital part of the business but

[1] "National Directory of Commodity Specifications," Miscellaneous Publication 130, U. S. Printing Office, Washington, D. C., 1932.

also perform a most interesting economic function. Acting for both the enterprise and the consumer, they are really the forces which steadily cause the industry to achieve and maintain a higher level of quality. Production and research men are continually striving to provide new and better products, but it is the salesmen who constantly insist on getting better and still better things and so provide much of the stimulus for progress. It seems that the day-by-day insistence of the sales forces on "quality," and on the achievement of definite fulfillment of even the most minute details, is perhaps the most powerful and permanent source of evolutionary progress in the industry.

It should be a very interesting and highly practical economic undertaking to try to find out how much is really spent in any particular enterprise and in the industry as a whole, for achieving "quality" and thereby "progress." No one, so far, seems to have stopped to figure it out. But if one takes that part of production salaries and wages which was spent to obtain better than average employees, and adds all expenses for technical research, and also those extra amounts that have been paid to obtain not only the necessary but the best available equipment, and includes the extra amounts paid for only the best raw materials, fuels, and containers, then he will have figured out fairly well what "progress through quality" costs. The amount spent by the entire industry is undoubtedly high in the millions each year.

DELIVERY STIPULATIONS

Delivery clauses determine the exact time and the exact locality for the delivery of the products. All charges for handling, transportation, and insurance up to this time and place are carried by the seller and are, of course, included in the price. All charges after delivery have to be carried by the buyer.

Time Clauses. In order to keep their own investment in raw material stocks at a reasonable minimum, buyers stipulate definite dates when they desire delivery, and in chemical industries this is even more customary than in others. Thereby they force the seller to render extra service by living up to the stipulation. The time clauses are of special importance when large quantities of chemicals have been bought on a contract basis and either regular or irregular shipments are desired. Dependent on the arrangement, buyers may call for prompt or immediate shipments (within two days), or short deliveries (within eight or ten days), or shipment at daily, weekly, monthly, or any other intervals.

It is rather interesting that by the gradual increase in the severity of delivery conditions the speed of chemical distribution has been greatly accelerated, and that today more chemicals are shipped by rail (82 per cent of all outgoing shipments) than by water freight (12 per cent outgoing). The latter is not entirely eliminated by any means, and perhaps is increasing again owing to higher railroad rates and seaboard location of plants, but rail and truck shipments are better suited to the quicker modern tempo that now prevails in the industry. This has increased the cost of distribution for the seller in some lines quite considerably, and the buyers usually are the main beneficiaries. They save in investment, while the producers have to carry sufficient stock to fulfill regular as well as irregular specifications. In the course of a year considerable additional capital must be invested in chemical inventories, and extra expenses are paid by chemical producers for higher freight charges, an item hardly ever mentioned among the contributions of the chemical industries to industrial economic progress.

Those interested in figures will find these statements confirmed by the fact that chemical wholesale distributors, for instance, obtained only 8.73 inventory turnovers in 1935, while the entire wholesale trade of the United States achieved 10.34 stock turnovers during the same year. Offhand this means that approximately 20 million dollars out of 163 million dollars worth of wholesale trade stocks had to be carried for special accommodation purposes. If in the factories only 30 million dollars worth of additional inventory were carried for the same purpose, a total of 50 million dollars was invested for accommodation in deliveries alone. This is a sizable amount indeed!

Locality Clauses. F.o.b. factory delivery is the simplest and for the seller most convenient delivery clause. It means that the seller delivers the goods at the factory "free on board" the vehicle which is used for transportation. F.o.b. includes loading, and in chemical shipping it also means that all provisions have been made to comply with the rules and regulations possibly established for this kind of shipment. This is definitely the responsibility of the shipper and involves sometimes considerable extra services which he has to provide but cannot always charge to the buyer.

Spot Delivery. Unless the seller states differently, spot delivery is understood to be prompt delivery (within two days) in the seller's own or in some rented warehouse. The buyer, therefore, has to arrange for prompt removal of the goods. In public warehouses rent for space is paid on a monthly basis, and if the buyer delays removal until after the seller's rent has expired, he has to pay rent of his own; he

may also have to pay insurance and handling charges for shifting the goods to some other place within the warehouse if the seller needs his space.

Freight allowed delivery means that the entire freight charges to the buyer's place are paid by the seller.

C.i.f. delivery indicates that the seller pays "cost, insurance, and freight" to the main freight station of the locality indicated, but not more. There may be local transfer, shunting, handling, and agent charges which are not his concern. In overseas shipments c.i.f. covers all inland freight charges to seaboard, handling in seaport, ocean freight, and insurance to the port of destination. All unloading and local charges there have to be paid by the receiver or his agent.

F.a.s. delivery is delivery "free alongside" ship or railramp and does not include handling or loading unless these charges are expressly included.

Ex dock, a phrase used frequently in reference to naval stores delivered in southern ports, indicates that the goods are delivered on a specified dock of a specified port. Ex dock New York, in reference to imported goods, means goods unloaded on the New York dock ready for reshipment to inland destinations at the expense of the buyer.

Ex factory or *ex warehouse* means goods ready, but not loaded, in these places. Factories and distributor warehouses usually do not charge for loading, but public warehouses do.

Nearby delivery may be actually near by, but if, for instance, it refers to soy bean or soy bean oil import shipments, it may just as well designate delivery in any port on the Pacific coast. This is really near by, if contrasted with *Far East* delivery which means any Far Eastern port at the seller's option. Freight from any one of them to San Francisco is almost the same.

American chemical industries buy from and ship to every state of the union, import from and export to almost every country on earth, and thus deliver or take deliveries in tens of thousands of localities. The amazing part in these transactions is that all these actual exchanges of enormous quantities of material are carried out so smoothly and so efficiently that they hardly attract attention, or are reported merely as matters of fact. But it should not be overlooked that the industry is giving business to every kind of transportation company and indirectly provides livelihood for tens of thousands of freight brokers, transportation agents, customs officers, railroad employees, sailors, handling clerks, and warehousemen, all of whom are needed in these delivery processes and in the fulfillment of delivery clauses.

Thus further economic service is rendered by the industry in a measure which very conservatively may be appraised at 10 per cent of the annual total value of sales. This would amount to 300 million dollars in any year when 3 billion dollars worth of chemicals were produced and sold. At present, sales are considerably higher.

PAYMENT STIPULATIONS

Payment of bills aggregating 3 billion dollars or more per year is an enormous financial transaction and in its totality as well as in its details needs careful consideration and proper policies, suited to individual payments ranging from a few cents to hundreds of thousands of dollars. The payment clauses, therefore, are as important as any others.

If cash payment is insisted upon by a company, it need not borrow extra money to finance credit extensions. Its money makes no economic detours and remains fairly constantly in productive use. If only short credits are extended to the buyers, probably some extra capital will have to be borrowed and part of the industry's or company's money will be tied up in bills outstanding, but if the detour is limited to a brief period, up to thirty days' credit as an average, the burden will be bearable. If long credits are granted, from thirty days to six or twelve months, as can be observed in the automobile, furniture, and similar trades, considerable amounts of money have to be borrowed, special financing organizations have to be created, and finance charges have to be paid by sellers and buyers. These are the basic facts which should be considered in establishing or scrutinizing payment clauses.

Different chemical companies naturally follow different credit policies, but, if generalization is possible, they neither insist on cash payment nor do they extend long credit terms. The basic rule in selling to industrial consumers was and pretty well still is: net payment within thirty days. However, in order to stimulate earlier settlement, especially within ten days, many companies allow 2 per cent extra discount for such payments. Such a payment clause frequently reads: "payment within thirty days or 2 per cent discount for cash in ten days." In sales to wholesalers and others who receive many shipments during a month and are dependent on more favorable credit terms, many companies also permit monthly settlement on the tenth or twentieth proximo (next month). They also allow 1 or 2 per cent for earlier payment, depending on policy.

Installment payments and fancy credit schemes have not as yet been "achieved" by the industry. Proposals of this kind brought up in the paint and varnish industry in 1926 were only of short-lived interest. The industry does not deal as yet to a great extent with the ultimate consumer and therefore does not need this kind of sales promotion. Nor do many companies try any more to demonstrate their "liberality" through their credit terms. The "customary" terms are fairly well observed by all, and buyers that are to be favored are not treated to a discount cascade of "twenty per cent and ten and five and two for cash," as is customary in some trades. They simply are quoted a lower price.

The days when price cutting and condition chiseling were in vogue are definitely gone. The prices for chemicals are so low by now that they do not permit drastic experiments, and the last depression has definitely disclosed that progress in selling is not achieved by sharp practice.

CHAPTER 9

CHEMICAL PRICES

HISTORY OF CHEMICAL PRICES

From the days of the Pharaohs until long after the Middle Ages, chemicals were definitely expensive. Those who could make substances that had magic powers or produced unusual effects could well ask a high price and reward themselves in line with the value of their product as determined by its scarcity and by the uses it filled. Roman dyers could pay very high prices for Egyptian alum and natural saltpeter, Spanish copper salts, Sicilian sulphur, and Adriatic purple, because it was only to the very rich that they sold the goods which they dyed with these materials. In the early days doctors prepared and handled most of the chemicals known, and their prescriptions against poisons and illnesses were worth a high price to the patients, even if it were only verdigris which was applied to cure eye trouble, or very impure copper sulphate to relieve epicureal overindulgence. Modified vinegars, used as tonics for rich Romans; lion fat from Africa; bear fat from the Alpine mountains; snake, dragon, and turtle fats from Asia, applied for kidney and liver troubles; and turpentine for embalming, were worth their weight in gold. Spanish cinnabar, used by painters, sold for 70 sestercii per Roman pound (approximately 3.15 gold dollars for 11 ounces), and emperor Cajus was willing enough to pay 4 pounds of gold for 10 pounds of cadmium sulphide because he believed it could be turned into that precious metal.

Even 1,500 years later, when French, Spanish, Dutch, and English traders ventured forth into new lands and after two or four years' absence brought home new spices, precious stones, new dyestuffs, perfumes, and chemical raw materials in larger quantities, prices did not come down appreciably. The silk and velvet dyers of Lyons, the linen industries of Flanders and Brussels which gradually came into being between A.D. 1200 and 1500, the soap makers of Marseilles, London, and Amsterdam, the painters, glass makers, hatters, tanners, and armorers of France and Western Europe—all used more chemicals than had been used in the days of Rome, but they did not pay much

less for them in their respective currencies. Potash, the most-used chemical of those days, cost in Amsterdam 6 to 10 silver florins per load (150 kg.) in 1500, but rose in price to 100 florins in 1522. The same load of potash could be bought in Denmark for 11 to 20 silver shillings plus freight at its cost to the buyer. This was considerably more than was paid for a serf. When during the wars of reformation Rome condemned the "devil's dyes, deceitful dogwood and chemistry in toto," prices for chemicals went so high that non-Christian Dutchmen, who, unhampered by these religious teachings, took over the chemical trade, made fortunes in dyes, drugs, oils, fats, spermaceti, and similar materials.

Only after the French revolution, when the French government again encouraged the chemical sciences and manufactures and the new machine industries began to create new markets, did the supply of chemicals gradually increase in every land and chemicals begin to lose their rarity values. The discovery of new processes for making cheaper substitutes (Leblanc soda for potash, etc.) not only filled the increasing demand, but finally sent prices of chemical products on their downward trend.

France and England became the main producers of the new chemicals, and, because after the revolution and devastations of the Napoleonic Wars the European consumers could not pay other than minimum prices, the chemical producers began to consider and calculate the actual costs of production. A new era of chemical prices began to dawn, which took into account that most of the final goods then made by machines were made not for the knights and nobles but for the middle classes, the farmers and the people.

But, as yet, chemicals were not by any means cheap. In 1800 Tennant sold his bleaching powder, chloride of lime, made in the St. Rollox works in Glasgow, for £140.0.0 per ton or 1 shilling 5 pence per pound. This would have corresponded to $680 per ton.[1] Potash sold then for £100.0.0 to £140.0.0 per ton, and sulphuric acid brought £50.0.0 to £70.0.0.

In 1863, two years before the first Solvay soda was placed on the market, the total production of 300,000 tons of the Leblanc product then made in England sold for about £13.0.0 per ton. Solvay asked the same price at first, but owing to competition the price of soda came down to £11.0.0 per ton in 1874. By 1885 the price was only £4.16.0, and from there it was reduced to £4.0.0. in 1902 and £2.2.6 in 1913.

[1] Stephen Miall, "A History of the British Chemical Industry," Benn, Ltd., London, 1931, p. 3.

ABSOLUTE CHANGES IN AMERICAN CHEMICAL PRICES

So long as the United States relied upon foreign producers for its chemicals, prices here remained high. It was necessary that they at least cover prices abroad plus freight, 15 per cent duty, and trader's profit. Naturally enough the price level thus established encouraged chemical production in the United States and made it even more profitable than it was in England. The early American producers thus were not forced to develop elaborate price theories or cost formulas. The import prices set the upper ceiling and simply were adopted for the domestic products. These facts explain the high profits reported for the earliest American chemical producers.

The same price policies were followed until domestic production reached such an advanced stage that real competition among producers began. But even before that prices here followed those in England in a gradual downward trend. In 1807 Harrison sold the first American-made sulphuric acid for 15 cents per pound or $300 per ton. In 1830 one pound cost only 12 cents, in 1865 8 cents, and in 1880 60° Baumé acid could be had for 1.1 cents or 60° Baumé acid for 1.6 cents per pound.

The 1880's mark the beginning of real industrial production and chemical expansion, and therefore it should be of special interest to see where chemical prices and their common price level stood then, what has happened to them since in peak years and depression times, and where they are today.

ONE POUND OVERALL COST 2.6 CENTS

In 1880, when the U. S. Census of Manufacturers for the first time listed "chemicals" as a separate group, these products were already cheap—quite cheap, if compared with previous levels—but they were bound for further decline in their absolute values.

The figures shown in Table 23 are neither complete nor absolutely correct, but nevertheless they bear out the following statements:

1. American chemical manufacturing already had become a "penny business" in 1880. That year the industry sold at least 60 per cent of its entire output at an average price of 2.6 cents per pound.
2. Since then prices for most chemicals have been reduced further.
3. The recent increases in prices expressed in paper dollars are in reality no increases. If these prices are expressed in terms of gold dollars (1 paper dollar = 0.59 gold dollar), as they should be

TABLE 23

ABSOLUTE CHANGES IN CHEMICAL PRICES IN THE UNITED STATES

1880, 1914, 1929, 1932/33, 1937

Data for 1880 based on census. Subsequent as reported by census or trade papers

Product	1880		1880	1914	1929	1932/33	1937	
	Pounds Produced	Value	Cents per Pound					
			Average	Average	Highs	Lows	Paper	Gold
Coal-tar dyes	80,518	$107,292	133.00	38.23	45.00	44.00	56.00	33.04
Anthracene	344,114	99,242	29.00	.....	.....	.....	40.00	23.60
Ammonia sulphate	16,575,088	618,485	3.73	3 01	2.40	0.90	1.35	0.80
Alum	39,217,725	808,165	2.06	1.06	3 30	3.00	3.00	1.77
Borax	3,692,443	277,233	7.51	3.91	3.25	1 80	2.10	1.24
Bromine	404,690	114,752	28 36	35.20	47.00	36.00	36.00	21.24
Phosphorus, red	56,292	29,271	52.00	43.64	32.00	27.50	42.00	24.78
Castor oil	893,802	790,741	88 47	65.00	13.50	9.50	10.50	6 20
Stearic candles	18,363,066	2,281,600	12.42	Mostly replaced by electricity				
Oleic acid soaps	33,058,411	1,707,969	5.17	5.35	18.49	13.95	10.40	6.14
Other hard soaps	378,743,627	18,299,350	4.83	5 06	6.27	3.51	8.90	5.25
Soft soap	34,494,100	358,280	1.04	2.98	5.97	5.31	11.00	6.49
Glycerine	7,117,825	961,477	13.51	18.02	16.00	9.75	25.00	14.75
Nitroglycerine	3,039,722	1,830,417	60.22	25.11	12.00	7.25	25.00	14.75
Fertilizers manufactured	1,454,906,000	19,921,400	1.37	0.91	1.19	0.85	1.21	0.71
Dry colors	67,482,415	4,086,821	6.06	5.10	6 08	5.30	7.50	4.43
White lead	123,477,800	8,770,699	7.10	5.16	9.25	5 85	8.00	4.72
Other lead salts	11,375,466	758,680	6.67	5.60	8 75	5 50	9.00	5.31
Ground barytes	38,330,000	371,829	0.97	0.70	1.20	1.10	1.18	0.70
Zinc oxides	20,121,761	766,337	3.81	5.00	7.62	4.85	5.90	3.48
Acetate of lime	6,593,009	156,892	2.38	1.31	4.50	2.00	2.18	1.29
Potash and perlash	4,571,671	232,643	6.25	1.21	7.12	6.00	6.38	3.76
Soda	40,259,938	866,560	3.00	0.76	1.40	1.15	1.25	0.74
Sulphur	1,200,000	21,000	1.85	1.83	0.93	0.90	0.90	0.53
Sulphuric acid	308,765,432	3,661,876	1.10	0 33	1.65	1 50	0.80	0.47
Total listed	2,613,164,915	$67,899,011	2.60	....	.....	.....	.....	.....

to become comparable with previous ones and to establish their true international value, they show American chemicals priced lower than ever.

4. The price of chemicals was then, as it is now, much lower than the price per pound asked for other commodities or products, for instance, steel, meat, flour, sugar, glass, cotton, wheat, wool, etc. This, no doubt, explains why chemical products have made and will make further progress in satisfying human wants.

Thus, taken on an absolute basis, chemical prices in the United States have continued their downward trend which has been so characteristic since commercial manufacture began. The 1932 lows seem to represent the minimum at which production remains desirable. How far prices will decline, expressed in gold, will depend partly on the further manipulation of the value of this basic measure of prices. The same manipulation will also partly determine the extent of the rise in paper values.

In the main, the decline in prices is mostly attributed to technological improvements and unrestricted competition. There is no denying the fact that modern equipment and the gradual transition of production from laboratory batches to industrial quantities has caused savings and therefore the price decline. The question remains, however, how much longer the five-billion-dollar investment of the industry can be further subjected to the unchecked and uncontrolled continuation of these technical influences and competitive pressure at the same time. Their combined effect, expressed in lower and lower prices, represents perhaps the greatest danger threatening the industry today. If modern sociology and government policies are looking for new inventions to keep the nation prosperous and her people occupied, it seems that finding the proper ways and means of preserving one of the greatest assets which the country already has is just as important as, and probably nearer home than, all kinds of fantastic speculations in new fields of engineering or economics.

RELATIVE CHANGES IN CHEMICAL AND OTHER PRICES

One becomes more thoroughly confirmed in the above opinion if he considers not only the absolute decline of chemical prices but also their position relative to the prices of other products. These movements are usually shown by means of "index" figures which express the prices prevailing at any given time as percentages of those that prevailed at some other period. On the choice of the "base" period depends the informative value of the index series. By choosing a high-

price year as the base period, high prices can be made to appear as "normal" or relatively little increased; by selecting a low-price year as the base period, high prices can be made to appear very high and all kinds of wrong conclusions are likely to be drawn.

In order to provide really true information on prices particular care must be exercised in choosing a base year. It should be one in which the various prices appear to have been in a well-tested and therefore good relationship to one another. The U. S. Department of Labor, which compiles price index series, uses the year 1926 as a base, which indicates its belief that in this year the various prices were properly attuned to one another. Those who work much with prices, however, know that 1926 cannot be really representative of ideal or normal price conditions and interrelationships. In 1926 prices were not yet fully deflated from war-time influences and at the same time were further affected by the new and all-embracing credit boom and financial experimentation which prevailed and three years later brought on the crisis of 1929. Therefore, 1926 prices do not appear to be a very suitable base for a really informative demonstration of price movements. The last time prices were in normal relationship and the country was economically healthy was in 1913 and 1914, and therefore either of those years is bound to furnish a better base than any later year for showing the real movement of prices. It is interesting to know that, after much useless experimentation with various base years, many English and German indexes are now again based on 1913 or 1914 conditions.

In order to visualize the behavior of chemical wholesale prices and their changes relative to those of other products during the last twenty-three years, various index series are shown in Table 24 as they are presented by the Department of Labor, and in Table 25 they appear recalculated to correspond to the base of 1914 = 100. The reader may decide for himself which series furnishes the more useful information.

These data reveal that:

1. Chemical prices have paralleled none of the other price movements. According to the series compiled by the Department of Labor, their trend since 1922 is close to that reported for the 582 finished products, but the cross check on the basis of 1914 = 100 reveals that even these two series did not follow the same movements.

2. The notorious chemical price increases during the war were not out of line if compared with those of other commodities, and since then chemical prices have not been as high as those of other products. Chemical prices have remained definitely below the general price trend

TABLE 24

RELATIVE CHANGES IN CHEMICAL AND OTHER PRICES, 1914 TO 1937

Data from Wholesale Price Indexes, U. S. Dept. of Labor

1926 = 100.0

Year	89 Chemical Products	582 Finished Products	109 Raw Materials	93 Semi-Mfd. Goods	11 Grains	12 Cattle and Poultry	7 Leathers	64 Iron and Steel Products	20 Metals and Metal Products	36 Cotton Goods	14 Silks and Rayons	11 Papers and Pulps
1914	81.4	67.8	67.6	70.0	77.1	74.6	72 5	61.4	76.3	56.0	71.3	58.2
1915	112.0	68.9	67.2	81.2	93.8	68.6	75.8	64.7	108.6	52 3	68.3	56.7
1916	160.7	82.3	82.6	118.3	99.6	82.8	107.2	109.7	160.2	68.7	87.1	89.0
1917	165.0	109.2	122.6	150.4	170.4	119.4	141.9	176.7	165.7	98.7	98.4	112.7
1918	182.3	124.7	135.8	153.8	168.6	141.0	135.3	144.4	144.4	146.6	116.4	106.7
1919	157.0	130.6	145.9	157.9	177.4	148.7	187.5	118.9	118.9	147.5	145.5	115.1
1920	164.7	149.8	151.8	198.2	176.4	125.1	188.2	118.3	118.3	190.7	162.7	181.8
1921	115.0	103.3	88.3	96.1	89.1	78.2	111.7	78.3	78.3	99.5	110 5	107.6
1922	100.3	96.5	96.0	98.9	85.0	83.2	105.2	83.5	83.5	104.3	121.0	91.6
1923	101.1	99.2	98.5	118.6	88.0	77.7	104.1	117.3	95.3	116.9	129 5	102.8
1924	98.9	96.3	97.6	108.7	100.6	79.3	99.8	109.4	93.0	114.7	103.1	100.7
1925	101.8	100.6	106.7	105.3	118.3	98.9	104.8	102.2	101.4	110.0	104.5	105.2
1926	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1927	96.8	95.0	96.5	94.3	100.9	98.9	109.2	94.2	92.8	97.1	87.1	93.8
1928	95.6	95.9	99.1	94.5	107.3	105.4	126.3	93.5	95.1	100.4	83.7	91.4
1929	94.2	94.5	97.5	93.9	97.4	106.1	113.2	94.9	106.1	98.8	80.4	88.9
1930	89.1	88.0	84.3	81.8	78.3	89.2	101.3	89.1	82.4	84.7	60.2	86.1
1931	79.3	77.0	65.6	69.0	53.0	63.9	86.2	83.3	61.9	66.1	43 5	81.4
1932	73.5	70.3	55.1	59.3	39.4	48.2	65.1	79.4	49.8	54.0	31.0	75.5
1933	72.6	70.5	56.5	65.4	53.1	43.4	71.4	78.6	59.6	71.2	30.6	76.6
1934	75.9	78.2	68.6	72.8	74.5	51.5	75.0	86.7	67.7	86.5	26.7	82.7
1935	80.5	82.2	77.1	73.6	82.5	85.1	80.1	86.7	68.6	83.4	30.2	80.0
1936	80.4	82.0	79.9	75.9	88.3	84.7	85.6	87.6	87.0	80.3	31.2	80.7
1937	83.9	87.2	84.8	85.3	98.3	95.5	96.8	98.2	95.7	84.3	32.5	91.7

TABLE 25

RELATIVE CHANGES IN CHEMICAL AND OTHER PRICES, 1914 TO 1937

Data calculated from Wholesale Price Indexes

1914 = 100.0

Year	89 Chemical Products	582 Finished Products	109 Raw Materials	93 Semi-Mfd. Goods	11 Grains	12 Cattle and Poultry	7 Leathers	64 Iron and Steel Products	20 Metals and Metal Products	36 Cotton Goods	14 Silks and Rayons	11 Papers and Pulps
1914	100.0	100 0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1915	137.6	101.6	99.4	116.0	121.7	91.9	104.6	105.4	142.3	93.4	95.8	97.4
1916	197.4	121.4	122.2	169.3	129.2	111.0	147.9	178.7	209.9	122.7	122 2	152.9
1917	202.7	161.1	181.4	214.9	221.0	160.1	195.7	287.8	217.2	176.3	138.0	193.6
1918	223.9	183.9	200.9	219.7	218.7	189.0	186.6	235.2	189.3	261.8	163 2	183 2
1919	192.9	192.6	215.8	225.6	230.1	199.3	258.6	193.6	155.8	263.4	204.1	197.8
1920	202.3	220.9	224.6	283.1	228.8	167.7	259.6	192.7	155.0	340.5	228.2	312.4
1921	141.3	152.4	130.6	137.3	115.6	104.8	154.1	127.5	102.6	177.7	154.9	184.9
1922	123.2	142.3	142.0	141.3	110.2	111.5	145.1	135.9	96.3	186.3	169 7	157.4
1923	124.2	146.3	145.7	169.4	114.1	104.2	143.6	191.0	124.9	208.8	181.6	176.6
1924	121.5	142.0	144.4	155.3	130.5	106.3	137.7	178.2	121.9	204.8	144.6	173.0
1925	125.1	148.4	157.8	150.4	153.4	132.6	144.6	166.4	132.9	196.4	146.6	180.8
1926	122.9	147.5	147.9	142.9	129.7	134.0	137.9	162.9	131.1	178.6	140.3	171.8
1927	118.9	140.1	142.8	134.7	130.9	132.6	150.6	153.4	121.6	173.4	122.2	161.2
1928	117.4	141.4	146.6	135.0	139.2	141.3	174.2	152.3	124.6	179.3	117.4	157.0
1929	115.7	139.4	144.2	134.1	126.3	142.2	156.1	154.6	139.1	176.4	112.8	152.0
1930	109.5	129.8	124.7	116.9	101.6	119.6	139.7	145.1	107.9	151.3	84.4	147.9
1931	97.4	113.5	97.0	98.5	68.7	85.7	118.9	135 7	81.1	118.0	61.0	139.9
1932	90.3	103.7	81.5	84.7	51.1	64.6	89.8	129.3	65.3	96.4	43.5	129.7
1933	89.2	103.9	83.6	93.4	68.9	58.2	98.5	128.0	78.1	127.1	42.9	131.6
1934	93.2	115.3	101.5	103.8	96.6	69.0	103.4	141.2	88.7	154.5	37.4	142.1
1935	98.9	121.2	114.1	105.1	107.0	114.1	110.5	141.2	89.9	148.9	42.4	137.5
1936	98.8	120.9	118.2	108.4	114.5	113.5	118.1	142.7	114.0	143.4	43.8	138.7
1937	103.1	128.6	125.4	121.9	127.5	128.0	133.5	159.9	125.4	150.5	45.6	157.6

and are in a class by themselves. They have been "weak" since 1919. Various reasons could be given, but the anxiety of obtaining volume in order to use as much as possible of the available plant capacity and the absence of any common price policy are most likely the real causes. The industry has reached technologically and competitively the state where it is forced to maintain a lower price level than other industries. A glance at the relative position of silk and rayon prices, which really should be shown in segregated series, confirms this conclusion and also casts a most ominous shadow upon the farflung expansion undertaken by this industry in recent years.

3. On the other hand, the indexes of chemical prices reveal a more steady transition from one price level to another and show the absence of panic prices such as can be found in the food, metal, and raw-material groups. Even in depression years and in the state of most intense competition, the tremendous costs of maintaining the plants simply prevents prices from being lowered below the critical minimum level which seems to lie a trifle below the 1914 basis.

PRICE SETTING AND ITS INTRICACIES

Price setting is an economic art as important as forecasting, but the factors involved are much better known and can be considered with greater mathematical definiteness. Although there are only a few pricing methods the application of which seems economically justified—and one would assume that by now all the sad results obtained with wrong pricing methods would induce all companies to use them—it appears that a good deal more of bitter experience will have to be gathered before everyone will have learned to do what is right and best for himself and for all.

The "adoption" of market prices, which is considered by many as the best pricing policy, is merely the most convenient method of price setting, not the best, because it neglects the fact that there are and should be considered definite relationships between prices, sales volume, costs, expenditures, and profits. Before any market prices are "adopted" they should at least be tested to see whether they will fit the peculiar conditions of the enterprise. If prices are not fitted to volume and costs like a tailor-made suit to the body, the effects will be just as unsatisfactory and the best operating technique may be frustrated. When calculating prices, a definite volume and carefully established expenditures have to be determined.

Price setting on the basis of "normal" conditions, another often-

recommended method, is hardly possible because there is no assurance that "normal" conditions prevail or that "existing" conditions will continue. As a rule they do not, and therefore the best policy which one can adopt is that of trying to estimate conditions and to price according to plans and changes that can be foreseen. In such a policy lies the secret of proper pricing.

Also convenient, but only of legal value, is the practice followed by many companies of protecting themselves and their prices by "open price clauses" which give them the right to change prices as and when they find it necessary. Occasionally there may be real reason for applying the clause, but the danger in this method is that frequent price changes are irritating and affect sales because the buyers begin to withhold or increase orders so as to get the maximum benefit from the price uncertainty. As also considerable and costly work is involved in supplying the whole distribution apparatus repeatedly with new factory price lists, prices should be established and upheld for periods of three, six, or preferably twelve months, or at least for an entire season.

As individual pricing of hundreds or thousands of different chemicals made by some companies is impossible, and chemical processing rarely furnishes only one specific product at a time, price calculations should be made for logically established groups of items, the costs of which will be lumped at first and treated as a combined unit until the theoretical sales value of the group is determined. This method of pricing does not segregate by-products from main products until at the very end of the procedure, nor does it attempt complicated cost allocations to individual products, a practice which usually results in artificial prices and wrong production policies. The greatest advantage of "group pricing," as the method may be called, is its suitability for determining whether market prices are profit prices or whether their use means a loss to the company.

THE ROUTINE OF PRICE SETTING

In almost every company the setting of prices is considered highly confidential and therefore only relatively few people come to acquire a real pricing knowledge. And yet it is very important that every employee have at least a definite understanding of the fundamentals of this job, because only then can he do his best in keeping the many elements which make up the price in line with what has been planned. Good price setting does not begin with experiments involving final prices, but attempts to arrive at them by the most careful determina-

tion of all the costs that the prices finally will have to cover. In order to show in detail the various elements which make up a price and to explain how they should be dealt with, the following comments are offered:

Cost of Material. The costs of raw materials needed for the manufacture of any of the established product groups should be carefully calculated on the basis of raw-material prices that will have to be paid during the pricing period. If no price changes are expected, latest material prices should be applied to the quantity data furnished by the manufacturing department. To the cost of raw materials should be added as special items the cost of *incoming freight* on material shipments, *container charges, credits for returns,* and any *other costs* that may arise in bringing raw materials into the plant. Provision must be made also for *handling, analyzing,* and *storing,* which may be reported combined as *handling charges.* For most chemicals these combined "costs of material" represent the major cost group of the final wholesale price, and therefore these items are the foundation upon which the entire price structure rests.

Cost of Labor. In mechanical industries great pains are taken to distinguish between direct and indirect labor, but in chemical industries any too careful distinction between these two kinds of labor is well-nigh impossible, because the "indirect" helper, for instance, who merely grinds part of the product to powder, actually does more direct work than the "direct" worker who has supervised the processing in the autoclave. Similarly it would be difficult to allocate the wages of a man who has to supervise a process (direct labor) and also maintain and repair the equipment (indirect labor), to two different cost-of-labor categories. Therefore for pricing purposes the cost of labor may well include all wages paid with the exception of the maintenance crew, if there is one. Total wages should be distributed as carefully as possible among the product groups on the basis of man-hours needed for each.

Manufacturing Expenses. Under this heading such a great number of different production costs is collected that for pricing purposes details should be avoided. Manufacturing expenses include: the salaries of the production staff, including foremen on a salary basis; the entire cost of the research staff and laboratory, reduced by the credits for routine analyses made for the material and sales departments; maintenance personnel; maintenance and operating material used for keeping the plant and equipment in operation (asbestos, cotton waste, grease, cocks, valves, packings, etc.); tools; fuel, water, electric current, light,

steam, gas, compressed air; the costs of depreciation and obsolescence of land, rent of floor space, land improvements, apparatus, equipment, cranes, conveyors, pipe lines, etc.; maintenance of lagoons and lanes; sums needed for shop alterations and changes; minor appropriations; all taxes for land, property, or water used in production and other assessments by local and state authorities; removal of waste; and last but not least provision for a reserve to be used as and when occasion arises for the purchase of additional equipment. The Bureau of the Census includes containers, fuels, and electric current with the cost of material, but this is not customary industrial practice.

The manufacturing expenses should not be distributed on a uniform percentage basis in line with cost of labor but should be allocated most carefully to the various groups according to actual production conditions and as they are really caused. Regrettable as it is, many production men and even cost accountants tend to load more manufacturing expenses than are justified on some products and less on others in order to arrive at "more likely" prices. Such distortion of technical truths is highly undesirable and against the best interests of the company, which should be: to make and sell at profit only those products which it can in consideration of true costs. If the manufacture and selling of certain high-cost products is insisted upon, their true costs should at least be known. The list price, not the manufacturing expenses, is the place to make price adjustments.

Containers are not raw materials, nor do they find a proper place among the manufacturing expenses. As without them the products cannot be sold, or even placed at the disposal of the sales department, they are definitely part of the cost of production and should be included in the price, unless it is customary to make a special charge for them. For price calculations in either case the costs of containers should also provide for repairing, cleaning, and reconditioning. The total should be allocated to the various product groups at actual cost.

Cost of Production is such an important figure in any price calculation that it should be established as the sum of cost of materials, labor, manufacturing expenses, and containers. It represents the critical minimum below which products should not be sold under any circumstances, not even to the most-favored branch or consumer, because at such a price they contribute nothing to the cost of distribution or to the financial requirements of the company. These cost elements must always be determined and added to the costs of production. The difference between cost of production and final net sales price is called *gross profit.*

Selling Expenses. The many items which make up selling expenses have been named before. Their repetition in the pricing formula would make it unwieldy, and therefore only the required total selling expenses should be added to the costs of production and distributed among the various product groups. Two methods of distribution are possible: (*a*) in proportion to the costs of production so far determined for each group, or (*b*) allocation on a weight basis. The first method seems to be the more desirable because prices so established provide for the distribution expenses in line with the value of the product groups. Expense allocation according to the weight of the final products represented in each group is advisable only when there is little difference in the per unit value of the various products. If there are great differences, the highly competitive bulk products probably are charged too large and the high-value products too small a portion of the total cost of distribution. In some instances this may and in others it may not be the most desirable way of allocation. A brief analysis of actual conditions will easily reveal the most desirable allocation procedure, in which the sales manager should consider further any other special selling conditions or distribution arrangements applying only to individual groups.

Freight Equalization and Shipping Charges. These charges have been considered part of the selling expenses but may be shown separately in the price calculation if circumstances warrant. Similar considerations may be applied to special allowances, discounts, and all other items deserving special treatment in distributing them by groups.

General Administration Expenses. Obviously there must be included in every price a certain amount to cover those "general" expenses which are not directly allocable to the products but nevertheless must be provided for in order to maintain the chief executive offices, personnel department, legal staff, patent and trade-mark department, advisers, bookkeeping and treasurer's offices, stenographic and mailing sections, and similar general activities. Distribution of these costs should always be in line with the cost values of the product groups.

Financial Requirements. So far only a few of the financial requirements have been included among the cost elements: actual depreciation, amortization, and obsolescence of plants, land, properties, and equipment used for manufacturing and distribution. But considerably more must be provided to create the necessary reserves for all properties, inventories, royalties, sinking fund, contingencies, minority interest, bond redemption, subsidiary investments, new expansion, raw-material depletion, and similar items. It is relatively easy for the

treasurer's department to establish fairly accurately these requirements for any period ahead, but, in pricing a great variety of products, it may need quite careful thinking to allocate some of these cost items properly to the various groups. Allocation in line with actual group requirements should be aimed at, and general items be distributed percentagewise according to the cost values of the various lines.

Profit and Taxes. Last, but not least, prices have to provide also for: interest to be paid on bonds outstanding and mortgages, dividends for stock outstanding or held by the company, surplus to be carried forward, and federal, state, and municipal income taxes. Although each item must be determined singly, for pricing purposes they must all be grouped together when determining net income and taxes. This grouping is necessary because taxes depend on profits and both are bound to vary with the prices not as yet chosen. Thus for the entire business and for every product group there are three interdependent unknowns to be determined, in reference to which it is known only that the final prices must yield a net income sufficient to cover interest, dividends, surplus, and taxes. The solution can be found only by determining first the total at which all groups combined should be sold in order to provide for all requirements of the company during the pricing period. This information is obtained by adding together the group totals for cost of production, selling, administration, and financial needs, plus a further amount required to cover total profit and taxes. When this total is known the job of pricing the individual products can begin.

Pricing the Various Products. In order to arrive at the final factory prices for the various individual products it is necessary to make up for each product group a list showing in detail the kinds and quantities of main products, by-products, and wastes produced. The prices applied to these quantities will be at first only tentative and must be chosen in consideration of present market prices, previous and future special price policies of the company, quality features of each product, and probable changes in the costs of production due to new processing or improvements. Choosing these tentative prices is not a scientific procedure but a matter of experience and judgment which as yet cannot be replaced by any automatic formula.

Only in rare instances will these prices indicate immediately an amount which may be taken as the desirable figure for total sales. Some prices will have to be changed and tested a number of times until every item is priced so that it fulfills all the considerations referred to above and until the sale of all quantities at the finally chosen prices

furnishes an amount equal or very close to the theoretically required figure for grand total sales. In really good pricing practice all these requirements will be fulfilled not only for the total business but in every group as well, and a fairly even profit rate will be aimed for in all of them. Only as an exception should higher profits be taken in some groups, and then not more than is necessary to make up for lower profits enforced by competitive conditions in other groups.

Price setting undertaken in this manner furnishes factory prices which are not scientifically established but at least are thoroughly tested and can be safely adopted. Such pricing also represents the best, most thorough, and condensed cross check on the sales forecast and the entire operating program. If the prices are "built up," as has been recommended, in totals and for every individual product group, the results obtained from each can be steadily checked and if need be prices can be changed in a systematic and controlled, instead of haphazard, manner. Besides, changes that may occur in reference to any one cost element in any one group can be easily tested and scrutinized to see whether or not they are of sufficient magnitude to justify setting a new price. Thus pricing thoroughly done can be developed into a systematic price-control procedure, which is one of the best economic safety devices any management can adopt.

Budget control and enforcement of departmental budgets are good practice but have the great disadvantage that they are only "best guesses" which easily become rigid and in the departmental budgets do not take into consideration the whole range of effects which their fulfillment or non-fulfillment may have. Price control embodies the advantages of budget control but at the same time extends the scope of observation to the very border line where the effects of changes attain economic importance and therefore should be controlled and adjusted, namely, in the prices through which the enterprise attempts to compete. Thus it would seem that price control, as outlined above, represents a perhaps new but further step in the development of the art of management.

Prices to Branches, Wholesalers, and Retail Buyers. Owing to existing regulations against price agreements between manufacturers and dealers, most chemical companies have preferred so far to establish only factory wholesale prices, at which they sold to wholesalers or direct buyers. This policy left it up to the middlemen to establish their own local retail prices as best they could, and relieved the companies from any possible conflict with federal or other price regulations.

Other manufacturers, however, who had definite reasons for having

their products sold at the same prices by all their middlemen, established list prices that in reality were not factory wholesale prices but retail prices. From them they granted different discounts to different trade outlets, for instance 30 per cent discount to their own branches, 25 per cent to distributors, 15 per cent to small dealers, and no discount to retail buyers. In this manner they attempted to keep within the law and yet establish uniform retail prices, which could not have been achieved by agreements with distributors or dealers.

As during the last few years legislation on prices and price maintenance has become rather involved and observation of these rulings is more important than ever, excerpts of the law texts are offered.

THE LAWS TO BE OBSERVED

At present four acts are simultaneously in effect which contain the main rulings to be guarded against. They are: the Sherman Act of 1890, the Clayton Act of 1914, the Robinson-Patman Act of 1936, and the Tydings-Miller Clauses, contained in the District of Columbia Taxation Act, approved August 17, 1937.

The Clayton Bill was enacted in order to provide protection against all those monopolistic practices which the Sherman Act of 1890 did not sufficiently cover. Sections 2 and 3 contain the most important rulings, which expressed in simplified form mean that different prices can be quoted in so far as this practice does not discriminate unfairly among purchasers, does not substantially lessen competition, or does not tend to create a monopoly in any line of commerce. Equally important are the *Provided* clauses which grant the right to quote different prices for differences in products and in the quantities of sales and further uphold the right of a seller to select his own customers.

The Robinson-Patman Act is in its purposes and intents the same kind of act as the Sherman or Clayton Acts, only it was meant to be still stronger and more explicit. However, even careful readers will not find it immediately much clearer.

It is of special interest that the act specifically permitted price changes (section 2, *and provided further*) and that it made unlawful the payment as well as acceptance of any commission, brokerage, or other compensation which was not based on actual services (section 2c).

Furthermore, it should be noted (section 2f) that unfair price discrimination was made unlawful for both parties involved.

October 15, 1914.
[H. R. 15657.]
[Public, No 212.]

CHAP. 323.—An Act To supplement existing laws against unlawful restraints and monopolies, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That "antitrust laws," as used herein, includes the Act entitled "An Act to protect trade and commerce against unlawful restraints and monopolies," approved July second, eighteen hundred and ninety; sections seventy-three to seventy-seven, inclusive, of an Act entitled "An Act to reduce taxation, to provide revenue for the Government, and for other purposes," of August twenty-seventh, eighteen hundred and ninety-four; an Act entitled "An Act to amend sections seventy-three and seventy-six of the Act of August twenty-seventh, eighteen hundred and ninety-four, entitled 'An Act to reduce taxation, to provide revenue for the Government, and for other purposes,'" approved February twelfth, nineteen hundred and thirteen; and also this Act.

Antitrust Act, 1914. Laws included in this Act.
Vol. 26, p. 209
Vol. 28, p. 570.
Vol. 37, p. 667.

"Commerce," as used herein, means trade or commerce among the several States and with foreign nations, or between the District of Columbia or any Territory of the United States and any State, Territory, or foreign nation, or between any insular possessions or other places under the jurisdiction of the United States, or between any such possession or place and any State or Territory of the United States or the District of Columbia or any foreign nation, or within the District of Columbia or any Territory or any insular possession or other place under the jurisdiction of the United States: *Provided*, That nothing in this Act contained shall apply to the Philippine Islands.

Meaning of terms. "Commerce"
Insular possessions included.
Provisos. Not applicable to the Philippines.

The word "person" or "persons" wherever used in this Act shall be deemed to include corporations and associations existing under or authorized by the laws of either the United States, the laws of any of the Territories, the laws of any State, or the laws of any foreign country.

"Person" or "persons."

SEC. 2. That it shall be unlawful for any person engaged in commerce, in the course of such commerce, either directly or indirectly to discriminate in price between different purchasers of commodities, which commodities are sold for use, consumption, or resale within the United States or any Territory thereof or the District of Columbia or any insular possession or other place under the jurisdiction of the United States, where the effect of such discrimination may be to substantially lessen competition or tend to create a monopoly in any line of commerce: *Provided*, That nothing herein contained shall prevent discrimination in price between purchasers of commodities on account of differences in the grade, quality, or quantity of the commodity sold, or that makes only due allowance for difference in the cost of selling or transportation, or discrimination in price in the same or different communities made in good faith to meet competition: *And provided further*, That nothing herein contained shall prevent persons engaged in selling goods, wares, or merchandise in commerce from selecting their own customers in bona fide transactions and not in restraint of trade.

Difference in prices to purchasers to lessen competition, etc., unlawful.
Provisos. Permitted for different grades, qualities, etc.
To meet competition.
Selection of customers allowed.

SEC. 3. That it shall be unlawful for any person engaged in commerce, in the course of such commerce, to lease or make a sale or contract for sale of goods, wares, merchandise, machinery, supplies or other commodities, whether patented or unpatented, for use, consumption or resale within the United States or any Territory thereof or the District of Columbia or any insular possession or other place under the jurisdiction of the United States, or fix a price charged therefor, or discount from, or rebate upon, such price, on the condition, agreement or understanding that the lessee or purchaser thereof shall not use or deal in the goods, wares, merchandise, machinery, supplies or other commodities of a competitor or competitors of the lessor or seller, where the effect of such lease, sale, or contract for sale or such condition, agreement or understanding may be to substantially lessen competition or tend to create a monopoly in any line of commerce.

Leases, sales, etc., binding purchaser not to use goods of competitors, unlawful.
If lessening competition, etc.

Recovery of threefold damages for injuries by antitrust violations.

SEC. 4. That any person who shall be injured in his business or property by reason of anything forbidden in the antitrust laws may sue therefor in any district court of the United States in the district in which the defendant resides or is found or has an agent, without respect to the amount in controversy, and shall recover threefold the damages by him sustained, and the cost of suit, including a reasonable attorney's fee.

Decrees of antitrust violations prima facie evidence against defendants in other suits.

SEC. 5. That a final judgment or decree hereafter rendered in any criminal prosecution or in any suit or proceeding in equity brought by or on behalf of the United States under the antitrust laws to the effect that a defendant has violated said laws shall be prima facie evidence against such defendant in any suit or proceeding brought by any other party against such defendant under said laws as to all matters respecting which said judgment or decree would be an estoppel as between the parties thereto: *Provided*, This section shall not apply to consent judgments or decrees entered before any testimony has been taken: *Provided further*, This section shall not apply to consent judgments or decrees rendered in criminal proceedings or suits in equity, now pending, in which the taking of testimony has been commenced but has not been concluded, provided such judgments or decrees are rendered before any further testimony is taken.

Provisos.
Consent judgments excepted.
Pending proceedings.

Statute of limitations.
Suspended fo. private cases while Government suit pending.

Whenever any suit or proceeding in equity or criminal prosecution is instituted by the United States to prevent, restrain or punish violations of any of the antitrust laws, the running of the statute of limitations in respect of each and every private right of action arising under said laws and based in whole or in part on any matter complained of in said suit or proceeding shall be suspended during the pendency thereof.

Labor not a commodity, etc.
Labor, etc., organizations not forbidden.

SEC. 6. That the labor of a human being is not a commodity or article of commerce. Nothing contained in the antitrust laws shall be construed to forbid the existence and operation of labor, agricultural, or horticultural organizations, instituted for the purposes of mutual help, and not having capital stock or conducted for profit, or to forbid or restrain individual members of such organizations from lawfully carrying out the legitimate objects thereof; nor shall such organizations, or the members thereof, be held or construed to be illegal combinations or conspiracies in restraint of trade, under the antitrust laws.

Rights of individual members.
Legality of organizations.

No corporation may acquire stock of another, to lessen competition, etc.

SEC. 7. That no corporation engaged in commerce shall acquire, directly or indirectly, the whole or any part of the stock or other share capital of another corporation engaged also in commerce, where the effect of such acquisition may be to substantially lessen competition between the corporation whose stock is so acquired and the corporation making the acquisition, or to restrain such commerce in any section or community, or tend to create a monopoly of any line of commerce.

Of two or more corporations.

No corporation shall acquire, directly or indirectly, the whole or any part of the stock or other share capital of two or more corporations engaged in commerce where the effect of such acquisition, or the use of such stock by the voting or granting of proxies or otherwise, may be to substantially lessen competition between such corporations, or any of them, whose stock or other share capital is so acquired, or to restrain such commerce in any section or community, or tend to create a monopoly of any line of commerce.

Purchasing solely for investment permitted.

This section shall not apply to corporations purchasing such stock solely for investment and not using the same by voting or otherwise to bring about, or in attempting to bring about, the substantial lessening of competition. Nor shall anything contained in this section prevent a corporation engaged in commerce from causing the formation of subsidiary corporations for the actual carrying on of their immediate lawful business, or the natural and legitimate branches or extensions thereof, or from owning and holding all or a part of the stock of such subsidiary corporations, when the effect of such formation is not to substantially lessen competition.

Subsidiaries, etc., allowed.

Condition.

[CHAPTER 592.]

AN ACT

June 19, 1936.
[H. R. 8442]
[Public, No. 692]

To amend section 2 of the Act entitled "An Act to supplement existing laws against unlawful restraints and monopolies, and for other purposes", approved October 15, 1914, as amended (U. S. C., title 15, sec. 13), and for other purposes.

Antitrust Act of 1914, amendment.
Vol. 38, p. 730
U. S. C., p. 511.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 2 of the Act entitled "An Act to supplement existing laws against unlawful restraints and monopolies, and for other purposes", approved October 15, 1914, as amended (U. S. C., title 15, sec. 13), is amended to read as follows:

Discriminations in price between different purchasers.

"SEC. 2. (a) That it shall be unlawful for any person engaged in commerce, in the course of such commerce, either directly or indirectly, to discriminate in price between different purchasers of commodities of like grade and quality, where either or any of the purchases involved in such discrimination are in commerce, where such commodities are sold for use, consumption, or resale within the United States or any Territory thereof or the District of Columbia or any insular possession or other place under the jurisdiction of the United States, and where the effect of such discrimination may be substantially to lessen competition or tend to create a monopoly in any line of commerce, or to injure, destroy, or prevent competition with any person who either grants or knowingly receives the benefit of such discrimination, or with customers of either of them: *Provided*, That nothing herein contained shall prevent differentials which make only due allowance for differences in the cost of manufacture, sale, or delivery resulting from the differing methods or quantities in which such commodities are to such purchasers sold or delivered: *Provided, however*, That the Federal Trade Commission may, after due investigation and hearing to all interested parties, fix and establish quantity limits, and revise the same as it finds necessary, as to particular commodities or classes of commodities, where it finds that available purchasers in greater quantities are so few as to render differentials on account thereof unjustly discriminatory or promotive of monopoly in any line of commerce; and the foregoing shall then not be construed to permit differentials based on differences in quantities greater than those so fixed and established: *And provided further*, That nothing herein contained shall prevent persons engaged in selling goods, wares, or merchandise in commerce from selecting their own customers in bona fide transactions and not in restraint of trade: *And provided further*, That nothing herein contained shall prevent price changes from time to time where in response to changing conditions affecting the market for or the marketability of the goods concerned, such as but not limited to actual or imminent deterioration of perishable goods, obsolescence of seasonal goods, distress sales under court process, or sales in good faith in discontinuance of business in the goods concerned.

Lessening, etc., competition.

Provisos.
Differentials.

Quantity limits.

Selection of customers.

Price changes.

Hearing on complaint.

"(b) Upon proof being made, at any hearing on a complaint under this section, that there has been discrimination in price or services or facilities furnished, the burden of rebutting the prima-facie case thus made by showing justification shall be upon the person charged with a violation of this section, and unless justification shall be affirmatively shown, the Commission is authorized to issue an order terminating the discrimination: *Provided, however*, That nothing herein contained shall prevent a seller rebutting the prima-facie case thus made by showing that his lower price or the furnishing of services or facilities to any purchaser or purchasers was made in good faith to meet an equally low price of a competitor, or the services or facilities furnished by a competitor.

Burden of proof.

Proviso.
Lower price made in good faith to meet competition.

Brokerage, etc., payments

"(c) That it shall be unlawful for any person engaged in commerce, in the course of such commerce, to pay or grant, or to receive or accept, anything of value as a commission, brokerage, or other compensation, or any allowance or discount in lieu thereof, except for services rendered in connection with the sale or purchase of goods, wares, or merchandise, either to the other party to such transaction or to an agent, representative, or other intermediary therein where such intermediary is acting in fact for or in behalf, or is subject to the direct or indirect control, of any party to such transaction other than the person by whom such compensation is so granted or paid.

Payment for services rendered.

Discriminatory payments by seller to buyer for services, etc.

"(d) That it shall be unlawful for any person engaged in commerce to pay or contract for the payment of anything of value to or for the benefit of a customer of such person in the course of such commerce as compensation or in consideration for any services or facilities furnished by or through such customer in connection with the processing, handling, sale, or offering for sale of any products or commodities manufactured, sold, or offered for sale by such person, unless such payment or consideration is available on proportionally equal terms to all other customers competing in the distribution of such products or commodities.

Furnishing services or facilities by seller to a buyer upon terms not accorded to all buyers

"(e) That it shall be unlawful for any person to discriminate in favor of one purchaser against another purchaser or purchasers of a commodity bought for resale, with or without processing, by contracting to furnish or furnishing, or by contributing to the furnishing of, any services or facilities connected with the processing, handling, sale, or offering for sale of such commodity so purchased upon terms not accorded to all purchasers on proportionally equal terms.

Inducing or receiving discrimination in price.

"(f) That it shall be unlawful for any person engaged in commerce, in the course of such commerce, knowingly to induce or receive a discrimination in price which is prohibited by this section."

Discounts, rebates, allowances, advertising service charges.

SEC. 3. It shall be unlawful for any person engaged in commerce, in the course of such commerce, to be a party to, or assist in, any transaction of sale, or contract to sell, which discriminates to his knowledge against competitors of the purchaser, in that, any discount, rebate, allowance, or advertising service charge is granted to the purchaser over and above any discount, rebate, allowance, or advertising service charge available at the time of such transaction to said competitors in respect of a sale of goods of like grade, quality, and quantity; to sell, or contract to sell, goods in any part of the United States at prices lower than those exacted by said person elsewhere in the United States for the purpose of destroying competition, or eliminating a competitor in such part of the United States; or, to sell, or contract to sell, goods at unreasonably low prices for the purpose of destroying competition or eliminating a competitor.

Sales, etc., at discriminatory prices to destroy competition.

Penalty for violation.

Any person violating any of the provisions of this section shall, upon conviction thereof, be fined not more than $5,000 or imprisoned not more than one year, or both.

Cooperative associations.

SEC. 4. Nothing in this Act shall prevent a cooperative association from returning to its members, producers, or consumers the whole, or any part of, the net earnings or surplus resulting from its trading operations, in proportion to their purchases or sales from, to, or through the association.

Approved, June 19, 1936.

*

Section 3 has been considered the most important part of the act, in so far as it deals with discriminatory price and discount policies and tries to eliminate unreasonably low price policies for the purpose of destroying or eliminating competition.

The act does not define which prices would be considered unreasonably low. But if need be this ruling might easily be interpreted as meaning any prices below cost, and therefore the method of cost allocation and price making observed in a company is of special significance.

Price agreements and retail price-fixing or price-maintenance agreements between producers and retailers had been made unlawful in the Sherman Act and had been upheld as unlawful since then. Many states, however, had permitted retail price fixing under certain conditions and therefore many difficulties arose in reference to setting retail prices.

Through the rulings of the Tydings-Miller Act the all-exclusive stipulations of the Sherman-Clayton Anti-Trust Laws have been modified so that now any state law that permits agreements on price maintenance will be recognized by the federal authorities of that particular state, territory, or the District of Columbia, in which such resale is to be made. If the state statutes permit price agreements on minimum prices, the trust laws will not be applied, provided that these agreements pertain to branded or trade-marked merchandise and that the contracts or agreements are not unfair methods of competition as defined in section 5, as amended and supplemented, of the Federal Trade Commission Act of September 26, 1917. All regulations of this act are upheld.

At the present time the laws of forty-two states approve of price agreements, and the Tydings-Miller clauses, eliminating conflicting legislation, undoubtedly will help in preventing at least cut-throat competition in these states and in putting chemical prices on a much-needed sounder basis.

All these laws are subject to much controversy and special interpretation, and quite a few contradictory rulings have been handed down by the courts.

In view of such conditions to even attempt the establishment of a "simple" set of rules which would help to keep out of trouble would be useless, but some reminders ought to be helpful:

1. Study the texts of the laws and try to apply them.
2. Do not guess at your costs; establish them carefully.

THE TYDINGS-MILLER CLAUSES

[PUBLIC—No. 314—75TH CONGRESS]
[CHAPTER 690—1ST SESSION]
[H. R. 7472]

AN ACT

To provide additional revenue for the District of Columbia, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act divided into titles and sections may be cited as the District of Columbia Revenue Act of 1937.

TITLE VIII—AMENDMENT TO THE ANTITRUST LAWS

Section 1 of the Act entitled "An Act to protect trade and commerce against unlawful restraints and monopolies", approved July 2, 1890, is amended to read as follows:

"SECTION 1. Every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several States, or with foreign nations, is hereby declared to be illegal: *Provided*, That nothing herein contained shall render illegal, contracts or agreements prescribing minimum prices for the resale of a commodity which bears, or the label or container of which bears, the trade mark, brand, or name of the producer or distributor of such commodity and which is in free and open competition with commodities of the same general class produced or distributed by others, when contracts or agreements of that description are lawful as applied to intrastate transactions, under any statute, law, or public policy now or hereafter in effect in any State, Territory, or the District of Columbia in which such resale is to be made, or to which the commodity is to be transported for such resale, and the making of such contracts or agreements shall not be an unfair method of competition under section 5, as amended and supplemented, of the Act entitled 'An Act to create a Federal Trade Commission, to define its powers and duties, and for other purposes', approved September 26, 1914: *Provided further*, That the preceding proviso shall not make lawful any contract or agreement, providing for the establishment or maintenance of minimum resale prices on any commodity herein involved, between manufacturers, or between producers, or between wholesalers, or between brokers, or between factors, or between retailers, or between persons, firms, or corporations in competition with each other. Every person who shall make any contract or engage in any combination or conspiracy hereby declared to be illegal shall be deemed guilty of a misdemeanor, and, on conviction thereof, shall be punished by fine not exceeding $5,000, or by imprisonment not exceeding one year, or by both said punishments, in the discretion of the court."

Approved, August 17, 1937.

3. Do not "adopt" prices, but set them where they should be.
4. Do not change prices arbitrarily; keep them in line with your needs.
5. Try to establish your price structure and discount policies as simply as possible.
6. Avoid fancy tricks and pricing schemes.
7. Ask your association or your lawyer for legal advice *before* you are in trouble.

THE "HIGH POLICIES" OF PRICING

Pricing is not merely an internal routine matter. Through the prices which it announces a company affects its own economic status and that of its competitors and customers as well. Therefore, the basic policies which can be injected into the pricing routine are definitely worth considering in detail. This may at least help to avoid some of the most serious mistakes that have occurred in the past.

In view of the price statistics the industry hardly can be blamed for following generally a *high price policy,* and those few managements that traditionally or deliberately still price their products high are either definitely justified in doing so on account of the high and special quality of their products or because they must be content with the restricted volume that they can get. In all cases where the demand is definitely limited for technical reasons and production costs per unit are high, such policy is definitely the best a management can choose, because lowering of prices would have hardly any effect on volume but would seriously impair the company's financial status.

In those lines where excess capacity prevails and where there are possibilities of expanding volume by low prices, a *low price policy* is dictated by circumstances and is the general rule among the managements. This policy, however, can be applied in various degrees. Prices can be set low and still provide for all reasonable requirements of operation, or they can be set so low that they barely cover the cost of production. All too often chemical producers have endangered not only their own interests but also those of all other producers by disregard for the low price limits and by not fitting the extent of price reductions to the thereby obtainable volume of sales and to the simultaneous changes in the per-unit costs. It is easy enough to make price concessions, but it seems that only very few realize their final effects. In order to visualize the results of price lowering two examples are offered which deserve most careful attention.

In many cases prices are being lowered merely to *retain a customer* or to *meet competition.* In such instances no additional volume

will be obtained and obviously the per-unit cost of production will remain unchanged, but company profits will be affected as indicated in the figures:

Before Reduction		After Price Reductions of		
Sale of 10,000 lb.		5%	8%	10%
Selling price per pound.	10¢	9.5¢	9.2¢	9.0¢
Net sales value.....	$1,000	$950	$920	$900
Cost to company	$920	$920	$920	$920
Company profit.....	$80	$30	zero	$20 loss

Price reductions of 5, 8, or 10 per cent may not appear as great concessions and yet they reduce the profit involved in the transaction very quickly from its usual eight per cent to three per cent, to zero, and soon enough transform it into a loss for the company.

In other cases price lowering actually *produces additional volume,* and, as the fixed charges of operation are spread over a greater number of units produced, the costs of production are reduced. Rarely, if ever, are these reductions in costs equal to those granted in the form of price reductions. Mostly they are so small that they do not represent a sufficient inducement to the buyer. Thus the company which makes price concessions and wants to maintain its own profit will have to obtain much more additional volume than it is likely to get. Therefore most companies, even if they obtain more volume through price lowering, merely experience the following development:

Before Reduction		After Price Reductions of			
Sale of		5%	8%	10%	20%
Pounds.....	10,000	11,000	12,000	13,000	14,000
Selling price per pound....	10¢	9.5¢	9.2¢	9.0¢	8.0¢
Net sales value.....	$1,000	$1,045	$1,104	$1,170	$1,120
Cost to company	$920	$1,001	$1,068	$1,144	$1,120
Cost per pound.....	9.2¢	9.1¢	8.9¢	8.8¢	8.0¢
Company profit.....	$80	$44	$36	$26	zero

A small price reduction of 5 per cent may produce a 10 per cent increase in volume but more likely than not the profit is reduced, in this instance by 45 per cent. Therefore more vigorous price lowering is attempted to make it "worth while," and yet only a smaller profit per unit is obtained, which is considered as "gravy or velvet," because it comes from additional volume. But the velvet zone is very narrow indeed, and if further price lowering is attempted to get still more the company finds itself operating at still higher volume and bigger net

sales but no profits. Thus it achieves the famous *"profitless prosperity"* which has been a surprise and puzzle to many a manager and to many stockholders who, not familiar with the workings of price policies, cannot understand how a big volume can yield so little or no profit.

Profitless prosperity can be overcome only by the erection of a *mammoth plant* in which most up-to-date equipment produces such considerable savings in costs per unit that prices can be quoted so low that they become irresistible and the volume can be doubled or trebled with ever-increasing financial profits for the company but with paralyzing effects upon the smaller enterprises.

Fortunately for the latter the financial costs to be provided for in the prices of the mammoth factory are usually so high and represent such a definite obligation that it cannot lower its prices much below those of smaller enterprises which operate with great diligence and efficiency, and less overhead. Nevertheless, in the *possible difference in prices and price policies between big and smaller operators* lie most serious economic problems which will have to be solved if stable progress is desired for all.

In the past these differences have come to the surface mainly at the time of tariff hearings and during the numerous *price wars* which for many years have been such characteristic features of the industry, not in depression times but whenever conditions prevailed which should have given an opportunity to the smaller enterprises to gather strength. Price wars have been less frequent since 1932 but they are bound to be revived as soon as expansion of sales through lower prices appears feasible to those who do not have true regard for price wisdom or economic ethics. Price wars are not forbidden by law because they are mostly carried out in the form of reckless but open lowering of the prices of those products for which the company taking such action desires a greater field. The disagreeable features of price wars are their disregard for economic consequences and their suddenness. Forced to match the lower prices or lose orders, the competitors are confronted with unforeseen losses which may upset their entire operating plans. Only the consumers are benefited, but only temporarily, because usually the price-cutting company raises its prices as soon as it has achieved its purposes.

Liquidation prices or *price reductions to promote seasonal or off-seasonal sales* have been tried in the fertilizer, paint and varnish, insecticide, and other industries but with very little effect and therefore are not typical price policies in chemical industries. Especially the

liquidation of excess stocks has been given up. Such short-time bargain selling is mostly avoided nowadays by better planning of production and distribution.

Stability of price is considered the most desirable policy by many leaders in the industry, but the old problem remains of how to achieve it. As raw-material costs amount to 45 per cent of all wholesale prices combined, changes in raw-material prices will always affect the final prices for chemicals. But these changes do not cause what is known as instability of prices. This condition is mostly caused by new processes, oversupply, and price policies pertaining thereto. Those industries that already have turned to the last known means of overcoming profitless prosperity, to mammoth plants where they make fertilizers, rayons, paints, coal-tar products, acids, and soda, have already reached the limit for individualistic competition and now require stability. And they need it the more, the greater their investment. Any new process that makes it possible for one of these very big producers to lower the price for any of his quantity products endangers the smaller companies but at the same time threatens the very existence of the big investment competitors.

As hardly any other means is left to obtain stability in such a case, *price agreements* must be considered the next logical step if serious economic losses are to be avoided. But price-fixing agreements among producers are taboo according to law, and so are created such unhealthy conditions as prevail in the rayon industry. According to official statistics their prices are among the lowest and least recovered, their plants are already so costly and up-to-date that hardly any further technical improvements can be built into them, and yet the companies were haled into courts for price fixing at 44 per cent of 1914 prices. Since then they have gone out again and borrowed still more money to increase their capacity! To uphold laws against monopolistic agreements is obviously justified, but conditions in the rayon industry prove that it cannot be right to drive an industry to economic desperation by upholding laws that do not fit the case.

The *open price agreements* which were conceded the fertilizer industries in similar predicaments, while the National Recovery Act was in effect, were perhaps among the most interesting measures of this period. They made the National Fertilizer Association a clearing house for price information and forced every producer to inform every competitor of changes in prices and conditions. They could not go into effect before the others could adjust their prices accordingly if they cared to do it. This procedure took at least the surprise element out

of the competitive price struggle and was the nearest that the law permitted to achieving economic stability in the industry, but still such measures cannot be considered the final solution of all price problems.

What the chemical industries need is *reasonable price stability,* and, even if present laws attempt to prevent fair price agreements among producers together with unfair ones, some day economic considerations will prove themselves stronger than present legal concepts on prices and agreements and will demonstrate that fair price agreements not only are desirable between dealers and producers but are justified and even more necessary between manufacturers as well.

CHAPTER 10

FINANCIAL POLICIES

THE FINANCIAL RECORD OF THE INDUSTRY

In Table 2 it was shown that the raw-profit percentages obtained by all chemical manufacturers combined steadily declined as time went on, competition increased, and prices came down. The same table also proved that, on account of the tremendous investment that was necessary to bring the industry to its present height, the returns on investment became small indeed, compared with those of previous decades.

Obviously, with the decline in raw profits and the simultaneous increase in the cost of doing business went a definite decline in net profits to the point where they did not furnish sufficient funds for the expansion desired and required by the general progress of the country. Therefore quite a few companies, which originally had been entirely financed and enlarged out of private funds and their own earnings, turned to public financing and corporate organization.

This movement which took on more definite form after 1890 caused also the establishment of new companies on the basis of corporation charters; it opened up new investment possibilities to the public and made some chemical corporations highly important financial factors within the industry and in the financial world.

The public and investors availed themselves in full measure of the new investment opportunities and placed steadily increasing amounts at the disposal of these new corporations which transformed them into new plants, improvements, equipment, and chemical products. The Census of Manufactures shows net *investment* in

1889 at	$ 317,681,725	100.00
1899 "	499,726,124	167.30
1904 "	685,396,601	215.75
1909 "	982,124,494	309.15
1914 "	1,352,923,636	425.87
1919 "	2,799,551,273	881.24

The rate of growth represented in these figures has rarely been paralleled in any industry anywhere.

It is unfortunate that after 1919 no figures are available which would represent reliably the further increase in investment which has taken place and that therefore we have to depend on estimates and occasional special studies for this very important information. It is, however, safe to assume that in 1929 a total net investment (total assets minus reserves) of $4,554,000,000 was reached and that this figure has been still further increased since the depression, so that at present (1938) the net investment can be safely stated as close to five billion dollars. Most of it is properly utilized and put to good economic use. But just as surely part of it, probably nearly 15 per cent, represents overcapacity in certain branches of the industry.

Concerning the recent *income conditions* of the industry fairly reliable information is available which ties in rather well with the data presented in the Censuses of Manufactures. The information is contained in the "Statistics of Income" published annually by the U. S. Treasury Department. The income record of the industry, according to this source, is shown in Table 26. Four good years (1926–1929) are presented, and four lean years (1930–1933), so that the eight years' totals and average percentages ought to be truly representative of actual income conditions. The income record for 1934, which is the latest available at present (1938), is also shown and merely accentuates the findings.

TABLE 26

United States Chemical Industries

Total Income and Net Profit — Profitable and Loss Business

Data from Income Tax Returns. Values in Thousand Dollars

Year	1926	1927	1928	1929	1930	1931	1932	1933	Eight Years' Totals and Percentages	1934
Entire Chemical and Allied Industries										
Number of returns	6,700	6,596	6,850	6,865	6,726	6,626	6,772	6,977	54,112	7,298
Gross income (sales)	3,756,071	3,731,503	3,909,132	4,241,952	3,643,240	2,919,608	2,244,845	2,347,346	26,793,697	2,831,781
Net income	313,932	295,038	370,464	397,521	248,350	142,423	54,503	153,544	1,975,775	237,300
Taxes paid	46,662	43,955	47,349	46,737	35,718	25,162	18,015	30,390	293,988	37,753
Net profit	267,270	251,083	323,115	350,784	212,632	117,261	36,488	123,154	1,681,787	199,547
Net income as per cent of sales	8 36	7.91	9 48	9.37	6 82	4.88	2.43	6.54	7.37	8.38
Net profit as per cent of sales	7 12	6 73	8 27	8 27	5 84	4 02	1.63	5.25	6 28	7.05
Returns Showing Net Income										
Number of returns	3,788	3,693	3,884	3,754	3,040	2,589	1,601	2,248	24,597	2,764
Gross income (sales)	3,380,036	3,360,468	3,507,543	3,828,288	2,949,620	2,254,988	1,583,551	1,887,664	22,752,158	2,415,581
Net income	358,967	338,469	405,898	433,066	305,842	214,891	130,886	214,551	2,402,570	270,476
Taxes paid	46,662	43,955	47,349	46,737	35,718	25,162	18,015	30,390	293,988	37,753
Net profit	312,305	294,514	358,549	386,329	270,124	189,729	112,871	184,161	2,108,582	232,723
Returns as per cent of all returns	56 54	55.99	56.70	54 68	45 20	39.07	23 64	32 22	45 46	37.87
Sales as per cent of all sales	89 99	90 06	89.73	90.25	80.96	77 24	70 54	80.42	84 92	85.30
Net income as per cent of sales	10 62	10.07	11 57	11 31	10 37	9.53	8 27	11.37	10 56	11 20
Net profit as per cent of sales	9 24	8 76	10 22	10 09	9 16	8.42	7 13	9.76	9.27	9.63
Returns Showing Deficits										
Number of returns	2,912	2,582	2,594	2,744	3,375	3,683	4,850	4,264	27,004	4,023
Gross income (sales)	376,035	371,035	401,589	413,664	693,620	664,620	661,294	459,682	4,041,539	416,200
Deficits—net loss	45,035	43,431	35,434	35,545	57,492	72,468	76,383	61,007	426,795	33,176
Returns as per cent of all returns	43 46	39.14	37.87	39.97	50.18	55.58	71.62	61.12	49.90	55.12
Sales as per cent of all sales	10 01	9 94	10.27	9 75	19.04	22.76	29 46	19.58	15 08	14.70
Deficits as per cent of sales	11 98	11 71	8 82	8 59	8.29	10 90	11 55	13.27	10.56	7.97
Inactive returns	.. ..	321	372	367	311	354	321	465	2,511	511

These figures are of very great significance inasmuch as they reveal:

1. That, out of a steadily increasing *number* of companies represented by their returns, the majority has been doing business on the borderline of profit and deficit, and that a considerable portion of them has been in that state regardless of the prevailing economic conditions.

2. Consideration of the small business *volume* transacted by this majority (deficit companies) would indicate that most of them must be small companies, but financial statements reveal that even some large companies are not quite immune against losses.

3. The minority of companies (reporting income) show net profit percentages ranging from 7.13 to 10.22. These profits can be considered satisfactory, especially as the eight-year average is 9.27 per cent. But owing to the losses suffered by most companies the financial results in the *entire industry* are not anywhere near as good as is usually assumed. The total net profit ranged from 1.63 per cent in 1932 to 8.27 per cent in the best years, 1928, 1929.

4. No data are available as yet which would show income and profit conditions for 1935 and later. In view of the increases in the costs of material and labor it is most doubtful that these profit percentages have been reached again.

5. Taxes, paid only by the profitable companies, were close to the usual corporation tax rate of 12½ per cent and averaged slightly more on the total industry's taxable income. Including all companies the tax percentage was 14.88.

Thus the recent income record of the industry shows quite definitely that an enterprise manufacturing chemicals is no longer assured of high profits or even of any profits. As in every other phase of industrial operation financial gains depend upon the application of the right kind of policies.

THE SMALL COMPANIES

Relatively little is heard in public about the financial policies and methods of the small chemical enterprises. Reports and reader interest are concentrated upon the financial doings, stock-market quotations, and dividend records of the large chemical corporations, in spite of the fact that in the United States there are probably not more than eighty really large chemical corporations among the close to seven thousand chemical manufacturing enterprises lately reported by the Census of Manufactures.

As any distinction between "large" and "small" companies can be made according to various definitions, all of which would have to be arbitrary, no attempt is made to draw a definite line, but implicitly the following remarks refer to those companies which are not listed on the stock exchanges and employ anywhere from five to five hundred employees.

Financed only by the limited private capital of individuals, friends, or small groups of partners, most of the small companies go quietly about their business, filling some of the local and near-by demands for the many chemical products which have become so indispensable in modern civilization.

Undoubtedly the greatest number are in the pharmaceutical, drug, oil, turpentine, rosin, paint, fertilizer mixing, fine chemical, insecticide, and similar industries. If properly managed they furnish a fairly comfortable but none too lucrative income to owners and partners who supplied funds. Undoubtedly this group also experiences the greatest number of bankruptcies or voluntary liquidations whenever chemical demand recedes or more aggressive competition captures part of their market.

Refining, specialization, and still more often semi-diversification of production in closely related lines are the pursuits which keep most of these enterprises in business and occasionally lead them into the ranks of medium-size companies, from which they may develop into large companies either by means of borrowed funds or by attracting the attention of some big concern offering technical-financial cooperation leading to final merger. Quite a few of the companies resist the temptation to merge, but often enough the aged founder or his heirs, faced with the proposition of becoming members on the board of directors of a big company, and to be given a goodly sum in the form of stocks or cash, prefer to join the bigger concern providing economic advantages far beyond their previous reach.

Rarely, if ever, do large corporations or financial holding companies interest themselves in defunct or otherwise weak enterprises, nor do they try to "run them down in order to gobble them up." The small companies are induced to join large companies mainly because of their achievements, special processing rights, patents, or similar advantages. Nor are depressions the times when mergers are most frequent, as one might assume. The best chances for small companies are when business is good.

The establishment of small chemical enterprises is favored by the fact that most chemical processes have to go through a period of trial

and gradual evolution from small beginnings to the larger, commercial unit production. Therefore such enterprises can be started with relatively small funds ($5,000 to $50,000) and can be gradually enlarged as and when, by careful financial operation, they become profitable. Quite a few of the large companies of today have gone through such a process of evolution, and this explains why they show interest in small enterprises which have reached the point at which they themselves began to look for stronger backing and where the small company now does the same.

Financial troubles or failures in small enterprises are usually caused not by mistakes or negligence in financing or establishing the capital structure, but by carelessness in calculating costs, expenses, prices, and, just as often, by a definite lack of commercial organization. Inventors who turned producers without having familiarized themselves sufficiently with the business and economic possibilities for their new enterprise suddenly find that the trade either is not interested in their products or offers much less for them than they had hoped. After a few belated but futile efforts to find a way of saving their company they give up and lose their own investment and that of their friends.

Others, unfamiliar with the practices of some professional "financiers," entrust a "thorough exploitation" of their invention to professional promoters, and exploitation is exactly what they get. Soon they find themselves enmeshed in contractual obligations of all kinds and with such a small share in their "own" business affairs and earnings that giving up entirely to the promoters appears preferable to constant friction, agony, and grief. In order to avoid similar experiences great care should be exercised also in entering any partnership; not only the present intentions of the prospective partner should be considered, but also his past actions and business record. Financial malpractices are not more frequent in small chemical undertakings than in other industries, but they are frequent enough to deserve special mention.

The financial operation of small chemical companies is complicated only where the small-scale manufacture of many products is attempted, thus involving more cost accounting, but otherwise no unusual difficulties are encountered. Only in highly competitive branches is special care needed and operation should be begun only if sufficient initial resources are available and additional capital or well-founded sales possibilities are secured.

THE LARGE COMPANIES

In their earliest beginnings most of the chemical enterprises grew because of their technical achievements. Today technical perfection is relatively easy to accomplish, and perfection and superiority of their administrative, financial, and economic policies are now the fundamental prerequisites without which the big companies cannot maintain their absolute and relative positions. Hence all the technical efforts which they make, important though they be, are in reality only part of their economic functions, no longer the prime end itself. The giant plant, most carefully thought-out processing, automatic quantity production, multiplant operation, even equipment ten times as large as the largest now known, cannot be used if their application is not financially and economically justified.

In most chemical industries technical improvements of this kind help to some extent but soon reach their economic limitations which are set primarily by the already existing demand for the products.

In other industries this condition is reversed. The construction of a giant rolling mill, a giant press, a superhuman conveyor system must be undertaken first, before certain products can be made at a price at which an entirely new demand actually can be created. Success and competitive survival of large companies in the steel, automobile, and food industries depend primarily on their equipment and only secondarily on the already existing demand for their products. These industries can create new demand and expand it by means of super equipment. This explains why Mr. Ford annually reinvests enormous sums in his factory, why the United States Steel Corporation alone has more than $1,500,000,000 worth of assets, why the Chrysler organization does not hesitate to scrap millions of still fairly good machinery, if better equipment can be had, and why even meat packers and canners nowadays buy more and only the most up-to-date machinery. The mammoth plant means to these industries cost savings *and* a new and larger market. In the chemical industries a mammoth plant *may mean* cost savings and special advantages over competitors in the established market but not a new and larger market unless the products are for ultimate consumers.

This technical and economic dependence on their industrial-economic environment naturally must and should determine their financial policies.

THE FINANCIAL POLICIES OF LARGE COMPANIES

The economic significance of the fundamental financial policies applied by the large American chemical companies can perhaps be demonstrated best by contrasting the practices customarily followed here with those in other leading chemicals-producing countries.

Original Capitalization. In the United States, first capitalizations of large chemical enterprises are attempted primarily through common and/or preferred stocks, issued through the facilities of large investment banks who usually retain none or only small portions of the issue. Bonds or debentures are avoided as much as possible for capitalizing chemical companies, mainly to save in the fixed interest obligations which are usually higher than have to be offered by public utilities, railroads, and other bond-issuing companies.

In England, chemical companies incur considerably more funded debts than in the United States. To obtain capital from the public they have to sell bonds, debentures, and preferred stocks, which guarantee the investor a definite and fairly secure income, at least somewhat better than competitive securities offer. As the British public appreciates financial security more than voting rights, the public is offered preferred stock without voting rights, and voting rights are restricted in the funded securities and vested mainly in the common stocks, large blocks of which are retained by banks and investors. Thus the British chemical industry is financed really from two major sources in two different ways.

German and French chemical companies obtain their funds primarily from banks and only in part from the public to whom are sold preferred and common stocks. The funded obligations, issued in larger proportions than in the United States, remain mostly in the portfolios of banks and syndicates which on the strength of their holdings delegate direct representatives to the board of directors of the company or to the "Aufsichtsrat," a special super board established to guide not the detail management but the financial and economic policies of the borrowing company.

In Russia, which at present develops more large chemical enterprises than any other country, the amounts needed for chemical developments are calculated far in advance by the Gosplan and are provided annually according to plan by the Union Treasury and the states by way of the syndicates (government-enforced industrial trusts). Labor is provided by the labor exchanges and the unions, and a market is assured for the products by the syndicates of consuming industries.

As stocks are considered undesirable capitalistic instruments, no such securities are issued, but bonds are offered for sale in some instances to workers, who thus become direct interest-holders in the enterprise.

Japan promotes her chemical industries pretty much according to European financial methods, but issues also considerable amounts of common stocks to the public which is eager to buy them because of the appreciation in value and the fairly high dividends paid so far.

Of all these, the American capitalization method is undoubtedly the most liberal with the public, but at the same time, there is danger that chemical financing may become less restrained. The banks make careful studies to determine the advisability of the issues which they sell, and their responsibilities have been greatly increased under the new Securities and Exchange Regulations, but as they are still acting only as responsible banking intermediaries, not as permanent participants in these deals, they leave mainly to the managements the determining of the desired amounts and their own responsibility is still primarily limited to cases of outright fraud or misrepresentation.

It does not seem as yet that too many stocks have been issued, but the figures in Table 27 show an amazing increase since January 1, 1929, in the number of chemical stocks listed by leading companies on the New York Stock Exchange. At the same time the changes in their market values, and the changes which have taken place in the absolute average prices of all chemical stocks and in their relation to the average prices of all United States stocks, reveal the extent of financial risk which goes with chemical investment. The 7.1 billion dollars worth of shares listed in 1929 were reduced in value to 1.2 billion dollars in 1932, a loss of 82.96 per cent, in spite of a considerably greater number of shares. Only financially strong resources can withstand such strains. On the other hand, the chemical price ratios (average prices of chemical stocks related to average prices of all United States stocks listed on the New York Stock Exchange) show clearly the higher valuation in which chemical stocks have been held during 1937 and the resistance which developed to prevent them from being drawn fully into the general decline which occurred during the later part of that year.

Capital Increases are obtained in the United States also through stock issues whenever circumstances indicate the need for more new capital. To obtain the additional funds as much as possible from those already holding stocks, the stockholders are given special "rights" to purchase new stocks at a price slightly below the market price of old stocks. The "rights" are issued in the form of certificates which

TABLE 27

MARKET VALUE OF UNITED STATES CHEMICAL STOCKS

Data from N. Y. Stock Exchange Bulletins

Date	No. of Issues	Shares Listed, Common and Preferred	% of 1929 Average	Total Market Value	% of 1929 Average	Average Price per Share	% of 1929 Average	All U. S. Stocks, Average Price	Chemical Price Ratio
1929 Jan. 1....	65	29,455,622	64 05	$4,437,714,037	82.53	$150.66	128.85	$89.18	1.689
Feb. 1....	63	30,304,408	65 90	5,067,577,072	94.24	167.22	143 01	88.14	1.897
Mar. 1....	64	38,349,214	83.39	5,092,065,345	94.69	132.78	113.56	85 39	1.555
Apr. 1....	64	38,826,771	84.43	4,807,895,966	89.41	123 83	105.90	81 04	1.528
May 1....	62	39,160,745	85.16	5,042,860,361	93.78	128.77	110.13	82.62	1.559
June 1....	64	45,920,839	99.86	4,825,454,669	89.74	105.08	89.87	76.52	1.373
July 1....	64	46,145,189	100.34	5,503,566,964	102.35	119.27	102.00	82.24	1.450
Aug. 1....	69	48,195,106	104.80	5,983,824,039	111.28	124.16	106.18	84.62	1.467
Sept. 1....	72	56,606,178	123.09	7,112,152,781	132.26	125.64	107.45	89.76	1.400
Oct. 1....	72	56,868,668	123.66	6,705,883,229	124 71	117.92	100.85	83.56	1 411
Nov. 1....	72	60,237,774	130.99	5,370,065,421	99.86	89.15	76.24	64.98	1.372
Dec. 1....	74	61,776,030	134.33	4,579,159,767	85.16	74.13	63.40	57.23	1.295
1929 Average...	.....	45,987,212	100.00	$5,377,351,630	100 00	$116.93	100.00	$80.44	1.453
1932 Jan. 1....	78	67,426,922	146 62	$2,217,733,854	41 24	$32.89	28.13	$20.63	1.594
Feb. 1....	78	67,430,347	146.63	2,145,351,515	39.90	31.82	27.21	20.32	1.566
Mar. 1....	78	67,430,488	146.63	2,254,863,835	41.93	33 44	28.60	21.24	1.574
Apr. 1....	76	66,750,832	145 15	2,003,150,248	37 25	30.01	25.66	19.00	1.579
May 1....	76	66,747,816	145.14	1,496,224,906	27 82	22.42	19.17	15 65	1.433
June 1....	76	66,558,386	144 73	1,273,497,635	23 68	19.13	16 36	12.49	1.532
July 1....	76	66,557,648	144.73	1,212,039,066	22 54	18.21	15.57	12.12	1.502
Aug. 1....	76	66,557,100	144.73	1,499,662,159	27 89	22 53	19.27	15.86	1.421
Sept. 1....	76	66,557,333	144.73	1,934,805,340	35 98	29.07	24.86	21.56	1.348
Oct. 1....	76	66,562,696	144.74	1,993,423,193	37.07	29.95	25.61	20.74	1.444
Nov. 1....	76	66,560,821	144.74	1,748,573,007	32.52	26.27	22.47	18.18	1.445
Dec. 1....	76	66,565,374	144.75	1,708,948,737	31 78	25.67	21.95	17.26	1 487
1937 Jan. 1....	81	81,684,285	177.62	$6,502,233,633	120 92	$79 60	68.07	$44 22	1 800
Feb. 1....	81	81,687,161	177.63	6,649,478,222	123 66	81 40	69 61	45.54	1 788
Mar. 1....	81	81,744,399	177.75	6,573,366,524	122 24	80.40	68.76	45.72	1.759
Apr 1....	82	82,954,887	180.39	6,495,107,893	120 79	78 30	66.96	45.43	1.724
May 1....	82	84,298,568	183.31	6,174,998,383	114 83	73.25	62 64	42.03	1 743
June 1....	82	84,308,434	183 33	6,297,139,340	117 10	74 69	63.88	41.47	1.801
July 1....	83	85,257,275	185 39	6,185,872,487	115 04	72.56	62 05	39.39	1 842
Aug. 1....	83	85,610,161	186.16	6,536,613,791	121.56	76 35	65 30	42.48	1 797
Sept. 1....	83	85,628,270	186 20	6,374,281,825	118.54	74 44	63.66	40 69	1.829
Oct. 1....	84	85,726,801	186.41	5,762,336,199	107.16	67.22	57.49	35 23	1 913
Nov. 1....	85	86,281,464	187 62	5,241,609,970	97 48	60 75	51.95	31.91	1.903
Dec. 1....	85	86,954,211	189.08	4,768,563,045	88 68	54 84	46 90	29.03	1.889

usually are transferable, have a market value of their own (a few dollars) and can be traded on the exchanges, if the owners of old stocks, to whom the rights have been issued, do not care to make use of them. The final owners of the "rights" can in due time buy their shares of the new issue. Quite often, however, additional stocks are floated without the issuance of rights.

The acquisition of another company, addition of a new plant, refunding or redemption of callable issues, or even the mere expansion of the range of products is a sufficient reason in the United States for issuing new securities. Surplus funds are usually not reduced for these purposes and cannot be, because they represent in most companies not surplus but saved-up capital used to cover part of the assets.

In other countries public borrowing is resorted to occasionally for expansion purposes, but is not looked upon favorably by the original investors. Opinion prevails that expansion should be carried on out of current earnings or surplus, or through special reserves accumulated for this purpose until they are sufficiently large to cover the new project.

Unlike practice in the United States, new companies are acquired or added to German holding concerns, for instance, not by means of capital borrowing from the public but by an exchange of securities between the companies directly concerned and in some instances also by an exchange of securities involving a third or fourth company in which they are both interested. The respective banks, syndicates, and holding concerns of either party may also participate in these exchanges, through which finally everyone owns everyone else without having put up a great deal of new capital, if any. This method is applied primarily to save heavy taxes on excess income, new stock issues, and outright capital-transfer transactions, and to stabilize earnings as much as possible by mutual vertical and horizontal financial integration. The capitalization records of the large German potash, lignite, and dye concerns offer very interesting examples of this kind of chemical financing.

Dividends, Interest Payments and Surplus Policies. In the United States most chemical concerns have followed as liberal a dividend and interest payment policy as possible, mainly because they kept their stocks thereby in favor with the public and created further opportunities for additional issues. Liberal financial policies were furthermore required to compensate the investors for the higher risks which some chemical production involves. In order to avoid overborrowing, most companies which could afford it re-invested part of their earnings and

created "surpluses," which often have been considered by the public as special protection for the investors and have helped considerably in floating new chemical stocks. In actuality, however, most companies had to use their surpluses as saved-up capital, and they increased their assets in line with surplus accrued. Thereby they saved in capital service charges and provided a generally healthier financial structure.

German chemical corporations also paid high dividends and interest and as a rule accumulated large surpluses, until adverse political economic measures and taxation induced them to distribute less among the investors and to use the undistributed profits for strengthening their internal financial structure and economic position as indicated before, and for a simultaneous improvement of every phase of operation and research. Thus legislation designed to force industry into a "better distribution of wealth" actually achieved this, but not in the desired form. Instead, the wealth was covered up.

Liberal dividend policies on chemical stocks can also be found in England, France, and Japan, and the tendency to pay as much as circumstances permit can be considered as a generally recognizable financial policy of the large chemical concerns everywhere.

Financial Absorption and Integration. In addition to the establishment of new plants and new subsidiary companies, the financial absorption and integration of established companies into the finance structure of large concerns is almost the rule among the large chemical corporations.

Even in the formation of the earliest American chemical corporations we find that the plant properties of various small companies were combined in order to obtain large corporation status and corporate capital. The new corporations became not only the owners of these properties but also their financial agents and holding companies.

The large chemical corporations of today thus are not all primarily producing companies. Some are in their main function financial holding companies, founded to obtain funds, for which they assume responsibility to the public. They handle the financial activities of the companies and plants which they own outright or in part (subsidiary or affiliated companies), they direct patent matters, furnish a common sales organization, and act as a common clearing house in general on production and other problems.

There is hardly any large chemical corporation in the United States that has not absorbed other companies since its foundation. This process is one of the most interesting features of chemical financing. As agreements among manufacturers are impossible, the consolidation

of desirable enterprises into the corporate structure through financial means is, for American corporations, the next best method of rounding out their technical and financial position.

In actually carrying out these consolidations the great problem is to determine whether or not the costs of such acquisitions are in line with the advantages obtained, what effect they may have on the financial structure of the holding company and on profits, and what possible future financial requirements they may entail. Technical and sales advantages have to be weighed against financial costs and possible losses. The desire for increased profits is not always the determining factor. In chemical integration the non-financial factors are usually the more important ones in arriving at a final decision.

Holding companies operating in the basic chemical field (acids, sodas, basic coal-tar products) have financial integration in two directions to choose from: horizontal or vertical, meaning that they have the opportunity to extend their interests either to similar or to different companies. Fertilizer, oil, rayon, and solvent companies usually find it most prudent to branch out horizontally only. Financial investment in raw-material resources has not always been found a profitable undertaking. It increases the fixed charges and does not permit taking advantage of raw-material price recessions which invariably occur during the lifetime of the investment. Only when very rare or very cheap raw materials needed in quantity are involved is it definitely advisable to expand financial investment into such resources.

Horizontal as well as vertical financial integrations have been found highly successful. Simon-pure examples of either policy are rare, but horizontal integration, for instance, mainly prevails in the Texas Gulf Sulphur Company, the Commercial Solvents Corporation, and the Virginia-Carolina Chemical Corporation. E. I. du Pont represents a typical vertical organization, based on the use of acids and nitrocellulose. In vertical integration success seems to depend on making the integration from the very beginning as complete as possible and to avoid missing links. Any omission of companies vitally needed in the transformation of basic into final products may prove a most costly oversight, because later acquisition of such companies, or the establishment of a new one to fill the gap, may become possible only at considerable sacrifice. Facts further bear out that horizontally organized corporations usually find it extremely difficult to branch out vertically. Thus the right choice of integration policy is of vital importance to any large chemical corporation.

To follow up the moves which have been and still are being made

by the various companies in their integration policies is as fascinating as it is instructive to study the results of financial integrations which find their expression in price changes, cost reductions, process improvements, patent exchanges, financial transactions, abandoning of old plants, concentration of production in best-suited locations, improvement of distribution systems, changes in personnel, and other, mostly cost-saving, actions.

The great dangers which always threaten a large concern are: (1) the creation of a similar organization with equal financial strength aiming at the same market, and (2) new inventions, held by new, financially strong interests. Provided that either the new concern or the new invention has really sterling qualities, even the best-established company has difficulties in holding its previous position. As a decisive battle merely means economic losses of greatest seriousness to both groups, combination of the two potential enemies is by far the better solution, and by pooling their resources they can create one organization bigger, better, and stronger than either alone would be fighting the other. If competition is not entirely eliminated and no anti-trust regulations are violated, the merging of even great corporations appears entirely feasible and within the law.

The histories of the largest chemical concerns—Interessengemeinschaft der Farbenindustrie in Germany and Imperial Chemical Industries in England—indicate that financial and economic chemical developments have not reached their *final solution* until they have been expressed in the form of a mammoth organization which then becomes able really to protect all chemical interests. It would be surprising if in other countries no such evolution should take place sometime in the future. When the combined production capacity of all competitors has outdistanced the maximum potential market of good years, low prices do not cover costs, and frantic borrowing for still further expansion is attempted in spite of available super equipment, duplication of plants, and excess capacity, it is evident that the time is ripe for the next move.

Financial integration need not always be inspired by monopolistic tendencies, and in the chemical industries which serve thousands of different demands the simultaneous requirements for maximum specialization, diversification, adaptability to economic changes, quantity production, and security of investment cannot be achieved forever without a definite economic-financial plan which would make the tremendous national investment really safe and secure. At present the industry seems to have reached an impasse which will have to be re-

lieved by quite important decisions. One is confirmed in this belief if he studies in detail the most recent financial conditions of a representative group of large corporations.

THE CAPITALIZATION OF TWENTY-EIGHT LARGE COMPANIES

Table 28

The most convenient records on the financial conditions of corporations are the Report and Statistical Sections of the *Standard Corporation Records,* published by the Standard Statistics Company, Hudson Street, New York. With the assistance of this company the financial data of the sample group of twenty-eight representative chemical companies have been compiled.

Common stocks furnished 70.20 per cent of the entire capitalization of the sample group stated at balance-sheet values. The par values of these stocks range from $1 to $5, $10, $20, $40, $50 per share but are rarely higher. Occasionally one finds also no-par-value stocks which then are reported in the balance sheets at net investment values.

Preferred stocks supplied 26.95 per cent of the capital funds. Their par value is mostly $100 per share for the largest and $50 to $30 per share for smaller companies.

Bonds and *similar securities* appear to the extent of only 2.60 per cent of the entire capital obtained.

The figures do not reveal any rule which would be followed by the companies in order to obtain the "best" capitalization, meaning just as much funds as needed to secure progress for the company, the smallest capital service charges, and the greatest security for the investor. Nor do there seem to be any rules on the "ideal relationship" between the various kinds of securities that have been established, at least in theory, for railroads, public utilities, and a few other lines of capitalization. The choice of securities to be used depends on the risks involved in the project and on the decision of the banks regarding the kind of security with which they want to approach the public. Dynamite makers, synthetic and heavy chemical producers, facing a reluctant or overloaded investment market, have to offer more security than others. Therefore preferred stocks and bonds prevail in their capital structures. Common stocks would not attract sufficient capital, because everyone in a position to invest substantial sums knows the competitiveness and financial limitations of these industries, their subjection to seasonal changes, and their dependence on technical, legal, and political conditions.

TABLE 28

UNITED STATES CHEMICAL INDUSTRIES, CAPITALIZATION OF LARGE COMPANIES

Company	Date of Statement	Total Capital, Stocks and Bonds at Bal. Sheet Values	Common Stocks Outstanding		Preferred Stocks Outstanding		Bonds Outstanding, Amount	Total Surplus Amount
			Number	Amount	Number	Amount		
28 Companies	12-31-36	$638,456,262	35,040,083	$448,198,977	2,410,350	$172,081,741	$16,606,000	$565,084,378
Per Cent of Total	.....	100.00	. .	70.20	. ..	26 95	2 60	
Allied Chemical and Dye	12-31-36	$ 11,070,495	2,214,099	$ 11,070,495	.	. . .	. ...	$145,209,863
Amer. Agricultural Chemical	6-30-37	8,437,280	210,932	8,437,280	..			10,230,787
Amer. Cyanamid	12-31-36	32,722,677*	2,520,368†	25,203,680			$ 6,400,000	19,021,461
E. I. du Pont	12-31-36	331,745,040	11,065,762	221,315,240	1,092,948	$109,294,800	1,135,000	226,236,595
Davison Chemical	6-30-37	511,776	511,776	511,776			...	9,487,175
Mathieson Alkali Works	12-31-36	17,884,058	830,428	15,506,358	23,777	2,377,700	. .	6,448,255
Merck & Co	12-31-36	4,931,000	300,000	300,000	46,310	4,631,000	.	2,919,002
U. S. Industrial Alcohol	12-31-36	4,934,563	391,238	4,934,563	. .	.	. ..	6,934,254
Virginia Carolina Chemical	6-30-37	21,339,216	486,708	1	213,392	21,339,215	.	1,471,181
Total 9 Companies	.....	$433,576,105	18,531,311	$287,279,393	1,367,427	$137,642,715	$ 7,535,000	$427,958,573
Air Reduction	12-31-36	$ 24,190,299	2,532,065	$ 24,019,299	.	. . .	..	$ 10,984,105
Amer. Commercial Alcohol	12-31-36	6,262,218	260,935	5,218,696	104,352‡	$ 1,043,522‡	.	3,529,844
Atlas Powder Co	12-31-36	15,152,849	248,666	8,293,149	68,597	6,859,700	.	4,760,204
Catalin Corp	12-31-36	536,814	536,814	536,814	.. .	. .	. .	704,253
Columbian Carbon	12-31-36	21,930,474	538,420	21,930,474	. . .	. . .	. .	5,045,143
Commercial Solvents	12-31-36	6,593,452	2,636,878	6,593,452	... .	. .	..	10,030,680
Compressed Ind. Gases	12-31-36	753,775	150,755	753,775	.	.. .	...	1,991,797
Dewey and Almy Chemical	12-31-36	1,496,391	60,343	207,540	22,573	1,009,304		632,058
Dow Chemical Co	5-31-37	20,654,200	945,000	12,685,000	29,692	2,969,200	$ 5,000,000	9,480,163
Freeport Sulphur	12-31-36	9,193,905	796,380	7,963,805	12,301	1,230,100	.	7,332,552
Great Western Electr. Chemical	12-31-36	2,163,191	69,260	234,791	96,420	1,928,400		933,537
Hercules Powder	12-31-36	23,345,775	583,879	14,596,975	87,488	8,748,800		10,623,674
Monsanto Chemical	12-31-36	13,084,090	1,114,409	11,144,090	400,000	1,940,000	.	17,628,298
Newport Industr. Chemical	12-31-36	519,347	519,347	519,347	.....		.	2,906,052
Tennessee Corporation	12-31-36	8,339,480	853,696	4,268,480	. . .	.	4,071,000	11,717,676
Texas Gulf Sulphur	12-31-36	26,175,000	3,840,000	26,175,000	..... .	.	.	31,392,229
United Carbon Co	12-31-36	11,952,538	397,885	11,952,538	.. ..	.	. .	2,586,555
United Dyewood Corp	12-31-36	4,340,000	139,000	1,390,000	29,500	2,950,000		2,659,332
Westvaco Chlorine	1-2-37	8,196,359	284,962	2,436,359	192,000	5,760,000	.	2,187,653
Total 19 Companies	.....	$204,880,157	16,508,772	$160,919,584	1,042,923	$ 34,439,026	$ 9,071,000	$137,125,805

* Includes $1,118,997 preferred stock of subsidiary. † Includes Class A and B shares. ‡ Preferred stock of American Distilling Company, a subsidiary.

Who owns the 86,281,464 shares of stock of the chemical companies now listed on the New York Stock Exchange has never been statistically ascertained, but it is safe to assume that they are not held by only the very rich, and that they represent the carefully chosen and widely distributed investment of the American "middle class."

Insurance and investment trusts also have part of their holdings in chemical stocks, but do not favor them unduly, in spite of splendid dividend records and AAA ratings. This, and the fact that such trusts have begun to reduce their chemical holdings, deserves attention. There must be reasons, and there are, as will be shown.

The *surplus funds* of the sample group almost equal the par value of borrowed capital, and both combined just about equal the net value of all assets carried on the books. (Total assets minus reserves, see Table 29.) This proves that the twenty-eight companies combined are operating as much with saved-up capital as with borrowed funds and that their surpluses are not "surpluses" in the sense of excess funds. They are tied up in tangible investments as of old; they are not "free" amounts that could be taxed away or handed out in the form of higher dividends or wages. There is no doubting this because, no matter how one tests these companies, their surplus funds and all reserves must be considered to balance out their assets.

THE ASSETS OF TWENTY-EIGHT LARGE COMPANIES

Table 29

Of all assets reported by the twenty-eight companies, 70.72 per cent are *fixed investment* and only 29.28 per cent are *current assets*. These facts reveal right from the start the most important feature of chemical financing. Its main concern and worry are fixed assets.

It is well known that many chemical companies carry their fixed assets in their books and balance sheets at actual cost values so long as they are in existence. Their true values are established each year, however, and the actual costs are reduced to present-day values by reserves for depreciation in line with the wear and tear through age and use. The maintenance of the actual cost values is a peculiar practice not common to all industries but has been quite generally adopted for chemical bookkeeping, because it is the method which permits the most correct evaluation of the properties, a rather difficult process in chemical companies, and at the same time furnishes the clearest information about the changes which have taken place. These changes involve losses in value or utility as well as additions, expansions, im-

TABLE 29

UNITED STATES CHEMICAL INDUSTRIES—ASSETS, SUBSIDIARY INVESTMENT, AND RESERVES OF LARGE COMPANIES

Company	Date of Statement	Total Assets	Current Assets	Fixed Assets	Nonconsolidated Investments in Subsidiary and Affiliated Companies	Fixed Operating Assets	Total Reserves Including Depreciation
28 Companies	12–31–36	$1,714,424,226	$502,030,235	$1,212,393,991	$205,144,496	$1,007,249,495	$562,881,075
Per Cent of Total	.....	100 00	29 28	70.72	11 97	58 75	32.84
Allied Chemical & Dye	12–31–36	$377,501,577	$ 97,201,969	$280,299,608	. . . . .	$280,299,608	$207,566,424
American Agricultural Chemical	6–30–37	22,355,235	15,091,175	7,264,060	. .	7,264,060	5,733,803
American Cyanamid	12–31–36	62,858,018	27,761,040	35,096,978	$ 4,312,000	30,784,978	37,779,945
E. I. du Pont	12–31–36	721,230,126	155,229,948	566,000,178	188,027,102	377,973,076	105,231,761
Davison Chemical	6–30–37	12,200,230	6,641,098	5,559,132	. . . .	5,559,132	945,759
Mathieson Alkali Works	12–31–36	26,203,425	3,663,070	22,540,355	. . . . .	22,540,355	12,949,651
Merck & Co	12–31–36	8,973,076	5,856,816	3,116,260	65,480*	3,050,780	390,952
U. S. Industrial Alcohol	12–31–36	15,552,120	13,283,482	2,268,638	. . . . .	2,268,638	27,782,353
Virginia Carolina Chemical	6–30–37	25,920,024	10,384,969	15,535,055	1,336,298	14,198,757	4,485,868
Total 9 companies	.....	$1,272,793,831	$335,113,567	$937,680,264	$193,740,880	$743,939,384	$402,866,516
Air Reduction	12–31–36	$ 41,315,295	$ 21,709,791	$ 19,605,504	. . . .	$ 19,605,504	$ 21,331,276
Amer. Commercial Alcohol	12–31–36	16,717,944	10,266,500	6,451,444	$ 250,435*	6,201,009	4,017,999
Atlas Powder Co	12–31–36	24,935,641	9,563,271	15,372,370	956,940	14,415,430	7,947,294
Catalin Corp	12–31–36	1,404,782	548,840	855,942	. .	855,942	219,783
Columbian Carbon	12–31–36	50,910,482	7,487,020	43,423,462	4,331,281	39,092,181	21,271,075
Commercial Solvents	12–31–36	20,225,393	14,057,716	6,167,677	935,097*	5,232,580	10,460,066
Compressed Ind. Gases	12–31–36	3,076,415	1,000,820	2,075,595	409,155	1,666,440	1,530,681
Dewey & Almy Chemical	12–31–36	2,231,446	1,355,780	875,666	. . . .	875,666	1,069,434
Dow Chemical Co	5–31–37	35,682,938	12,924,256	22,758,682	557,800	22,200,882	13,129,734
Freeport Sulphur	12–31–36	19,710,113	10,010,370	9,699,743	275,000	9,424,743	4,900,323
Great West. Electr. Chemical	12–31–36	3,548,364	1,304,177	2,244,187	. . . .	2,244,187	2,978,392
Hercules Powder	12–31–36	42,125,740	17,833,604	24,292,136	1,083,967	23,208,169	18,911,439
Monsanto Chemical	12–31–36	44,947,240	16,144,675	28,802,565	. . . .	28,802,565	10,145,733
Newport Industr. Chemical	12–31–36	4,576,128	1,731,202	2,844,926	495,578	2,349,348	2,430,561
Tennessee Corporation	12–31–36	21,415,085	4,440,085	16,975,000	. . . . .	16,975,000	8,959,922
Texas Gulf Sulphur	12–31–36	61,537,593	27,097,581	34,440,012	347,160	34,092,852	9,856,735
United Carbon Co	12–31–36	27,768,347	2,752,369	25,015,978	1,062,980	23,952,998	11,892,220
United Dyewood Corp	12–31–36	8,794,752	4,591,934	4,202,818	698,223	3,504,595	2,531,611
Westvaco Chlorine	1–2–37	10,706,697	2,096,677	8,610,020	. . . . .	8,610,020	6,430,281
Total 19 companies	.....	$441,630,395	$166,916,668	$274,713,727	$ 11,403,616	$263,310,111	$160,014,559

* Less reserve.

provements, replacement value adjustments, inventory adjustments, occasional accruals in value, etc.

Although one would expect that in long-established companies "everything is written off," the figures reported by them refute this expectation. American chemical enterprises have not gone stale and continued to operate with old equipment. The fixed assets of most companies may not offer a beautiful sight or scenery and may only be housed in simple utility structures, but more likely than not these buildings harbor up-to-date investment. At least, that is what the financial statements indicate.

Inventories (stocks of raw materials and finished products) held by the companies, but not reported in the table, amounted to $178,889,770. This means that they represented about one-third of current assets or 10 per cent of total assets. They are reported at cost or market values, whichever are lower. As cost of sales of the entire group was $643,859,973 ($830,037,351 minus $186,177,378; see next table), the stocks were turned over only 3.60 times. This is only one-half or even less of the stock turnovers reported by other industries or all industries combined and indicates the extent to which "availability" is made the burden of the chemical producers.

Subsidiary and affiliated investment not consolidated with the assets of the companies were reported at only $205,144,496 or at roughly 12 per cent of total assets. In a corresponding sample group of German companies this item would be at least two or three times as high. This shows that American chemical "interest taking" has by no means reached its possible limit. E. I. du Pont has proved the financial, technical, and economic advisability of interest taking, especially in chemicals-consuming enterprises, and there is no reason why this same policy should not be just as successfully applied to a much greater extent than in the past by other large chemical producers in their own respective fields.

Total reserves of the twenty-eight companies amounted to $562,881,075, including reserves for depreciation. This covers approximately half of all fixed assets and corresponds to one-third of the entire total assets. This represents good, but not excessive, protection in view of the many purposes which these reserves may serve: depreciation, redemption of containers, uncollected accounts, replacements, pension funds, bonus fund for employees, stock and inventory losses through spoilage and evaporation, taxes, wage payments, insurance, funded debt, subsidiary investment, contingencies, and the ever-present "sundry requirements."

Reserves for depreciation are usually set up out of current earnings at annual amortization rates ranging from 2 to 33 per cent or even more according to the actual or expected lifetime of the various objects. Usually the common standard rates of amortization are used, but they are modified as greater wear and tear demand. The best policy, which also protects the company against any conflict with the tax collector, is to set up reserves that can be actually proved to be necessary. It is poor policy to write off more than actually can be justified because such practice understates the value of the assets, thus leading to erouble with all the tax-collecting agencies and to the reckless borrowing of new funds. To write off less than necessary is just as undesirable, because this overstates the value of the assets, misleads the investors, and makes it necessary to take heavy depreciation losses at times when they are least desired. Reserves will be set up correctly if they are kept in line with actual use, not with a rigid annual rate. In good years more will be produced, therefore, there will be more wear and tear and higher rates of depreciation; in lean years, lesser use and lower write-down charges.

NET SALES, PROFITS, INCOMES OF TWENTY-EIGHT LARGE COMPANIES

Table 30

The profit and loss statements of chemical companies are not reported uniformly, and many corporations leave out net sales, cost of sales, operating profits, and commercial expenses. Only net incomes and subsequent items are reported by all companies. It was possible, however, to estimate from available data those that were missing and to complete the financial picture of the sample group.

The variety in financial results is as surprising as the variety encountered in the methods of reporting these data. Some companies report operating profits (difference between sales and cost of sales values) related to net sales as high as 50 per cent; others announce their operating profits at 10 per cent or less. Fifty per cent may appear high and 10 per cent may seem rather low for covering the costs of distribution and providing net income. And yet both percentages may be just right, if they furnish in actual cash just what these companies need to cover all their expenses and fulfill their financial requirements.

The group combined has operated at the more likely operating profit of 22.43 per cent—a figure which is also close to those reported in past years by E. I. du Pont.

TABLE 30

UNITED STATES CHEMICAL INDUSTRIES—NET SALES, PROFITS, INCOMES OF LARGE COMPANIES

Company	Date of Statement	Net Sales, Estimated *	Operating Profit before Depreciation	Operating and Other Income after Selling and Operating Expenses before Depreciation	Net Income after All Charges Except Interest	Interest on Bonds	Net Income Available for Dividends	Dividends Paid	Added to Surplus or Withdrawn
28 companies	12–31–36	$830,037,351*	$186,177,378	$243,481,798	$173,061,377	$799,769	$172,261,608	$132,796,754	$49,830,194
Per Cent of Total	.....	100 00	22 43	29 33	20 85	0 10	20.75	16.00	6 00
Allied Chemical & Dye	12–31–36	$ 27,682,504‡	$30,085,436‡	$25,323,834	.....		$25,323,834	$13,284,594	$3,923,419
American Agricultural Chem.	6–30–37	2,866,507	2,866,507	1,868,944	.....		1,868,944	1,054,654	814,290
American Cyanamide	12–31–36	8,827,967	9,786,780	4,862,720	$407,790§		4,454,930	252,368	1,934,562
E. I. du Pont	12–31–36	68,187,715	116,938,424	89,941,199	56,750		89,884,449	73,960,083	29,924,367
Davison Chemical	6–30–37	1,413,872	1,509,183	578,943	.....		578,943	306,914	487,031
Mathieson Alkali Works	12–31–36	3,713,010	3,751,870	1,628,480	.....		1,628,480	1,412,184	159,485
Merck & Co	12–31–36	1,505,936	1,558,819	1,048,222	.....		1,048,222	517,860	462,444
U. S. Industrial Alcohol	12–31–36	113,121	756,214	red 77,581	.....		red 77,581	293,429	red 371,010
Virginia Carolina Chemical	6–30–37	2,001,968	2,144,678	1,254,040	.....		1,254,040	319,578	754,771
Total 9 companies		$518,571,767*	$116,312,600	$169,397,911	$126,428,801	$461,540	$125,964,261	$93,669,664	$38,089,359
Air Reduction	12–31–36	$ 27,833,880	$9,288,001	$9,882,360	$7,064,553	.....	$7,064,553	$6,960,781	$ 3,772
American Commercial Alcohol	12–31–36	35,463,632†	1,901,674	2,050,939	1,187,232¶	.....	1,187,232¶	1,191,354	red 504,122
Atlas Powder Co	12–31–36	15,895,300	2,111,054	2,224,852	1,430,080	.....	1,430,080	1,256,245	173,835
Catalin Corp	12–31–36	1,628,944	390,411‡	423,751‡	281,055	.....	281,055	214,757	66,299
Columbian Carbon	12–31–36	13,872,390	5,658,434	6,607,043	4,021,137	.....	4,021,137	3,084,198	896,866
Commercial Solvents	12–31–36	47,856,263	2,854,821	3,251,547	2,232,135	.....	2,232,135	2,109,447	125,923
Compressed Ind. Gases	12–31–36	2,442,941	543,112	592,818	355,823	.....	355,823	532,507	638,819
Dewey & Almy Chemical	12–31–36	3,647,401†	567,530	588,478	341,557	.....	341,557	245,288	137,377
Dow Chemical Co	5–31–37	25,578,911	7,920,708	8,534,249	4,247,688	$158,575§	4,089,113	3,046,095	1,212,697
Freeport Sulphur	12–31–36	10,998,645	2,994,223	3,059,795	2,009,783	.....	2,009,783	870,177	925,201
Great West. Electr. Chemical	12–31–36	2,719,212	1,137,556	1,142,020	475,675	.....	475,675	448,152	45,823
Hercules Powder	12–31–36	36,740,574	6,993,892	7,290,779	4,284,164	.....	4,284,164	3,655,909	445,518
Monsanto Chemical	12–31–36	28,848,438	6,924,089	7,365,622	4,468,704	.....	4,468,704	3,234,826	6,464,930
Newport Industr. Chemical	12–31–36	4,363,598	818,268	824,532	507,009	.....	507,009	311,608	269,606
Tennessee Corporation	12–31–36	9,656,717	950,957	973,120	529,952	176,654	353,298	128,054	222,031
Texas Gulf Sulphur	12–31–36	22,080,137†	11,906,215	12,077,295	9,853,014	.....	9,853,014	9,600.000	253,014
United Carbon Co	12–31–36	9,018,648	4,495,649	4,639,378	2,202,850	.....	2,202,850	1,372,703	491,181
United Dyewood Corp	12–31–36	6,001,128	637,715	740,746	514,156	.....	514.156	416,750	red 39,259
Westvaco Chlorine	1–2–37	6,913,825	1,770,469	1,814,563	626,006	.....	626,009	448,239	red 92,676
Total 19 companies		$311,465,584	$ 69,864,778	$ 74,083,887	$46,632,576	$335,229	$46,297,347	$39,127,090	$11,740,835

* Estimate. † Gross sales. ‡ After depreciation. § Includes amortization. ¶ Before reserve for estimated profits on sales subject to future delivery.

Additional income from investments, subsidiary activities, affiliated companies, royalties, and similar sources must be considerable in those companies which have such revenues (Allied Chemical, du Pont, Air Reduction, Columbian Carbon), because, even after selling and all operating expenses except depreciation have been deducted, the operating profit of the entire group appears increased to 29.33 per cent.

As *net income after depreciation* ($173,061,377) was 20.85 per cent of sales, depreciation must have amounted to 8.48 per cent of sales or $70,420,421. The amount represents 5.81 per cent of fixed assets ($1,212,393,991). This amortization rate would have to be considered conservative and is probably lower than in other years, when depreciation amounted to and exceeded 10 per cent of net sales or 8 per cent of fixed assets.

Net income after depreciation and all other charges is the amount available for interest payments on bonds, dividends, and transfers to surplus. At 20.85 per cent of sales the net income of these largest and other representative large companies appears twice as high as reported for the industry on the basis of income-tax returns. Thus without further investigation one is easily led to consider the large chemical corporations as taking and distributing too much profit and thereby operating contrary to modern concepts of social justice and economy.

A few simple calculations which anyone can make for himself fully disprove such statements and assumptions.

SUMMARY FINDINGS ON THE FINANCIAL CONDITIONS OF TWENTY-EIGHT LARGE COMPANIES

In order to obtain a true, conclusive picture of the financial conditions under which the largest chemical companies operate, the following key figures, taken from the preceding tables, are repeated:

Total borrowed capital	$ 638,456,262
Total saved-up capital (surplus)	565,084,378
Total capital used	$1,203,540,640
Total assets reported	$1,714,424,226
Minus total reserves	562,881,075
Net value of assets	$1,151,543,151
Total sales	$ 830,037,351
Bond interest and dividends paid	$ 133,596,523
1936 accrual to surplus	$ 49,830,194
Wages and salaries paid (calculated at 15.27% of sales)	$ 126,746,703

Through correlation of these figures the following facts can be established:

(*a*) *On the Economic Productivity of Chemical Capital Investment*

Sales produced by means of borrowed and saved-up capital are lower than the capital, the assets, or even the net assets employed in producing them. The capital turnover (sales divided by total capital used) indicates that capital could be transformed into sales only at a rate of a 0.69 turnover. Most industries obtain sales at least equal to their capital investment; many obtain sales two, three or more times their capital. These most recent data merely bear out the findings derived from census data, which showed capital turnovers of 0.68 for 1929, 0.69 for 1931, 0.63 for 1933, 0.70 for 1935.

Thus it appears that the sales productiveness of the large companies and of the industry as a whole has remained stagnant now for eight years, which should indicate that the present capital investment has reached the limits of its economic usefulness. Further investment without a relative increase in sales merely would reduce it further, and therefore new expansion on the basis of capital borrowing should be considered only after most careful consideration.

There can be no doubt that the industry has reached and is remaining at a critical point in regard to present and future capital investment.

(*b*) *On "Exorbitant Profits" to the Investor*

It has been shown that liberal dividend and interest policies are necessary in every country to attract investment funds for chemical production. The twenty-eight American producers who in 1936 paid out $133,596,523 or 20.92 per cent in interest and dividends on $638,-456,262 borrowed capital, expressed mostly at net par values, would actually have paid liberally too, provided that all the present stockholders obtained their stocks and bonds at par values or no-par valuations. In actuality, however, most recipients of dividends or interest payments did not acquire their holdings at bottom prices, and therefore they received their returns on investments which were probably twice or three times as high as they appear in the balance sheets.

Therefore the theoretical returns or yields of 20.92 per cent were in actuality not higher than 10.46 or 6.97 per cent, which is not superabundant and corresponds to yields which can be obtained, with the same or lesser risk, in other fields of investment.

The fabulous profitableness of chemical investment, reduced to what it really is, thus reveals another critical feature, viz., that it is very close to losing its financial attractiveness in many lines, and that it has reached the point where it becomes only one of many choices.

(c) *On the Social Fairness of the Most Recent Financial Policies*

It has been proved before that the chemical industries have steadily increased their social-economic share and that they have given employment, earnings, and living to a steadily increasing number of those engaged in industrial pursuits. These facts are upheld by an analysis of the most recent financial data.

The wages and salaries paid by the industry in

1925	were	15.30%	of net sales	
1927	"	15.34%	" " "	
1929	"	15.08%	" " "	
1931	"	15.52%	" " "	
1933	"	14.63%	" " "	(which is understated)
1935	"	15.65%	" " "	

For 1936 no data are available, but it is fair to assume that wages and salary payments for these years were at least equal to the weighted average of the six years, which was 15.27 per cent. This percentage applied to $830,037,351 (net sales) indicates wage and salary payments for 1936 of $126,746,703, which probably is too low in view of increases granted. As layoffs were few in 1936 the recipients of wages and salaries thus obtained almost the identical amount for their contribution to chemical economic progress as the investors received in the form of interest and dividend ($133,596,523) for risking their investment.

In view of these indisputable facts it should be difficult to uphold further any theories and general statements on economic greed or selfishness on the part of chemical producers.

(d) *Old Surplus, New Surplus, and Surplus Taxes*

There is no doubt that "surpluses" which almost equal the total amount of borrowed capital invested in an industrial group are bound to attract attention. It is also understandable that, as a remedy for serious economic depressions, theories are being propagated recommending that these funds be distributed, or heavily taxed if no distribution is made.

These theories are well meant but are based on wrong assumptions. As the surpluses are tied up by assets, as has been shown, their volun-

tary or enforced distribution is de facto impossible. They can be reduced only by simultaneous liquidation of assets. If tax laws are invoked to "distribute surplus," these laws will be fulfilled, as they have been in other countries, by writing off assets and surpluses at the same time and by hiding them in other ways. Thus are created hidden assets which are decidedly more undesirable than openly conceded saved-up capital. Laws can and should prevent genuinely unfair economic or social practices, but they cannot and never will overcome fair and definitely justified practices of economic self-preservation. The reasons why chemical companies are in special need of it have been explained.

New surplus creation has already been slowed up, if the 1936 accruals are an indication. Private individuals are encouraged to save in each year at least 10 per cent of their gross earnings. The twenty-eight companies set aside for surplus not more than $49,830,194, which represents only 6 per cent of their gross earnings or 4.14 per cent of their present fixed assets. At these rates they cannot create or maintain out of their own resources the necessary assets or capital. This demonstrates, how restricted new surplus creation must lead to more borrowing and higher capital service charges, lower dividends, and probably to a rapid aggravation of the now latent financial dangers. Restricted new surplus creation is thus against all principles of sound financing, which aims to build up an enterprise out of its own earnings by saving and setting aside of funds. This is the financial policy which has carried the American chemical industries to always higher heights and therefore should be as good today and in the future as it was thirty, fifty, and a hundred years ago.

(*e*) *On Future Financial Policies*

In view of the obviously restricted economic productivity of chemical investment which to all appearance cannot be improved to any great extent by the financial expansion of large chemical capital in the form of additional mammoth plants, super production, and super distribution systems, it seems that further progress should be sought by the large companies not by increasing the competitive pressure within the industry beyond the danger point which it has reached but by extending their financial interests into investment in:

(1) Non-chemical enterprises.
(2) New chemical fields.
(3) Foreign trade.

Diversification of investment by *expansion into chemical consuming lines of production* is economically more justified and desirable than further diversification within the industry, because this prevents further pressure upon the thousands of smaller enterprises that are hard pressed in spite of all diversification and limited in their actions to these fields. At present they "exist," but do not prosper. Closer technical and financial integration of chemical and non-chemical industrial enterprises is further bound to strengthen not only those directly participating but even the entire industrial economic structure of the country, which has been seriously shaken in recent years and needs internal strengthening and stabilization through its own actions.

Pioneering in new chemical fields and further investment in such lines is part of the tradition of the industry and has been carried on technically to a large extent but not always with the financial backing which such activities would merit. There are serious reasons for caution, but it seems that chemistry, chemical engineering, and synthetic production can still find and produce many new products which would benefit mankind without causing economic detriment to chemical industrial groups or to the American economic system as a whole. More definite financial support for really new products is needed and is bound to carry on progress in a direction where it would relieve the internal economic pressure now prevailing in the industry.

Expansion of foreign chemical trade is a moot subject to many, but concerns a field to which the industry as a whole has not given full attention. Financially, as well as economically, it offers possibilities of far-reaching importance, not perhaps in the immediate but in the more distant future. Aim-conscious, carefully organized expansion in this direction not only would properly complement the other two activities, but would bring the economic diversification of chemical industrial activities still nearer to the most ideal and at the same time practical state that present-day economic thinking and intelligent execution can achieve.

CHAPTER 11

FOREIGN CHEMICAL TRADE

TO EXPORT OR TO STAY AT HOME?

So long as the American market needed more chemicals than were domestically produced and many products had to be imported because they were not made as yet in all varieties, there was no reason, or much possibility, for export trade. The "do your business *at home*" policy was the only one to follow.

Even during the early post-war period, when many chemical industries were rounding out their production and perfecting their mass-production technique, the recommendations of the anti-export advocates were still justified and their warnings were the more understandable as the prices for most chemical products then made were usually much higher than those asked by competitors in the world markets.

As most chemical products are standard products and are bought in international transactions mainly on the basis of price, American chemical exports were restricted during these periods to those raw materials and crudes which were offered at lowest world prices, either because they were available in very large quantities or were not as yet fully utilized by American producers. Thus, although rosin, tar, turpentine, borax, sulphur, pigments, and later on paints, benzol, toluol, alkalis, and wood distillates found their way into England, Germany, and France, only a few other American chemical products could be offered competitively abroad.

Nowadays, however, since there is no longer a lack of chemical knowledge or of production facilities in the United States, production covers the whole range of chemical products, more products and by-products can be produced than can always be easily disposed of in the American market, and gold-value prices of United States chemical products are lower than ever before, it seems that the time has arrived when further progress of the chemical industries should lie as much in the direction of exports as in further intensification of activities at home.

Export causes inconveniences; export practices and export shipping routines are complicated and cumbersome; collection of bills is sometimes slow, and much special knowledge must be acquired, which is not needed in domestic trade. But *exporting is instructive,* much more so than may appear at first glance, and *helpful* in developing a company, its products, and its personnel to much greater perfection than can be achieved by domestic experience alone. The knowledge gathered in export territories on product requirements and application under various climatic and geographic conditions; the contact with foreign industrial enterprises and their different processes; the sales methods and business policies applied abroad; and the various legal, financial, and economic difficulties to be overcome, offer stimulation not otherwise available and are a testing ground for the enterprising spirit of young and seasoned men alike.

The fact that so far annually only 6 per cent of all United States chemical sales have been made to foreign buyers can hardly be sufficient ground to "stay at home" and leave this good and fertile field to others.

THE WORLD CHEMICAL TRADE

In order to determine the position which has been achieved by the United States chemical industries in the international exchange of goods it is necessary to know the total value of the chemical trade which is carried on throughout the world. Unfortunately the statistics of the various countries are not uniform, and some report as chemicals what others leave out. Therefore any figures which aim to show "world chemical trade" must be prepared with care and even then they are only approximations.

The last study of this kind was undertaken by the Chemical Division of the U. S. Department of Commerce and published in "World Chemical Developments for 1935" (Trade Information Bulletin 832, p. 15). The following data have been taken therefrom. Exports and imports are shown separately as well as combined because the two kinds of trade deal in entirely different products and are handled by different people, so that the real volume of foreign chemical trade carried on by any one continent or country is represented only in the total of exports and imports. The figures for 1934 are shown in Table 31.

In 1936, 1937, and 1938, world chemical trade was probably 25 per cent greater than indicated for 1934, but in the relative position of the individual countries, with the exception of Russia and perhaps Japan, hardly any change has taken place.

TABLE 31

WORLD CHEMICAL TRADE IN 1934

Values in Thousands of Dollars

Continent or Country	Exports	%	Imports	%	Total	%
Entire World	1,063,411	100 00	1,178,112	100.00	2,241,523	100.00
Europe	752,430	70 76	653,302	55 45	1,405,732	62.71
North and Central America	151,612	14 26	157,491	13 37	309,103	13 79
Asia	95,903	9 02	196,428	16.67	292,331	13.04
Africa	32,333	3 04	79,685	6 76	112,018	5.00
South America	26,685	2 51	57,462	4 88	84,147	3.75
Oceania	4,448	0 42	33,744	2 86	38,192	1.70
Germany	251,500	23.65	100,500	8.53	351,000	15 66
United States including Alaska, Hawaii, Puerto Rico	132,594	12 47	96,509	8.19	229,103	10 22
United Kingdom	123,400	11 60	105,052	8 92	228,452	10.19
France	111,894	10 52	76,406	6 49	188,300	8.40
Belgium	57,696	5 43	45,922	3 90	103,618	4.62
Netherlands	46,000	4 33	55,000	4 67	101,000	4 51
Japan	27,168	2 55	48,908	4 15	76,076	3 39
Switzerland	40,400	3 80	26,400	2 24	66,800	2.98
Italy	23,700	2 23	40,700	3 45	63,400	2 83
China	16,328	1 54	33,700	2.86	50,028	2 23
Canada	15,300	1 44	34,500	2 93	49,800	2 22
Soviet Russia	20,225	1 90	14,325	1 22	34,085	1 54
Algeria and Tunis	10,189	0 96	19,896	1 69	30,085	1.34
Brazil	5,400	0.51	22,400	1 90	27,800	1.24
Australia	2,858	0 27	21,566	1 83	24,424	1.09
Argentina	4,350	0 41	16,900	1 43	21,250	0.95
Chile	15,704	1 48	2,400	0 20	18,104	0.81

The figures demonstrate to what extent each country contributes to the international chemical trade and how much it absorbs. Europe appears so far ahead of the other continents only because there are 28 different countries reporting their exports and imports, whereas in North America, for instance, the interstate trade of 48 states is not reported as international trade. Mr. T. W. Delahanty, Assistant Chief, Chemical Division, U. S. Bureau of Commerce, proved in 1929 that European chemical exports, if they were recorded on a similar basis as American exports, viz., on the assumption that they were

states of a confederation, would hold only second position and American chemical exports would appear in first place.[1]

As yet we have no statistics relating the foreign chemical trade figures of each country to the total value of its chemical and entire industrial production, which would show how big a portion of its chemical output finds its way into exports and to what extent each country is really dependent on chemical imports. But, even without this information, the steadiness of the annual figures on international chemical trade prove that this trade is an integral and vital part of that activity which brings people of different races and nations together, whereby they come to know and help each other in building up a better civilization, a better standard of living.

THE HISTORY OF UNITED STATES CHEMICAL IMPORTS

Drugs, medicines, and elixirs of all kinds, powder, and indigo were undoubtedly the first chemical products regularly imported from the old world into the United States. Natural dyeing and tanning materials, herbs, gums, and balsams from Central and South America and the West Indies soon extended the list, and soap and potash kettles were only the earliest forerunners of much chemical equipment which gradually found its way into the new country.

Thus doctors, apothecaries, and druggists were the earliest chemical importers. The druggists in particular carried not only drugs but acids, alcohol, alum, ammonia, antimony, arsenic, bismuth, confections, copper, extracts, honeys, infusions, lead, lime, liniments, lozenges, magnesia, medicinal waters and wines, mercury, mixtures, mucilages, oils, ointments, pills, plasters, potassium, silver, sodium, spirits, sulphur, syrups, tinctures, vinegars and zinc as well.[2] They supplied the earliest chemical demands of the small shops that began to operate and were willing enough to lend their skill and advice for trying out new chemical mixtures or applications.

Strangely, paints and colors, so much in use today, were not imported in large quantities in those early days. The Puritans of the North were opposed to them for some time, and Southern settlers were much too occupied and too poor to use imported "luxuries" in quantities. But those paints that were brought in were mostly whites, to paint at least the church, the schoolhouse, and the public buildings, a custom still in vogue.

[1] *Chemical and Metallurgical Engineering,* Vol. 36, No. 1, January, 1929, p. 19.
[2] Pharmacopœia, 1830.

The states became well-to-do for the first time about two decades after they had been founded, and house painting was one of the signs through which they expressed it. This increased the demand for paints, then made with flaxseed oil, and when the domestic supply of seed did not suffice any longer, the paint makers started buying seeds abroad. Thus the imports of oilseeds and oils began, which represent today half of all imports. J. & L. K. Bridge, paint makers in Brooklyn, brought in the first shipment of linseeds from Sicily in 1836, and other imports were arranged successively from Odessa, Alexandria, and, after 1846, from India, direct.

At about the same time American soap makers, no longer content with turning out only crude standard soaps from waste fats and greases, began to import olive oil from Naples and Spain. Soon afterwards American ships scanned the ports of the West Indies and South America for palm oil, cocoanut oil, and copra. By 1850 more soap was exported than was brought in from England and France and oil and fat imports began to grow as soap consumption increased at home and abroad.

Chile saltpeter was imported into the United States early in the last century, but not for fertilizer. It was used in making powder. Its use as fertilizer was not attempted before 1848, when Liebig drew attention to its usefulness. From then on, imports from Chile grew. German potash imports, the main item in the fertilizer group, did not begin until 1858. From small beginnings with crude salts, a sizable import trade was developed, especially after refined kainite became available in 1888. The import trade in potash alone reached $18,073,865 in 1913.

The imports in coal-tar products never did and do not today consist exclusively of dyes, as many seem to believe. Dyes represented only a minor portion of the whole group, the value of which never exceeded $12,000,000 before the war. Imports of these products began in the seventies and seem to continue, in spite of all restrictions applied to this group for years.

During more recent years chemical imports have consisted of a great variety of products, and therefore the recent history of chemical imports is presented in statistical form, Table 32. It covers the period from 1900 to 1910, presented in the same manner as chemical imports are statistically reported now in the *Statistical Abstracts of the United States*, issued by the U. S. Department of Commerce. As it would have been too cumbersome and impossible to show, for the earlier period, chemical specialties segregated from the industrial chemical

TABLE 32

UNITED STATES CHEMICAL INDUSTRIES—IMPORTS OF MERCHANDISE FOR CONSUMPTION

Values in Thousands of Dollars

Year	Chemical Products and Materials	Chemical Products	Coal-Tar Products	Medicinals	Industrial Chemicals	Pigments, Paints, Varnishes	Fertilizers and Materials	Explosives	Soaps, Toilet Preparations, Candles	Chemical Materials
1900	55,771	36,697	5,659	3,121	19,571	1,639	5,135	383	1,189	19,074
1901	57,204	37,449	4,590	3,361	19,944	1,607	6,100	535	1,312	19,755
1902	63,092	40,662	5,978	3,157	21,063	1,731	6,503	551	1,679	22,430
1903	68,100	42,171	5,965	3,093	20,834	1,958	7,707	714	1,900	25,929
1904	70,848	45,841	5,555	3,202	24,750	1,780	7,908	731	1,915	25,007
1905	72,311	48,520	6,330	3,304	24,632	1,628	9,971	714	1,941	23,791
1906	80,619	53,413	6,381	3,181	28,995	1,813	10,030	866	2,147	27,206
1907	100,212	62,487	8,440	3,720	32,970	2,084	11,631	1,211	2,431	37,725
1908	91,922	56,788	7,698	2,891	29,975	1,788	11,466	902	2,067	35,134
1909	97,758	61,703	9,108	3,131	30,842	1,745	13,414	938	2,524	36,055
1910	117,246	73,932	8,822	2,034	40,945	1,984	17,024	1,064	2,058	43,314
1920	544,647	211,528	12,985	6,945	64,716	3,189	114,850	1,377	7,466	333,119
1921	230,136	80,782	11,226	3,870	25,367	2,362	30,688	670	6,599	149,354
1922	293,517	100,549	11,013	4,764	26,304	3,675	45,127	982	8,684	192,968
1923	370,887	123,458	17,274	5,446	26,317	3,307	63,913	947	6,254	247,429
1924	316,543	121,726	20,119	4,777	20,021	2,823	66,531	859	6,596	194,817
1925	371,982	138,340	20,657	5,730	22,407	3,235	78,072	1,104	7,135	233,642
1926	391,084	134,833	19,806	5,891	28,310	3,821	69,239	1,165	6,602	256,251
1927	371,915	129,857	24,042	5,423	28,504	3,755	58,842	1,093	8,197	242,058
1928	385,444	143,234	23,907	5,179	24,165	3,766	78,118	979	7,121	242,210
1929	340,873	144,062	22,824	6,422	30,705	3,823	72,340	960	6,988	296,811
1930	323,891	112,070	16,273	3,948	24,389	2,613	59,151	911	4,785	211,821
1931	217,726	82,738	11,164	3,972	16,519	2,012	45,441	566	3,064	134,988
1932	121,939	47,852	9,158	2,530	13,621	1,445	18,689	371	2,038	74,087
1933	160,518	59.287	9,589	3,568	17,064	2,020	24,574	267	2,205	101,231
1934	170,178	65,117	11,847	4,237	17,479	1,695	26,029	593	3,238	105,061
1935	235,231	68,716	13,558	4,128	16,146	2,109	28,561	827	3,388	166,515
1936	260,298	79,976	15,212	4,890	20,960	1,971	33,394	738	2,811	180,322
1937	312,267	102,572	18,353	4,894	26,447	2,179	46,704	864	3,131	209,695

* Chemical materials include: animal oils, fats, greases; other animal products; gums, resins, balsams; drugs, etc.; oils and oil seeds, dyeing material, etc.

group, both are reported combined throughout, as are all the chemical materials, which include: inedible animal oils, fats, greases; other animal products; gums, resins, balsams; drugs, herbs, etc.; inedible oils and oil seeds; dyeing and tanning materials, sulphur, and other non-metallic raw materials.

From 1900 to 1910 chemical imports still consisted mainly of finished chemical products. The last year of war-stimulated economic conditions is represented by 1920, and the gradual evolution of present-day conditions can be studied in the data for the years from 1921 to 1937.

Undoubtedly, the war brought about a definite change in chemical imports in that raw materials now outweigh finished products by far. But the belief that imports have been reduced is disproved by the figures. Absolutely and in relation to post-war exports chemical imports are now larger than ever, which appears logical, if one considers the expansion of the industry which has taken place during the last two decades. The same increase in chemical imports can also be observed in other countries where chemical production has increased. The decline in imports during the depression years does not indicate a permanent trend; it only confirms what has been stated repeatedly before, viz., that chemical production is closely adjusted to general business conditions. As the domestic demand for chemicals declined, naturally imports were restricted, but they will expand again as soon as United States conditions really warrant.

Those in search of reliable business barometers may find in chemical import figures very interesting material reflecting the actual state of economic conditions much more truthfully and reliably than many other indexes.

The fact that quite a few of the imported chemical products can be bought at home and even that high tariff rates are established on some products does not necessarily prevent their importation. There are always some foreign producers who can sell cheap and some American buyers who find it more advantageous to buy abroad than at home because they still do not get in the United States exactly what they need or cannot get it at a price which they can afford. Thus economically justified imports are effected by American buyers regardless of the availability of such products from domestic sources.

TARIFF PROTECTION AND TARIFF DUTIES ON CHEMICAL IMPORTS

Laymen economists and even those engaged in chemical pursuits usually have the impression that chemical industries are among the most highly protected American industries. If noisemaking is music, America is one of the most musical countries! With chemical tariff protection it is similar. The subject has been so noisily propounded, and so often and conspicuously repeated, that a wrong impression has been created.

It is obviously true that some American chemical branches are still in need of tariff protection and that it is afforded them in the form of higher-than-average duty rates on finished products, but they are relatively few. By far the greater part of chemical production in the United States is protected only as much as is really necessary to equalize costs of production with those of other countries whose products otherwise would be imported in undesirable quantities.

To determine what import duties represent fair equalization of costs and economically sufficient protection is the main problem in the permanent struggle which is going on between high-tariff advocates, lobbyists, austere senators, opposing consumer interests, high-cost small producers, low-cost large producers, interested importers, anxious trade association representatives, and last but not least the duty-collecting treasury.

It is no easy task to reconcile the different interests of all these groups and to express the solution in the form of duty rates acceptable to all at home and to the trade interests abroad, who mostly are in a position to retaliate through their own governments in one form or other if they consider themselves treated unfairly. Nevertheless, the principle of protecting American chemical production has been upheld by almost every administration in varying degree with the outcome that as time went on and new tariffs were established duty rates on manufactured chemical products were steadily raised from the original 5 per cent and that more chemical raw materials were placed on the free list.

The last tariff act, the regulations of which are still valid, became effective on June 17, 1930. It was inaugurated by President Hoover and is known as "An act to provide revenue, to regulate commerce with foreign countries, to encourage the industries of the United States, to protect American labor, and for other purposes. U. S. Public Laws, 71st Congress, Session II, Chapter 497, June 17, 1930." Excerpts of it are shown in the Appendix (Exhibits B and C).

Basically the act provides for revenue purposes and general protection "on all raw or unmanufactured articles not enumerated or provided for, a duty of 10 per centum ad valorem, and on all articles manufactured, in whole or in part, not specially provided for, a duty of 20 per centum ad valorem" (Paragraph 1558). These rates represent the fundamental average of duties levied, unless the articles are especially mentioned either in the free list, and therefore can be imported duty free, or on the dutiable list, and then pay the especially prescribed duty rates.

The duties consist of "ad valorem rates," in addition to which in many instances are levied "specific duties." The bases for ad valorem rates are:

1. The foreign value or the export value, whichever is higher;
2. If the appraiser determines that neither the foreign value nor the export value can be satisfactorily ascertained, then the United States value;
3. If the appraiser determines that neither the foreign value, the export value, nor the United States value can be satisfactorily ascertained, then the cost of production;
4. In the case of an article with respect to which there is in effect under section 336 a rate of duty based upon the American selling price of a domestic article, then the American selling price of such an article.[1]

In the regular import routine the foreign export values are usually recognized, but in many cases the appraisers invoked the American selling price for ad valorem duty calculations. This often caused delays and sometimes long-drawn appeals to the Customs Court.

The "specific duty rates" are calculated on a weight basis (per pound). They were provided because some foreign currencies showed no stable relation to the American dollar currency, and, by making part or the entire duty independent from currencies and exchange rates, a definitely fixed protection was provided for the American producer.

Since 1930, however, quite a few changes have been made in the original duty rates, especially since President Roosevelt, Secretary of State Hull, and Secretary of Commerce Daniel C. Roper agreed on a foreign trade policy, the essence of which was expressed by Secretary Roper in a radio broadcast on March 14, 1933, as follows:

> If the crisis has done nothing else, it has shown us that the exchange of our goods with other nations must go on, that even the United States cannot cut itself off from the rest of the world of trade. We know now

[1] Tariff Act of 1930, Title IV, Administrative Policies, Section 402.

that a healthy state of world trade is essential to a return to normal times.

For too many years there has been a design to foster foreign trade and at the same time to raise insurmountable obstacles against foreign nations who would trade with us. The vast majority of the American people have clearly shown they are tired of tariff policy antagonistic to every other nation of the world.

We are not suggesting unusual and violent reduction of the tariff walls. Our tariff policy will be one of common sense and of common decency toward other nations.[1]

The new foreign trade policy found its expression in special trade agreements concluded with quite a few foreign nations. Reductions in import duties were granted to foreign producers in return for duty concessions conceded abroad on imported American products. Furthermore, the present United States trade policies provide that the concessions made in American tariff rates should be available not only to the countries with whom the original agreement was concluded but to all nations who have a "most-favored-nation" agreement with the United States. The present foreign trade policy is usually called a "multilateral trade policy."

It is much more liberal than the "unilateral" trade policies applied by other countries, which, as a rule, grant no specific extensions of benefits to countries that offer nothing in return.

The changes made in the original duty rates have been summarized by the Tariff Commission (see Schedule 1 attached).

The U. S. Tariff Commission, in its publication "The Tariff and Its History" (pp. 83, 84), reports that the combined duties on chemical products, expressed uniformly on an ad valorem basis, amounted to

22% ad valorem in 1914 under The Tariff Act of 1913
29% " " " 1926 " " " " " 1922
30% " " " 1928 " " " " " 1922
36% " " " 1928 " " " " " 1930.

The recent concessions in duty rates undoubtedly have reduced the 36 per cent to a much lower figure.

In view of the technical progress made in the United States chemical industries this condition is not alarming, but, in consideration of the none too certain financial condition in which many enterprises of the industry actually are, the present duty rates are about at the point where further treaty concessions would be economically undesirable,

[1] *New York Times*, March 15, 1933.

unless they are balanced by really substantial export possibilities obtained abroad not only for agricultural, automotive, and other United States exports, but for the chemical industries proper, so that they also can expand their trade. So far only unimportant advantages have been secured.

Switzerland obtained duty reductions of approximately 23 per cent on imports of coal-tar dyes, color and stain imports, and 25 to 50 per cent on other kinds of chemicals: barbiturates, gluconic acid, digitalis glucosides, ergotamine, tartrate, pigments of lead suboxide, chloroacetic acid, and four perfume materials. United States chemical exports to Switzerland are larger in value than Swiss chemical exports to the United States, but no duty concession was obtained for them.

As a result of the negotiations with France the United States duty rates on four other perfume materials were lowered from 25 to 12.5 per cent ad valorem. The tariff rates were further reduced on ochers, orange mineral, and cellulose acetate. France in return increased the quota allotment for imports of butyl acetate, butyl alcohol, sodium, refined borax, hydraulic lime, potassium bichromates, chromates, and carborundum, but the sum total of concessions does not permit a considerable increase of American chemical exports into France.

And so it goes down the list of treaties. It is well understood that in modern times the economic welfare of states and nations cannot and should not be seen from a narrow industrial point of view. It is also known that any advantages obtained abroad have to be balanced by American concessions, but it does seem that American chemical industries could and should be more helped in reference to their export trade.

THE HISTORY OF UNITED STATES CHEMICAL EXPORTS

There seems to be no definite record when the United States began to export processed chemicals and who was the first exporter of such products. Chemical raw materials had been exported almost since the founding of the Colonies in the form of naval stores, pitch, tar, pearlash, and potash. But it is more than likely that soap, made in New York, was among the first chemical products exported after 1812, to which the early chemical producers, operating in Philadelphia, soon added others for regular shipment to the West Indies, South America, and even European ports. White and red lead paints, made in Philadelphia, Brooklyn, and New York, were among the first American manufactured products to enjoy international reputation, and Ameri-

can-made varnish, today recognized everywhere, was exported for the first time by Tilden and Hurlburt of New York to South America and Mexico in 1836.[1]

Among the pigments whites predominated for some decades, but laundry blue and more recently American carbon blacks for printing and other purposes have gradually gained predominance in this export group. In ready-mixed paints American exporters have pioneered successfully in many markets since 1852.

Shipments of American-made quinine from Philadelphia to South and Central America and the Caribbeans were reported as early as 1820, and the fevers and ailments prevailing in those countries have caused a steadily increasing export of medicinals, patent medicines, pills, and percolations ever since. On the other hand, sarsaparilla, ipecac, and balsams of all kinds, imported from Latin American countries, were re-exported in good quantities by American firms, mostly to Europe.

American exports in fertilizer materials consisted originally only of South Carolina phosphate rock, shipped to Europe for the first time in 1868. Germany and England were also among the first takers of Florida pebbles when they were offered in export after 1891. The fertilizer material trade was expanded to the Mediterranean and Central Europe, until in 1931 Moroccan phosphate competition began to reduce this trade. However, an agreement was reached between American and French producers in August, 1933, and a satisfactory share of the European market is still retained.

American exports in coal-tar products, and especially dyes, have been developed since 1920 and prove that, by choosing carefully the products, markets, and distribution methods, chemical exports are feasible even in those lines which usually are considered to be under European control.

Since the turn of the century chemical exports have increased in manufactured products. The progress made is by no means spectacular, but satisfactory, if one considers that so far chemical exporting has been taken seriously only by a relatively small number of companies.

[1] Chauncey Depew, "One Hundred Years of American Commerce," 1895, Vol. II, p. 622.

TABLE 33

UNITED STATES CHEMICAL INDUSTRIES—EXPORTS OF DOMESTIC MERCHANDISE

Values in Thousands of Dollars

Year	Chemical Products and Materials	Chemical Products	Coal-Tar Products	Medicinals	Industrial Chemicals	Pigments, Paints, Varnishes	Fertilizers and Materials	Explosives	Soaps, Toilet Preparations, Candles	Chemical Materials*
1900	64,600	27,517	.....	2,999	10,752	2,522	7,218	1,892	2,134	37,083
1901	67,425	27,031	.....	3,440	11,855	2,648	5,426	1,712	1,950	41,394
1902	64,796	26,966	.....	3,138	10,819	2,704	6,256	2,062	1,986	37,830
1903	69,806	29,754	.....	3,408	11,306	3,018	6,724	2,454	2,843	40,052
1904	66,812	31,825	.....	3,898	11,910	3,483	7,113	2,442	2,981	34,987
1905	73,354	34,745	.....	4,911	12,575	3,918	7,621	2,560	3,161	38,609
1906	90,210	40,013	.....	5,060	14,771	4,612	8,687	3,568	3,315	50,197
1907	100,502	43,046	.....	5,835	15,228	4,893	8,597	4,082	4,411	57,456
1908	100,734	44,751	.....	6,476	14,629	4,943	10,971	3,706	4,027	55,983
1909	88,396	41,429	.....	5,834	13,897	4,780	9.283	3,478	4,156	46,967
1910	90,097	46,504	.....	5,848	16,454	5,703	8,701	5,353	4,445	43,593
1920	395,469	315,980	30,963	21,215	129,171	28,601	36,556	41,579	27,895	79,489
1921	135,922	104,640	8,811	12,724	38,795	12,133	16,117	2,286	13,774	31,282
1922	145,355	106,110	7,622	14,000	37,646	11,479	16,640	3,400	15,323	39,245
1923	182,561	116,355	12,331	16,177	29,906	16,551	20,795	4,410	16,185	66,206
1924	176,873	104,570	9,976	17,441	27,637	14,327	16,509	3,695	14,985	72,303
1925	200,567	116,345	10,761	19,768	29,197	18,511	17,298	4,691	16,119	84,222
1926	210,904	124,856	14,093	19,677	31,130	18,888	20,040	4,223	16,809	86,048
1927	222,882	131,840	17,097	20,103	35,699	20,908	17,724	3,455	16,853	91,042
1928	222,012	137,331	13,792	20,843	39,271	25,614	16,905	5,185	15,721	84,681
1929	245,423	152,109	17,876	21,467	42,606	29,111	20,441	4,549	16,059	93,314
1930	199,214	127,855	17,557	17,800	38,605	21,689	15,284	2,950	13,970	71,359
1931	149,456	100,027	10,308	15,036	33,528	15,127	13,011	1,733	11,282	49,429
1932	109,441	70,348	8,752	9,966	24,907	10,366	8,653	1,281	6,422	39,093
1933	121,947	76,771	12,421	9,816	27,474	11,835	8,260	1,527	5,436	45,176
1934	141,296	92,565	13,264	10,945	33,281	14,207	12,537	2,152	6,180	48,731
1934	152,044	103,092	13,598	12,199	36,495	16,344	14,809	2,439	7,208	48,952
1936	172,471	114,172	13,776	14,393	42,501	17,788	17,750	2,618	5,346	58,299
1937	175,684	119,523	14,878	17,979	35,031	21,544	16,954	3,863	9,274	56,161

* Chemical materials include: animal oils, fats, greases; other animal products; gums, resins, balsams; drugs, etc.; oils and oil seeds, dyeing material, etc.

CHEMICAL EXPORTS EMBODY A FINE EXPORT PROGRAM FOR THE FUTURE

Close study of the latest details on chemical exports reveals some interesting facts about the products through which the United States contributes to a better civilization throughout the world. In order of their magnitude the items are:

1. Industrial chemicals: they help to create work and employment.
2. Chemical specialties next: most of them aim to ease the daily chores of men and beasts.
3. Naval stores, gums and resins: give luster to drab environments.
4. Pigments, paints, and varnishes: serve to embellish foreign homes.
5. Fertilizers: increase the fruit of other peoples' soils.
6. Medicinals: restore and keep their health.
7. Toilet preparations: improve their appearance.

This sequence reflects quite in the proper order the uses to which chemicals are put in American civilization and in principle seems to embody an excellent export program for the future.

EXPORT PROMOTION POLICIES

Until the war, neither the chemical industries, nor their government, had any definite chemical export policies. Exporting, like production or transportation, was an activity undertaken by any individuals or companies as and how they saw fit. Reports on export possibilities were scarce and none too good, even if they came from official, semi-official, or trade-association sources. Those who desired to export had to take their own chances and build up their export trade according to their own ideas.

The European nations, more advanced in the making of chemicals, established their export trades at a time when American producers still were struggling with production problems and thus, in most markets, had the first contacts with foreign consumers, which are so important in building up chemical trade. Much less handicapped by anti-combination laws, they also had established export agreements and cooperated in these activities as they did at home. Where they had no agreements, they had "understandings" on the territories which the various companies should serve, singly, jointly, or through a common sales office, and on the prices which should be asked. Thereby

they had their chemical foreign trade so well organized that any not properly organized attempt made by individual American chemical producers had only minor chances for success but major chances for failure.

The first attempts to overcome these handicaps and to develop systematic export activities from the United States were made through the Webb-Pomerene Act of April 10, 1918. The act exempted business associations and company agreements made exclusively for export purposes from the all-inclusive regulations of the Sherman Act of 1890, and permitted the establishment of export agreements among manufacturers.

Greeted with great hopes of obtaining through such export associations better trade at least with South America, a few Webb-Pomerene companies were incorporated, for instance, the Phosphate Export Association, New York; the American Tanning Materials Corporation, Wilmington, Delaware; the American Magnesia Export Association, Philadelphia; the U. S. Alkali Export Association, New York, and others.

Also many trade associations added export departments and attempted to stimulate export interest among their members. The efforts made by these organizations were laudable enough; the results, however, were meager. The desire for individual operation, distrust in cooperative methods, and dislike for cumbersome methods were still too strong to be overcome by a law which was intended to be liberal but nevertheless had too many strings attached to it to make it generally attractive. When, furthermore, quite a few export promotion schemes, undertaken by associations and independent promoters, failed as the result of ignorance or financial dishonesty, a good deal of the legally endorsed export enthusiasm disappeared.

However, these first attempts had their good results. Associations as well as individual companies began more thoroughly to investigate chemical export practices, customs duties, market conditions in various countries, prices, and kinds of sales organization required, and gradually more definite knowledge was acquired on *how* to export chemicals, even if in the practical application of this knowledge disappointments and occasional losses were encountered.

Also the Department of Commerce began to collect chemical trade information in a more thorough manner in all parts of the world, and in 1922 the Chemical Division was created to get what facts were needed and assist those chemical producers who cared to use its services.

April 10, 1918.
[H. R. 2316.]

[Public, No. 126.]

CHAP. 50.—An Act To promote export trade, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the words "export trade" wherever used in this Act mean solely trade or commerce in goods, wares, or merchandise exported, or in the course of being exported from the United States or any Territory thereof to any foreign nation; but the words "export trade" shall not be deemed to include the production, manufacture, or selling for consumption or for resale, within the United States or any Territory thereof, of such goods, wares, or merchandise, or any act in the course of such production, manufacture, or selling for consumption or for resale.

Promotion of export trade.
Meaning of term restricted.

That the words "trade within the United States" wherever used in this Act mean trade or commerce among the several States or in any Territory of the United States, or in the District of Columbia, or between any such Territory and another, or between any such Territory or Territories and any State or States or the District of Columbia, or between the District of Columbia and any State or States.

"Trade within the United States," defined.

That the word "association" wherever used in this Act means any corporation or combination, by contract or otherwise, of two or more persons, partnerships, or corporations.

"Association," defined.

SEC. 2. That nothing contained in the Act entitled "An Act to protect trade and commerce against unlawful restraints and monopolies," approved July second, eighteen hundred and ninety, shall be construed as declaring to be illegal an association entered into for the sole purpose of engaging in export trade and actually engaged solely in such export trade, or an agreement made or act done in the course of export trade by such association, provided such association, agreement, or act is not in restraint of trade within the United States, and is not in restraint of the export trade of any domestic competitor of such association: *And provided further*, That such association does not, either in the United States or elsewhere, enter into any agreement, understanding, or conspiracy, or do any act which artificially or intentionally enhances or depresses prices within the United States of commodities of the class exported by such association, or which substantially lessens competition within the United States or otherwise restrains trade therein.

Association solely for export trade not a violation of Antitrust Act.
Vol. 26, p. 209; Vol. 38, p. 736.

Conditions.

Proviso.
Acts affecting prices, or lessening competition prohibited.

SEC. 3. That nothing contained in section seven of the Act entitled "An Act to supplement existing laws against unlawful restraints and monoplies, and for other purposes," approved October fifteenth, nineteen hundred and fourteen, shall be construed to forbid the acquisition or ownership by any corporation of the whole or any part of the stock or other capital of any corporation organized solely for the purpose of engaging in export trade, and actually engaged solely in such export trade, unless the effect of such acquisition or ownership may be to restrain trade or substantially lessen competition within the United States.

Ownership in other similar associations allowed.
Vol. 38, p. 731.

Condition.

SEC. 4. That the prohibition against "unfair methods of competition" and the remedies provided for enforcing said prohibition contained in the Act entitled "An Act to create a Federal Trade Commission, to define its powers and duties, and for other purposes," approved September twenty-sixth, nineteen hundred and fourteen, shall be construed as extending to unfair methods of competition used in export trade against competitors engaged in export trade, even though the acts constituting such unfair methods are done without the territorial jurisdiction of the United States.

Unfair methods of competition in export trade prohibited.
Vol. 38, p. 719.

Statements required from associations solely in export trade. Details specified.

SEC. 5. That every association now engaged solely in export trade, within sixty days after the passage of this Act, and every association entered into hereafter which engages solely in export trade, within thirty days after its creation, shall file with the Federal Trade Commission a verified written statement setting forth the location of its offices or places of business and the names and addresses of all its officers and of all its stockholders or members, and if a corporation, a copy of its certificate or articles of incorporation and by-laws, and if unincorporated, a copy of its articles or contract of association, and on the first day of January of each year thereafter it shall make a like statement of the location of its offices or places of business and the names and addresses of all its officers and of all its stockholders or members and of all amendments to and changes in its articles or certificate of incorporation or in its articles or contract of association. It shall also furnish to the commission such information as the commission may require as to its organization, business, conduct, practices, management, and relation to other associations, corporations, partnerships, and individuals. Any association which shall fail so to do shall not have the benefit of the provisions of section two and section three of this Act, and it shall also forfeit to the United States the sum of $100 for each and every day of the continuance of such failure, which forfeiture shall be payable into the Treasury of the United States, and shall be recoverable in a civil suit in the name of the United States brought in the district where the association has its principal office, or in any district in which it shall do business. It shall be the duty of the various district attorneys, under the direction of the Attorney General of the United States, to prosecute for the recovery of the forfeiture. The costs and expenses of such prosecution shall be paid out of the appropriation for the expenses of the courts of the United States.

Similar annual statements.

Connections with other associations.

Penalty for failure to furnish information.

Prosecution.

Costs, etc.

Investigation of acts believed to be in restraint of trade, etc., within the United States.

Whenever the Federal Trade Commission shall have reason to believe that an association or any agreement made or act done by such association is in restraint of trade within the United States or in restraint of the export trade of any domestic competitor of such association, or that an association either in the United States or elsewhere has entered into any agreement, understanding, or conspiracy, or done any act which artificially or intentionally enhances or depresses prices within the United States of commodities of the class exported by such association, or which substantially lessens competition within the United States or otherwise restrains trade therein, it shall summon such association, its officers, and agents to appear before it, and thereafter conduct an investigation into the alleged violations of law. Upon investigation, if it shall conclude that the law has been violated, it may make to such association recommendations for the readjustment of its business, in order that it may thereafter maintain its organization and management and conduct its business in accordance with law. If such association fails to comply with the recommendations of the Federal Trade Commission, said commission shall refer its findings and recommendations to the Attorney General of the United States for such action thereon as he may deem proper.

Corrective recommendations to be made.

Action on noncompliance.

Federal Trade Commission to enforce Act. Vol. 38, pp. 717-724.

For the purpose of enforcing these provisions the Federal Trade Commission shall have all the powers, so far as applicable, given it in "An Act to create a Federal Trade Commission, to define its powers and duties, and for other purposes."

Approved, April 10, 1918.

By December, 1926, five hundred officers of the U. S. Department of Commerce were supplying chemical trade data, advice on transportation, and information on credit, sales, and contract conditions in the various countries of the world.

Without their assistance, undoubtedly a good deal of the chemical trade that had been gradually established would have been lost again during the world-wide depression from 1930 to 1935, because it led to tariff increases, exchange restrictions, and special import permit procedures in almost every country. Through innumerable negotiations with foreign officials and through actual, practical assistance given to American exporters, their business was upheld and carried on, even if it had to be temporarily restricted. Export failures were amazingly few, partly because those active in this field are more cautious owing to the very nature of their transactions and partly because the trade had learned to avoid doubtful promoters and those dangerous financing schemes that after the war had troubled and hindered this branch of the chemical trade.

At present, international trade is consolidating itself again, but in new forms. The old idea that "free trade" is best for all seems to have lost ground for good. Similarly, the old advice given to nations to develop "tricornered trade" seems to have lost most of its convincingness. Years ago some countries could be induced to buy goods from one country in the hope and intent to pay for them by selling their own products to a third one. This was in the days of free and tricornered trade. But nowadays nations are much more particular about their balances of trade and balances of payment. They frequently insist on evening them up directly, and, where unregulated trade does not do this, they maintain restrictions, high duties, and import permit procedures, or conclude direct barter and currency clearance agreements, under which a regulated and direct exchange of goods is brought about with a minimum of transfer of monetary funds, under the control and with the approval of the central banks of the respective countries.

The British Empire has and will have its preferential duty system; Germany has and will have clearance and barter agreements with more than 85 per cent of all countries; France hoped for more foreign trade by devaluing her currency; and Japan carries on her foreign trade on the basis of lowest prices and by means of special agreements concluded by trade missions visiting even the most remote corners of the globe.

In view of these conditions the American chemical exporter, operat-

ing under multilateral treaties, faces a rather difficult situation, but not a hopeless future. The formation of a more effective export policy seems to be definitely needed—that much is sure; leadership must come to the fore, and action is urgent. Whether it comes from the government, from trade-association initiative, a sound revival of Webb-Pomerene activities, or from more individual efforts, as of old, would make little difference. But something should be done, because properly organized, carefully financed chemical export activities can be brought about, they are desirable, and they can be safely considered as worthwhile economic projects, in spite of all the trials and tribulations that seem to darken the international horizon for the time being.

ORGANIZATION AND TRADE PRACTICES IN CHEMICAL EXPORTS

Chemical exporting can be organized fundamentally in five different ways, viz., through:

1. Independent export houses, export jobbers, export agents located in the United States.
2. A factory export department, located at the factory or in a harbor city.
3. Independent import houses, import jobbers, import agents located abroad.
4. Company-owned sales offices, located abroad.
5. Company branch plants, located abroad, with or without local financial or management participation.

The volume of business and the character of the chemical products involved decide which form to choose. As in domestic selling, exporting through middlemen has its advantages and disadvantages. Undoubtedly it is less expensive than direct operation, but it is not so profitable or always so reliable in execution as direct operation. This is not meant to be a general condemnation of export middlemen, among whom are the most reliable and best experienced chemical exporters. Exports need longer periods of financing, and, if the manufacturer does not care to undertake it, the export middleman will do it. For this reason, and because the general business expenses are much higher and a much more complicated business routine must be performed, export middlemen ask for higher than domestic discounts, or for a special rebate if the producer sells f.o.b. factory. Export shipments need special packing, but usually this is paid by the ultimate buyer.

By operating through export middlemen, located in the United States, the producer saves himself all inconveniences except perhaps special packing, wrapping, and billing. He foregoes, however, any definite organization of his export activities and often enough has to give up his identity as producer because export houses, more frequently than domestic middlemen, insist on having their own special brand or name or no name at all on the merchandise. Thereby they develop their own reputation in foreign markets, and, as they are dependent on lowest costs and are experienced shoppers, the producer is neither too sure of their orders nor sure at all about the proper marketing and pricing of his products abroad.

In order to assure themselves of the proper handling of their export trade, many chemical companies make permanent contractual arrangements with reliable and well-introduced export firms, but even then they have to grant certain concessions. As exporting chemicals needs a variety of products to be profitable and stable, or large volume in a few standard products, export houses usually buy their different products from various manufacturers and try to develop those lines which are the most profitable ones. Thus the amount of business obtained depends on concessions made and consideration given to all the "special" cases and requests, of which there are many. If a manufacturer is willing to meet the exporter's fair requests, very substantial and mutually satisfactory export activities can be developed.

Export brokers operate on behalf of foreign firms for whom they buy, or of American firms for whom they merely carry out the necessary export routine. When acting for foreign buyers they also make the necessary "shopping" and testing arrangements and appraise quality and price according to instructions received, but do not enter directly or financially into the deal. Export brokers are called in when the orders are not sufficiently large to justify a trip of the consumer to the United States and yet need special handling or attention. They usually reveal the names of their foreign clients, and, though they do not offer any guarantees as to their solvency, losses in their transactions are not more frequent than in other forms of trade.

Direct exporting from producers to importers located abroad, who may be either foreign consumers, distributors, dealers, or special import houses or brokers, requires, in order to be successful, a small but well-organized export section within the producer's sales organization. Provided that sufficient volume is obtained, this set-up is highly desirable. However, the requirements are often overlooked and only fragmentary provisions are made to handle the "export end." The

young man in charge is expected to be: expert in sales promotion, advertising and customer relations in foreign countries, credit appraiser, collection wizard, duty expert, shipping agent, and special packing foreman. In some cases he is also to be: linguist in a few languages and his own typist for writing letters, customs declarations, consular invoices, and special statistical papers—all that for about thirty dollars per week or so. Naturally he is bound to do a poor job, and exporting is declared an undesirable line by his employers.

If direct exporting is attempted, it should be organized with good and experienced help and sufficient financial backing, such as would be given to any special sales section for the United States, definite responsibility should be placed, and opportunity should be afforded for real efforts. If these intentions are absent, importing through independent export houses is preferable by far.

Direct chemical export trade promotion is more difficult than trade promotion at home, but it is possible of achievement if it is done with the same patience, attention to detail, and the will to make good. It must be undertaken as a proposition for a long pull and with the definite desire for permanency. Direct exporting, planned in the form of tentative schemes, should be abandoned *before* they are started, and losses will be avoided.

A good factory export sales organization needs:

1. Men ready to go abroad not for profit or adventure mainly, but for work.

2. Most careful, thorough, and permanent market research to determine the lines really suited for export, the conditions which can be granted, and the best possible method of distribution. This research also should include a permanent study of prices, duties, customs, and other regulations. The Chemical Division of the U. S. Department of Commerce furnishes such information currently and up to date in the form of publications and in reply to special inquiries.

3. Great care in selecting the representations located abroad. There are in almost every country well-established American resident and foreign chemical middlemen, who are just as honest, efficient, and reliable as any middleman at home, and, if they are given the opportunity to familiarize themselves with the sales methods which the American company desires to be applied, they are bound to obtain good results by utilizing their better knowledge of conditions peculiar to their territory. If, besides, arrangements are made for regular visits to their territories by an experienced American representative of the

company, the set-up will be sufficiently good to handle a good-sized volume and will cost less than the maintenance of special American-operated sales offices or permanent company representatives, who will, however, be valuable when the volume has become sufficient to sustain them. The largest American chemical exporters operate through their own foreign branches as well as foreign distributors very satisfactorily and in good relations with the local buyers of their products.

The customary longer credit extension which in many countries was often the most serious stumblingblock for American chemical export promotion has been overcome by many exporters by restricting their dealings to foreign dealers and consumers who were sufficiently advanced to see the wisdom of buying on a cash basis or on short-term credits. Other exporters grant credit extension, but only to well-known correspondents. This slows up expansion but makes for more permanent relations. Generally, collections of invoice amounts is not more risky abroad than in the United States, and final losses are small, because foreign laws on commercial transactions are just as strict and are enforced just as definitely as those in the United States.

The real and serious troubles in exporting come mainly from impediments imposed by foreign governments or from carelessness on the part of the exporter. Against the former the individual company can do nothing; but, in spite of all trade barriers, chemical export activities have made headway, quietly and unobtrusively. Carefulness and thorough investigation of all export projects has been practiced rather than headlong expansion. What has been achieved is built solidly and with a minimum of financial risk because most of the latest expansion in foreign chemical trade has been attained with much lesser fixed investment than expansion at home.

CHEMICAL ECONOMIC PENETRATION

The most effective form of doing foreign business is through the establishment of affiliated companies and production facilities in foreign countries. In view of the many economic and political uncertainties prevailing today throughout the world, this form of expansion may appear as entirely too risky and therefore undesirable. However, experience and observation show that other nations have applied this method successfully in times similarly filled with international uncertainties and still adhere to their method. The secret to success lies in the details of execution, not in the method itself.

Chemical economic penetration, as the method may be called, may

have two extreme reasons: either a company that has so far merely imported feels it advisable to produce locally because it sees an exceptionally favorable and good market for its products ahead; or a foreign company begins to produce locally, knowing that its products would find a good market if it were not for the trade barriers established to keep the products out of the country. To start producing where one is not wanted may appear illogical, but it is feasible enough.

Diversification of products and markets is one of the most useful policies in chemical economics, and to extend this policy into international dimensions is not only logical but sometimes really advisable as part of a long-trend program. Large companies are established to last for decades, whereas even serious disturbances among nations never can last longer than for a few years and then again must give way to more normal relations which permit some exchange of funds, even if the exchange of merchandise still may be blocked or handicapped. The tendency to "leave the country" is greatly enhanced among producers when adverse taxation or other policies at home make the foreign investment an additional asset, where otherwise the money would have to be paid for taxes. Almost all of the German chemical investment made abroad during the past decade is due to these reasons.

The foreign countries where the new enterprises are established undoubtedly gain more than they lose, and therefore permit not only the establishment of the new factory but also transfer of at least some earnings for special raw materials or intermediates or even for dividend payments to the parent company. These amounts paid out of the foreign country are usually negligible in comparison to the employment created, wages and materials paid, construction work done, and dealer income produced within the foreign country by the application of the knowledge and experience made available through the new company.

Almost invariably a new branch factory in foreign countries is founded by taking out a local company charter, which makes the affiliated company a "national" company. From there on, different operating policies may be followed. Some foreign trade experts advise strongly against any participation of foreigners in the management and capitalization of the new company; others recommend both on the grounds that national participation gives to the new enterprise real national character and saves it many legislative difficulties and surprises which sometimes are enacted against strictly foreign-owned and foreign-operated companies, which then are not considered as really "national enterprises" in spite of their "national" charter.

European chemical concerns, almost from the beginning of their international expansion, have accepted foreign national part-ownership and also participation in management. American chemical concerns have mostly tried to avoid both, at least in the past. Facts make the more liberal policy appear more practical, because it reduces the amount of capital required, reduces the risk, provides greater safety, and generally produces more business, thereby furnishing in the long run more revenue than a "pseudo-national" company could hope to muster. More lately also American interests seem to have changed their policies, and what recent international economic penetration has been undertaken is carried on with foreign participation.

The world-wide operations of the Interessengemeinschaft der Farbenindustrie and of the Imperial Chemical Trust are common knowledge. Much less is it known that E. I. du Pont at present owns production facilities in Mexico, Chile, Germany, France, Uruguay, two plants in Argentina, a 46.86 per cent interest in Canadian Industries, Ltd., and a plant in Brimsdown, England. The same company owns outright chartered sales offices in quite a few other countries. Monsanto owns Monsanto Chemicals, Ltd., in England, and has sales offices in London, Shanghai, and Singapore. Union Carbide has carbide production facilities and makes ferro-alloys in Canada and Norway, in which country it also has hydropower plant facilities. The same company is also represented through numerous sales offices in the Far East, Europe, South Africa, and other countries. The Allied Chemical and Dye Corporation has no foreign production facilities, because it was and probably still is the American holding company for a Belgian concern, controlling production facilities in other countries directly. The Air Reduction Company, Inc., manufactures and sells oxygen and acetylene in Cuba and makes liquid and solid carbon dioxide, soda fountain and carbonating equipment, syrup, and extracts in Havana. The Glidden Company, one of the greatest paint and fat producers of the United States, buys its raw materials almost everywhere, but has so far only one plant in Canada. Freeport Texas Company owns manganese mines in Cuba and sells its sulphur through the Sulphur Export Corporation in thirty-five countries.

The International Agricultural Company holds a half-interest in a German potash mine. Colgate-Palmolive-Peet manufacture American soap in Canada, England, Mexico, Cuba, and New South Wales. The company has selling companies in Argentina, Belgium, Denmark, Holland, South Africa, and Sweden, and it deals in oil in Italy. Commercial Solvents Corporation handles molasses in Cuba and Puerto

Rico and manufactures solvents and ethyl alcohol in Great Britain. Bromo-Seltzer (Emerson Drug Company) is at home in the entire world, but is made only in the United States and in Canada. U. S. Industrial Alcohol gathers molasses in the West Indies through an outright owned Dominican company and distils in Cuba. Eastman Kodak products are distributed throughout the world by twenty-five outright owned companies, and part of the products sold are made in Canada, England, Germany, and France.

Thus quite substantial beginnings have been made to expand American chemical industries beyond the limits of the United States. The list of achievements could be extended by many other companies who sell permanently abroad through less conspicuous channels, but the main task for the next decade is: to follow suit, to do it right, and to continue the progress!

APPENDIX

EXHIBIT A

CHEMICAL MEASURES

1 avoirdupois pound = 0.453592427 kilogram; 1 kg. = 2.204622341 lb.
1 troy pound or apothecary pound = 0.8228571 lb. = 0.37324177 kg.

1 avoirdupois pound		1 kilogram	
= 7,000	grains	= 15,432.356	gr.
= 350 apothecary	scruples	= 771.6178	ap. scr.
= 291.6	pennyweights	= 643.01485	pwt.
= 256 avoirdupois	drams	= 564.38332	av. dr.
= 116.6 apothecary	drams	= 257.20594	ap. dr.
= 16	ounces	= 35.27396	av. oz.
= 1.215278	troy pounds	= 0.37324	ap. lb.
= 0.01	hundredweight	= 0.022046	cwt.
= 0.0005	short ton	= 0.0011023	sh. to.
= 0.0004464	long ton	= 0.0009842	l. to.
= 0.0004536	metric ton	= 0.001	m. to.

1 short ton		1 long ton	
= 32,000	ounces	= 35,840	oz.
= 2,000	pounds	= 2,240	lb.
= 20	hundredweights	= 22.4	cwt.
= 0.892857	long ton	= 1.12	sh. to.
= 907.184860	kilogram	= 1,016.04704	kg.
= 0.907185	metric ton	= 1.101605	m. to.

1 gallon (U. S.) = 3.785332 liters = 231 cu. in.
1 liter (liquid) = 0.264178 gallon = 61.025 cu. in.
1 dry bushel = 4 pecks = 32 dry quarts = 64 dry pints.

Quite a few chemical raw materials are sold by the bushel, which then represents different weights. All chemical bushels are struck and do not require a heap unless it is voluntarily added. The weights of dry bushels for various substances are fixed by state laws. Under the New York state law:

1 bushel of

cottonseed (upland)	= 30 pounds
cottonseed (sea or island)	= 44 pounds
linseed	= 55 pounds
lime	= 70 pounds
coarse salt	= 70 pounds
fine salt	= 56 pounds

In addition, the following terms are customary:

Contract lot	= the number of units specified as the quantity usually to be called for
Jobber lot	= 10,000 pounds
Car lot	= 40,000 pounds, which can be shipped in any car
Round lot	= 5,000 pounds or any quantity stated
Small lot	= any lot less than a car lot

Tank cars have different capacities, and therefore products shipped in them are not quoted or sold in terms of tank cars or tank loads. The number of tank cars may be stated, but pounds or gallons are used as the actual measure. Neither are barrels or kegs of equal size for various products, and the gross and net content of each shipment is definitely required.

1 cord of wood is 8 feet long, 4 feet wide, 4 feet high
= 128 cubic feet.

These are only the most customary units of measure found in chemical trading, to which quite a few foreign ones could be added that are used mainly in raw-material transactions.

EXHIBIT B

THE FREE LIST

TARIFF ACT 1930, SCHEDULES 16 AND 17

In the free list are mentioned the following chemical materials and products:

PARAGRAPH	
1601	Certain special acids and acid anhydrides
1602	Crude drugs, herbs, leaves
1609	Dyeing and tanning materials
1610	Antitoxins, serums, vaccines, etc.
1611	Argols, tartar, wine lee, calcium tartrate
1613	Arsenic sulphide
1614	Arsenious acid or white arsenic
1619	Chinchona bark or other for quinine
1633	Borate of soda, or borax or other borates
1641	Calcium
1642	Calcium arsenate
1651	Coal-tar products, crude
1667	Cyanide
1669	Crude drugs, herbs (continued)
1670	Dyeing and tanning materials (continued)
1685	Nitrogenous fertilizer materials
1686	Gums and resins
1687	Gun powder
1698	Iodine crude
1707	Lac, crude, etc., and shellac
1727	Oil bearing seeds and nuts
1728	Belladonna, ergot, etc.
1730	Cod oil
1731	Oils, distilled and essential
1732	Oils, expressed or extracted
1737	Paris green and london purple
1740	Phosphates, crude and apatite
1745	Potassium fertilizer materials
1746	Potassium nitrate, crude = saltpeter
1748	Quinine and salts or alkaloids from chinchona bark
1766	Sodium (saltcake, bicarbonate, nitrate, niter cake)
1777	Pyrites
1780	Tankage, fish scrap and meal
1794	Vegetable tallow
1796	Wax

U. S. Tariff Commission, Changes in Import Duties Since the Passage of the Tariff Act of 1930, 3rd edition. January 21, 1937, U. S. Printing Office, Washington, D. C.

June 17, 1930.
[H. R. 2667.]
[Public, No. 361.]

CHAP. 497.—An Act To provide revenue, to regulate commerce with foreign countries, to encourage the industries of the United States, to protect American labor, and for other purposes.

Tariff Act of 1930.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

TITLE I. DUTIABLE LIST.

TITLE I—DUTIABLE LIST

Duties levied on imports from abroad.

Vol. 42, p. 858; U. S. C., Supp. IV, p. 214.

Philippine and Virgin Islands, American Samoa, and Guam excepted.

SECTION 1. That on and after the day following the passage of this Act, except as otherwise specially provided for in this Act, there shall be levied, collected, and paid upon all articles when imported from any foreign country into the United States or into any of its possessions (except the Philippine Islands, the Virgin Islands, American Samoa, and the island of Guam) the rates of duty which are prescribed by the schedules and paragraphs of the dutiable list of this title, namely:

SCHEDULE 1. Chemicals, oils, and paints.

SCHEDULE 1.—CHEMICALS, OILS, AND PAINTS

Acids and acid anhydrides.

PARAGRAPH 1. Acids and acid anhydrides: Acetic acid containing by weight not more than 65 per centum of acetic acid, 1⅜ cents per pound; containing by weight more than 65 per centum, 2 cents per pound; acetic anhydride, 3½ cents per pound; boric acid, 1 cent per pound; chloroacetic acid, 5 cents per pound; citric acid, 17 cents per pound; formic acid, 3 cents per pound; lactic acid, containing by weight of lactic acid less than 30 per centum, 2 cents per pound; 30 per centum or more and less than 55 per centum, 4 cents per pound; and 55 per centum or more, 9 cents per pound: *Provided*, That any lactic-acid anhydride present shall be determined as lactic acid and included as such: *And provided further*, That the duty on lactic acid shall not be less than 25 per centum ad valorem; tannic acid, tannin, and extracts of nutgalls, containing by weight of tannic acid less than 50 per centum, 5 cents per pound; 50 per centum or more and not medicinal, 11 cents per pound; 50 per centum or more and medicinal, 18 cents per pound; tartaric acid, 8 cents per pound; arsenic acid, 3 cents per pound; gallic acid, 6 cents per pound; oleic acid or red oil, 20 per centum ad valorem; oxalic acid, 6 cents per pound; phosphoric acid, 2 cents per pound; pyrogallic acid, 12 cents per pound; carbon dioxide, weighing with immediate containers and carton, one pound or less per carton, 1 cent per pound on contents, immediate containers, and carton; and all other acids and acid anhydrides not specially provided for, 25 per centum ad valorem.

Acetaldehyde, etc.

PAR. 2. Acetaldehyde, aldol or acetaldol, aldehyde ammonia, butyraldehyde, crotonaldehyde, paracetaldehyde; ethylene chlorohydrin, propylene chlorohydrin, butylene chlorohydrin; ethylene dichloride, propylene dichloride, butylene dichloride; ethylene oxide, propylene oxide, butylene oxide; ethylene glycol, propylene glycol, butylene glycol, and all other glycols or dihydric alcohols; monoethanolamine, diethanolamine, triethanolamine, ethylene diamine, and all other hydroxy alkyl amines and alkylene diamines; allyl alcohol, crotonyl alcohol, vinyl alcohol, and all other olefin or unsaturated alcohols; homologues and polymers of all the foregoing; ethers, esters, salts and nitrogenous compounds of any of the foregoing, whether polymerized or unpolymerized; and mixtures in chief value of any one or more of the foregoing; all the foregoing not specially provided for, 6 cents per pound and 30 per centum ad valorem.

Acetone.

PAR. 3. Acetone and ethyl methyl ketone, and their homologues, and acetone oil, 20 per centum ad valorem.

Alcohol.

PAR. 4. Alcohol: Amyl, butyl, hexyl, and propyl, all the foregoing whether primary, secondary, or tertiary; fusel oil; and mixtures in chief value of any one or more of the foregoing, 6 cents per pound; methyl or wood (or methanol), 18 cents per gallon; and ethyl for nonbeverage purposes only, 15 cents per gallon.

Chemical and medicinal compounds, etc.

PAR. 5. All chemical elements, all chemical salts and compounds, all medicinal preparations, and all combinations and mixtures of any of the foregoing, all the foregoing obtained naturally or artificially and not specially provided for, 25 per centum ad valorem.

Aluminum.

PAR. 6. Aluminum hydroxide or refined bauxite, one-half of 1 cent per pound; potassium aluminum sulphate or potash alum and ammonium aluminum sulphate or ammonia alum, three-fourths of 1 cent per pound; aluminum sulphate, alum cake or aluminous cake, containing not more than 15 per centum of alumina and more iron than the equivalent of one-tenth of 1 per centum of ferric oxide, one-fifth of 1 cent per pound; containing more than 15 per centum of alumina or not more iron than the equivalent of one-tenth of 1 per centum of ferric oxide, three-eighths of 1 cent per pound; all other aluminum salts and compounds not specially provided for, 25 per centum ad valorem.

Ammonium

PAR. 7. Ammonium carbonate and bicarbonate, 2 cents per pound; ammonium chloride, 1¼ cents per pound; ammonium nitrate, 1 cent per pound; ammonium perchlorate and ammonium phosphate, 1½ cents per pound; liquid anhydrous ammonia, 2½ cents per pound.

Antimony

PAR. 8. Antimony: Oxide, 2 cents per pound; tartar emetic or potassium-antimony tartrate, 6 cents per pound; sulphides and other antimony salts and compounds, not specially provided for, 1 cent per pound and 25 per centum ad valorem.

Argols, tartrates, etc.

PAR. 9. Argols, tartar, and wine lees, containing 90 per centum or more of potassium bitartrate, 5 cents per pound; cream of tartar, 5 cents per pound; Rochelle salts or potassium-sodium tartrate, 5 cents per pound.

Balsams.

Proviso. Nonalcoholic

PAR. 10. Balsams: Copaiba, fir or Canada, Peru, tolu, styrax, and all other balsams, all the foregoing which are natural and uncompounded, 10 per centum ad valorem: *Provided*, That no article containing alcohol shall be classified for duty under this paragraph.

Gums.

PAR. 11. Amber and amberoid unmanufactured, not specially provided for, 50 cents per pound; synthetic gums and resins not specially provided for, 4 cents per pound and 30 per centum ad valorem; arabic or senegal, one-half of 1 cent per pound.

Barium.

PAR. 12. Barium carbonate, precipitated, 1½ cents per pound; barium chloride, 2 cents per pound; barium dioxide, 6 cents per pound; barium hydroxide, 1¼ cents per pound; barium nitrate, 2 cents per pound; and barium oxide, 2½ cents per pound.

Blackings, etc

Proviso Nonalcoholic

PAR. 13. Blackings, powders, liquids, and creams for cleaning or polishing, not specially provided for, 25 per centum ad valorem: *Provided*, That no preparations containing alcohol shall be classified for duty under this paragraph.

Bleaching powder.

PAR. 14. Bleaching powder or chlorinated lime, three-tenths of 1 cent per pound.

Caffeine.

PAR. 15. Caffeine, $1.25 per pound; caffeine citrate, 75 cents per pound; compounds of caffeine, 25 per centum ad valorem; theobromine, 75 cents per pound.

Calcium carbide.

PAR. 16. Calcium carbide, 1 cent per pound; calcium acetate, crude, 1 cent per pound; calcium oxalate, 4 cents per pound.

Calomel.

PAR. 17. Calomel, corrosive sublimate, and other mercurial preparations, 22 cents per pound and 25 per centum ad valorem.

Chloroform, etc.

PAR. 18. Carbon tetrachloride, 1 cent per pound; chloroform, 4 cents per pound; tetrachloroethane and trichloroethylene, 30 per centum ad valorem.

SCHEDULE 1.
Chemicals, oils, and paints.

Casein.

PAR. 19. Casein or lactarene and mixtures of which casein or lactarene is the component material of chief value, not specially provided for, 5½ cents per pound.

Chalk.

PAR. 20. Chalk or whiting or Paris white: Dry, ground, or bolted, four-tenths of 1 cent per pound; precipitated, 25 per centum ad valorem; ground in oil (putty), three-fourths of 1 cent per pound; put up in the form of cubes, blocks, sticks, or disks, or otherwise, including tailors', billiard, red, and manufactures of chalk not specially provided for, 25 per centum ad valorem.

Chemical compounds of gold, etc.

PAR. 21. Chemical compounds, mixtures, and salts, of which gold, platinum, rhodium, or silver constitutes the element of chief value, 25 per centum ad valorem.

Bismuth.

PAR. 22. Chemical compounds, salts, and mixtures of bismuth, 35 per centum ad valorem.

Medicinal capsules, etc.

PAR. 23. Chemicals, drugs, medicinal and similar substances, whether dutiable or free, when imported in capsules, pills, tablets, lozenges, troches, ampoules, jubes, or similar forms, including powders put up in medicinal doses, shall be dutiable at not less than 25 per centum ad valorem.

Chemical elements and medicinal compounds, etc., containing alcohol.

PAR. 24. Chemical elements, and chemical and medicinal compounds, preparations, mixtures, and salts, distilled or essential oils, expressed or extracted oils, animal oils and greases, ethers and esters, flavoring and other extracts, and natural or synthetic fruit flavors, fruit esters, oils and essences, all the foregoing and their combinations when containing alcohol, and all articles consisting of vegetable or mineral objects immersed or placed in, or saturated with, alcohol, except perfumery and spirit varnishes, and all alcoholic compounds not specially provided for, if containing 20 per centum of alcohol or less, 20 cents per pound and 25 per centum ad valorem; containing more than 20 per centum and not more than 50 per centum of alcohol, 40 cents per pound and 25 per centum ad valorem; containing more than 50 per centum of alcohol, 80 cents per pound and 25 per centum ad valorem.

Chicle.

PAR. 25. Chicle, refined or advanced in value by drying, straining, or any other process or treatment whatever beyond that essential to the proper packing, 5 cents per pound.

Chloral hydrate, etc.

PAR. 26. Chloral hydrate, terpin hydrate, thymol, and glycerophosphoric acid, and salts and compounds of glycerophosphoric acid, 35 per centum ad valorem; diethylbarbituric acid and salts and compounds thereof, $2.50 per pound; ethyl-hydrocupreine and salts and compounds thereof, 20 cents per ounce.

Coal-tar products.

Not medicinal.

PAR. 27. Coal-tar products:

(a) (1) Acetanilide not suitable for medicinal use, alphanaphthol, aminobenzoic acid, aminonaphthol, aminophenetole, aminophenol, aminosalicylic acid, aminoanthraquinone, aniline oil, aniline salt, anthraquinone, arsanilic acid, benzaldehyde not suitable for medicinal use, benzal chloride, benzanthrone, benzidine, benzidine sulfate, benzoic acid not suitable for medicinal use, benzoquinone, benzoyl chloride, benzyl chloride, benzylethylaniline, beta-naphthol not suitable for medicinal use, bromobenzene, chlorobenzene, chlorophthalic acid, cinnamic acid, cumidine, dehydrothiotoluidine, diaminostilbene, dianisidine, dichlorophthalic acid, dimethyl aniline, dimethylaminophenol, dimethylphenylbenzylammonium hydroxide, dimethylphenylenediamine, dinitrobenzene, dinitrochlorobenzene, dinitronaphthalene, dinitrophenol, dinitrotoluene, dihydroxynaphthalene, diphenylamine, hydroxyphenylarsinic acid, metanilic acid, methylanthraquinone, naphthylamine, naphthylenediamine, nitroaniline, nitroanthraquinone, nitrobenzaldehyde, nitrobenzene, nitronaphthalene, nitrophenol, nitrophenylenediamine, nitrosodimethylaniline, nitrotoluene, nitrotoluylenediamine, phenylenediamine,

phenylhydrazine, phenylnapthylamine, phenylglycine, phenylglycineortho-carboxylic acid, phthalic acid, phthalic anhydride, phthalimide, quinaldine, quinoline, resorcinol not suitable for medicinal use, salicylic acid and its salts not suitable for medicinal use, sulfanilic acid, thiocarbanilide, thiosalicylic acid, tetrachlorophthalic acid, tetramethyldiaminobenzophenone, tetramethyldiaminodiphenylmethane, toluene sulfochloride, toluene sulfonamide, tribromophenol, toluidine, tolidine, tolylenediamine, xylidine, anthracene having a purity of 30 per centum or more, carbazole having a purity of 65 per centum or more, naphthalene which after the removal of all water present has a solidifying point of seventy-nine degrees centigrade or above; all the foregoing products in this paragraph whether obtained, derived, or manufactured from coal tar or other source;

Distillates, etc.

(2) all distillates (except those provided for in subparagraph (b)) of coal tar, blast-furnace tar, oil-gas tar, and water-gas tar, which on being subjected to distillation yield in the portion distilling below one hundred and ninety degrees centigrade a quantity of tar acids equal to or more than 5 per centum of the original distillate or which on being subjected to distillation yield in the portion distilling below two hundred and fifteen degrees centigrade a quantity of tar acids equal to or more than 75 per centum of the original distillate;

Similar manufactured products.

(3) all products, by whatever name known, which are similar to any of the products provided for in this paragraph or in paragraph 1651, and which are obtained, derived, or manufactured in whole or in part from any of the products provided for in this paragraph or in paragraph 1651;

Mixtures.

(4) all mixtures, including solutions, consisting in whole or in part of any of the foregoing products provided for in this paragraph, except sheep dip and medicinal soaps;

Products, not colors, dyes, etc.

(5) all the foregoing products provided for in this paragraph, not colors, dyes, or stains, color acids, color bases, color lakes, leucocompounds, indoxyl, indoxyl compounds, ink powders, photographic chemicals, medicinals, synthethic aromatic or odoriferous chemicals, synthetic resinlike products, synthetic tanning materials, or explosives, and not specially provided for in paragraph 28 or 1651, 40 per centum ad valorem and 7 cents per pound.

Metacresol, etc.

(b) Metacresol having a purity of 90 per centum or more, orthocresol having a purity of 90 per centum or more, paracresol having a purity of 90 per centum or more, phenol, carbolic acid which on being subjected to distillation yields in the portion distilling below one hundred and ninety degrees centigrade a quantity of tar acids equal to or more than 5 per centum of the original distillate, cresylic acid which on being subjected to distillation yields in the portion distilling below two hundred and fifteen degrees centigrade a quantity of tar acids equal to or more than 75 per centum of the original distillate, and any mixture of any of the foregoing products with any of the products provided for in paragraph 1651, 20 per centum ad valorem and 3½ cents per pound.

Ad valorem rates, based on American selling price, as value.

(c) The ad valorem rates provided in this paragraph shall be based upon the American selling price (as defined in subdivision (g) of section 402, Title IV), of any similar competitive article manufactured or produced in the United States. If there is no similar competitive article manufactured or produced in the United States then the ad valorem rate shall be based upon the United States value, as defined in subdivision (e) of section 402, Title IV.

Post, p. 710.

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Articles deemed competitive.

(d) For the purposes of this paragraph any coal-tar product provided for in this Act shall be considered similar to or competitive with any imported coal-tar product which accomplishes results

SCHEDULE 1.
Chemicals, oils, and paints.
Other coal-tar products.
Colors, dyes, photographic chemicals, medicinals, etc.

substantially equal to those accomplished by the domestic product when used in substantially the same manner.

PAR. 28. Coal-tar products:

(a) All colors, dyes, or stains, whether soluble or not in water, except those provided for in subparagraph (b), color acids, color bases, color lakes, leuco-compounds, whether colorless or not, indoxyl, and indoxyl compounds; ink powders; photographic chemicals; acetanilide suitable for medicinal use, acetphenetidine, acetylsalicylic acid, antipyrine, benzaldehyde suitable for medicinal use, benzoic acid suitable for medicinal use, beta-naphthol suitable for medicinal use, guaiacol and its derivatives, phenolphthalein, resorcinol suitable for medicinal use, salicylic acid and its salts suitable for medicinal use, salol, and other medicinals; sodium benzoate; saccharin; artificial musk, benzyl acetate, benzyl benzoate, coumarin, diphenyloxide, methyl anthranilate, methyl salicylate, phenylacetaldehyde, phenylethyl alcohol, and other synthetic odoriferous or aromatic chemicals, including flavors, all these products not marketable as perfumery, cosmetics, or toilet preparations, and not mixed and not compounded, and not containing alcohol; synthetic phenolic resin and all resin-like products prepared from phenol, cresol, phthalic anhydride, coumarone, indene, or from any other article or material provided for in paragraph 27 or 1651, all these products whether in a solid, semisolid, or liquid condition; synthetic tanning materials; picric acid, trinitrotoluene, and other explosives except smokeless powders; all the foregoing products provided for in this paragraph, when obtained, derived, or manufactured in whole or in part from any of the products provided for in paragraph 27 or 1651; natural alizarin and natural indigo, and colors, dyes, stains, color acids, color bases, color lakes, leuco-compounds, indoxyl, and indoxyl compounds, obtained, derived, or manufactured in whole or in part from natural alizarin or natural indigo; natural methyl salicylate or oil of wintergreen or oil of sweet birch; natural coumarin; natural guaiacol and its derivatives; vanillin, from whatever source obtained, derived, or manufactured; and all mixtures, including solutions, consisting in whole or in part of any of the articles or materials provided for in this paragraph, excepting mixtures of synthetic odoriferous or aromatic chemicals, 45 per centum ad valorem and 7 cents per pound.

Natural colors, etc

Synthetic indigo and sulphur black.

(b) Synthetic indigo, "Colour Index No. 1177", and sulphur black, "Colour Index No. 978", 3 cents per pound and 20 per centum ad valorem.

Ad valorem rates based on American selling price.

(c) The ad valorem rates provided in this paragraph shall be based upon the American selling price (as defined in subdivision (g) of section 402, Title IV), of any similar competitive article manufactured or produced in the United States.

If no competitive American article.

If there is no similar competitive article manufactured or produced in the United States then the ad valorem rate shall be based upon the United States value, as defined in subdivision (e) of section 402, Title IV.

Articles deemed competitive.

(d) For the purposes of this paragraph any coal-tar product provided for in this Act shall be considered similar to or competitive with any imported coal-tar product which accomplishes results substantially equal to those accomplished by the domestic product when used in substantially the same manner.

Specific duties on colors, dyes, or stains, based on standards of strength.

(e) The specific duties provided for in this paragraph on colors, dyes, or stains, whether soluble or not in water, color acids, color bases, color lakes, leuco-compounds, indoxyl, and indoxyl compounds, shall be based on standards of strength which shall be established by the Secretary of the Treasury, and upon all importations of such articles which exceed such standards of strength the specific duty shall be computed on the weight which the article would have if it were diluted to the standard strength, but in no case shall any such

articles of whatever strength be subject to a less specific duty than that provided in subparagraph (a) or (b), as the case may be.

SCHEDULE 1. Chemicals, oils, and paints

(f) It shall be unlawful to import or bring into the United States any such color, dye, stain, color acid, color base, color lake, leuco-compound, indoxyl, or indoxyl compound unless the immediate container and the invoice shall bear a plain, conspicuous, and truly descriptive statement of the identity and percentage, exclusive of diluents, of such color, dye, stain, color acid, color base, color lake, leuco-compound, indoxyl, or indoxyl compound contained therein.

Importing colors, etc., without full statement on container, unlawful

(g) On and after the passage of this Act it shall be unlawful to import or bring into the United States any such color, dye, stain, color acid, color base, color lake, leuco-compound, indoxyl, or indoxyl compound, if the immediate container or the invoice bears any statement, design, or device regarding the article or the ingredients or substances contained therein which is false, fraudulent, or misleading in any particular.

With false statement as to ingredients on containers

(h) In the enforcement of the foregoing provisions of this paragraph the Secretary of the Treasury shall adopt a standard of strength for each dye or other article which shall conform as nearly as practicable to the commercial strength in ordinary use in the United States prior to July 1, 1914. If a dye or other article has been introduced into commercial use since said date then the standard of strength for such dye or other article shall conform as nearly as practicable to the commercial strength in ordinary use. If a dye or other article was or is ordinarily used in more than one commercial strength, then the lowest commercial strength shall be adopted as the standard of strength for such dye or other article.

Standards of strength for dyes, etc., to be adopted

(i) Any article or product which is within the terms of paragraph 1, 5, 37, 39, 60, 66, 82, or 1687, as well as within the terms of paragraph 27, 28, or 1651, shall be assessed for duty or exempted from duty as the case may be under paragraph 27, 28, or 1651.

Application of rates, etc., to other imports

PAR. 29. Cobalt: Oxide, 20 cents per pound; sulphate and linoleate, 10 cents per pound; and all other cobalt salts and compounds, 30 per centum ad valorem.

Cobalt

PAR. 30. Collodion and other liquid solutions of pyroxylin, of other cellulose esters or ethers, or of cellulose, 30 cents per pound.

Collodion, etc

PAR. 31. (a) Cellulose acetate, and compounds, combinations, or mixtures containing cellulose acetate:

Cellulose acetate, etc.

(1) In blocks, sheets, rods, tubes, powder, flakes, briquets, or other forms, whether or not colloided, and waste wholly or in chief value of cellulose acetate, all the foregoing not made into finished or partly finished articles, 50 cents per pound;

In blocks, etc., not finished

(2) made into finished or partly finished articles of which any of the foregoing is the component material of chief value, and not specially provided for, 80 per centum ad valorem.

Finished articles.

(b) All compounds of cellulose (except cellulose acetate, but including pyroxylin and other cellulose esters and ethers), and all compounds, combinations, or mixtures of which any such compound is the component material of chief value:

Other compounds of cellulose

(1) In blocks, sheets, rods, tubes, powder, flakes, briquets, or other forms, whether or not colloided, not made into finished or partly finished articles, 40 cents per pound, except that transparent sheets more than three one-thousandths of one inch and not more than thirty-two one-thousandths of one inch in thickness shall be subject to duty at the rate of 45 cents per pound;

Unfinished blocks, sheets, etc

(2) made into finished or partly finished articles of which any of the foregoing is the component material of chief value, not specially provided for, 60 per centum ad valorem.

Finished articles

(c) Sheets, bands, and strips (whether known as cellophane or by any other name whatsoever), exceeding one inch in width but not

Cellophane, etc., sheets, bands, or strips.

SCHEDULE 1. Chemicals, oils, and paints.

exceeding three one-thousandths of one inch in thickness, made by any artificial process from cellulose, a cellulose hydrate, a compound of cellulose (other than cellulose acetate), or a mixture containing any of the foregoing, by solidification into sheets, bands, or strips, 45 per centum ad valorem.

Hard fiber cellulose

PAR. 32. Compounds of cellulose, known as vulcanized or hard fiber, made wholly or in chief value of cellulose, 30 per centum ad valorem.

Casein compounds.

PAR. 33. Compounds of casein, known as galalith, or by any other name, in blocks, sheets, rods, tubes, or other forms, not made into finished or partly finished articles, 25 cents per pound; made into finished or partly finished articles of which any of the foregoing is the component material of chief value not specially provided for, 40 cents per pound and 50 per centum ad valorem.

Nonedible or animal drugs.

PAR. 34. Drugs, such as barks, beans, berries, buds, bulbs, bulbous roots, excrescences, fruits, flowers, dried fibers, dried insects, grains, herbs, leaves, lichens, mosses, roots, stems, vegetables, seeds (aromatic, not garden seeds), seeds of morbid growth, weeds, and all other drugs of vegetable or animal origin; any of the foregoing which are natural and uncompounded drugs and not edible, and not specially provided for, but which are advanced in value or condition by shredding, grinding, chipping, crushing, or any other process or treatment whatever beyond that essential to the proper packing of the drugs and the prevention of decay or deterioration pending manufacture, 10 per centum ad valorem: *Provided*, That the term "drug" wherever used in this Act shall include only those substances having therapeutic or medicinal properties and chiefly used for medicinal purposes: *And provided further*, That no article containing alcohol shall be classified for duty under this paragraph.

Proviso. Drug defined.

Nonalcoholic.

Aconite, etc.

PAR. 35. Aconite, aloes, asafetida, cocculus indicus, ipecac, jalap, manna; marshmallow or althea root, leaves and flowers; maté, and pyrethrum or insect flowers; all the foregoing which are natural and uncompounded, but which are advanced in value or condition by shredding, grinding, chipping, crushing, or any other process or treatment whatever beyond that essential to proper packing and the prevention of decay or deterioration pending manufacture, 10 per centum ad valorem: *Provided*, That no article containing alcohol shall be classified for duty under this paragraph.

Proviso. Nonalcoholic.

Coca leaves, digitalis.

PAR. 36. Coca leaves, 10 cents per pound; digitalis, 20 per centum ad valorem.

Ethers and esters.

PAR. 37. Ethers and esters: Diethyl sulphate and dimethyl sulphate, 25 per centum ad valorem; ethyl acetate, 3 cents per pound; butyl acetate and amyl acetate, 7 cents per pound; ethyl chloride, 15 cents per pound; ethyl ether, 4 cents per pound; and ethers and esters of all kinds not specially provided for, 25 per centum ad valorem: *Provided*, That no article containing more than 10 per centum of alcohol shall be classified for duty under this paragraph.

Proviso. Nonalcoholic.

Dyeing and tanning extracts.

PAR. 38. Extracts, dyeing and tanning: Chestnut, cutch, chlorophyll, divi-divi, fustic, hemlock, logwood, mangrove, myrobalan, oak, Persian berry, quebracho, sumac, saffron, safflower, saffron cake, valonia, wattle, and other extracts, decoctions, and preparations of vegetable origin used for dyeing, coloring, staining, or tanning, not specially provided for, and combinations and mixtures of the foregoing articles in this paragraph, 15 per centum ad valorem: *Provided*, That no article containing alcohol shall be classified for duty under this paragraph.

Proviso Nonalcoholic.

Flavoring extracts, etc.

PAR. 39. Flavoring extracts and natural or synthetic fruit flavors, fruit esters, oils, and essences, all the foregoing not containing alcohol, and not specially provided for, 25 per centum ad valorem.

Nonalcoholic.

Chemicals, oils, and paints.

PAR. 40. Formaldehyde solution or formalin, 1¾ cents per pound; solid formaldehyde or paraformaldehyde, 8 cents per pound; and hexamethylenetetramine, 11 cents per pound.

Formaldehyde, etc

PAR. 41. Edible gelatin, valued at less than 40 cents per pound, 20 per centum ad valorem and 5 cents per pound; valued at 40 cents or more per pound, 20 per centum ad valorem and 7 cents per pound; gelatin, glue, glue size, and fish glue, not specially provided for, valued at less than 40 cents per pound, 25 per centum ad valorem and 2 cents per pound; valued at 40 cents or more per pound, 25 per centum ad valorem and 8 cents per pound; agar agar, pectin, isinglass, and manufactures, wholly or in chief value of gelatin, glue, or glue size, 25 per centum ad valorem; casein glue, 30 per centum ad valorem.

Gelatin, edible, etc.

Glue.

PAR. 42. Glycerin, crude, 1 cent per pound; refined, 2 cents per pound.

Glycerin.

PAR. 43. Ink, and ink powders not specially provided for, 10 per centum ad valorem; drawing ink, 15 per centum ad valorem.

Ink.

PAR. 44. Iodine, resublimed, 10 cents per pound.

Iodine.

PAR. 45. Bromine and all bromine compounds not specially provided for, 10 cents per pound.

Bromine.

PAR. 46. Lead: Acetate, white, 2½ cents per pound; acetate, brown, gray, or yellow, 2 cents per pound; nitrate, arsenate, and resinate, 3 cents per pound; and all other lead compounds not specially provided for, 30 per centum ad valorem.

Lead chemical compounds.

PAR. 47. Licorice, extracts of, in pastes, rolls, or other forms, 20 per centum ad valorem.

Licorice.

PAR. 48. Lime, citrate of, 7 cents per pound; juice of lemons, limes, oranges, or other citrous fruits, unfit for beverage purposes, 5 cents per pound.

Lime, citrate of.

PAR. 49. Magnesium: Carbonate, precipitated, 1½ cents per pound; manufactures of carbonate of magnesia, 2 cents per pound; chloride, anhydrous, 1 cent per pound; chloride, not specially provided for, five-eighths of 1 cent per pound; sulphate or Epsom salts, three-fourths of 1 cent per pound; oxide or calcined magnesia, 7 cents per pound.

Magnesium chemicals.

PAR. 50. Manganese: Borate, resinate, sulphate, and other manganese compounds and salts, not specially provided for, 25 per centum ad valorem.

Manganese chemicals.

PAR. 51. Menthol, 50 cents per pound; natural crude camphor, 1 cent per pound; natural refined camphor, 5 cents per pound; synthetic camphor, 5 cents per pound. If at the end of three years after the enactment of this Act, the President finds that during the preceding six months the domestic production by quantity of synthetic camphor did not exceed 25 per centum of the domestic consumption thereof by quantity, or, at the end of four years after the enactment of this Act, that during the preceding six months such domestic production did not exceed 30 per centum of such consumption, or, at the end of five years after the enactment of this Act, that during the preceding six months such domestic production did not exceed 50 per centum of such consumption, he shall by proclamation so declare and, after six months thereafter, the rate on synthetic camphor shall be 1 cent per pound. To assist the President in making the investigation required by this provision, the Tariff Commission is empowered to investigate, to such extent as may be necessary, in the manner provided in the case of investigations under section 336 of this Act, and shall report to the President the result of its investigation.

Menthol and camphor

Rates on synthetic, if domestic product not equal to consumption at designated periods.

Investigation by Tariff Commission and report to the President to determine.

Post, p. 701.

PAR. 52. Oils, animal and fish: Sod, herring, and menhaden, 5 cents per gallon; whale and seal, 6 cents per gallon; sperm, crude, 10 cents per gallon; sperm, refined or otherwise processed, 14 cents

Animal and fish oil, fats and greases.

SCHEDULE 1. Chemicals, oil, and paints

per gallon; spermaceti wax, 6 cents per pound; wool grease containing more than 2 per centum of free fatty acids, 1 cent per pound; containing 2 per centum or less of free fatty acids and not suitable for medicinal use, 2 cents per pound; suitable for medicinal use, including adeps lanæ, hydrous or anhydrous, 3 cents per pound; all other animal and fish oils, fats, and greases, not specially provided for, 20 per centum ad valorem.

Expressed or extracted oils.

PAR. 53. Oils, vegetable: Castor, 3 cents per pound; hempseed, 1½ cents per pound; linseed or flaxseed, and combinations and mixtures in chief value of such oil, 4½ cents per pound; olive, weighing with the immediate container less than forty pounds, 9½ cents per pound on contents and container; olive, not specially provided for, 6½ cents per pound; poppy seed, 2 cents per pound; rapeseed, 6 cents per gallon; all other expressed or extracted oils, not specially provided for, 20 per centum ad valorem.

Coconut, etc., oils.

PAR. 54. Coconut oil, 2 cents per pound; cottonseed oil, 3 cents per pound; peanut oil, 4 cents per pound; palm-kernel oil, 1 cent per pound; sesame oil, 3 cents per pound; and soy-bean oil, 3½ cents per pound, but not less than 45 per centum ad valorem.

Turkey red, soluble greases, etc.

PAR. 55. Alizarin assistant, Turkey red oil, sulphonated castor or other sulphonated animal or vegetable oils, soaps made in whole or in part from castor oil, and all soluble greases; all the foregoing in whatever form, and suitable for use in the processes of softening, dyeing, tanning, or finishing, not specially provided for, 35 per centum ad valorem.

Hydrogenated oils and fats.

PAR. 56. Hydrogenated or hardened oils and fats, 4 cents per pound; other oils and fats, the composition and properties of which have been changed by vulcanizing, oxidizing, chlorinating, nitrating, or any other chemical process, and not specially provided for, 20 per centum ad valorem.

Combinations of animal, etc., oils.

PAR. 57. Combinations and mixtures of animal, vegetable, or mineral oils or of any of them (except combinations or mixtures containing essential or distilled oils), with or without other substances, and not specially provided for, 25 per centum ad valorem, but not less than the rate applicable to the component material subject to the highest rate of duty: *Provided*, That no article containing alcohol shall be classified for duty under this paragraph.

Proviso. Nonalcoholic.

Distilled or essential oils.

PAR. 58. Oils, distilled or essential: Lemon, grapefruit, and orange, 25 per centum ad valorem; eucalyptus, 15 per centum ad valorem; clove, peppermint, patchouli, sandalwood, and all other essential and distilled oils not specially provided for, 25 per centum ad valorem: *Provided*, That no article mixed or compounded with or containing alcohol shall be classified for duty under this paragraph.

Proviso. Nonalcoholic.

Opium, cocaine, etc.

PAR. 59. Opium containing not less than 8.5 per centum of anhydrous morphine, $3 per pound; morphine, morphine sulphate, and all opium alkaloids and salts, esters, and other derivatives thereof, $3 per ounce; cocaine, ecgonine, and salts, esters, and other derivatives thereof, $2.60 per ounce; tincture of opium, such as laudanum, and other liquid preparations of opium, not specially provided for, 60 per centum ad valorem; opium containing less than 8.5 per centum of anhydrous morphine, $6 per pound: *Provided*, That nothing herein contained shall be so construed as to repeal or in any manner impair or affect the provisions of the Narcotic Drugs Import and Export Act, as amended.

Proviso. Narcotic Acts not affected. Vol. 38, p. 614; Vol. 39, p. 775; Vol. 42, p. 596. U. S. C., p. 635.

Perfume materials.

PAR. 60. Perfume materials: Ambergris, castoreum, civet, and musk grained or in pods, 20 per centum ad valorem; anethol, citral, geraniol, heliotropin, ionone, rhodinol, safrol, terpineol, and all natural or synthetic odoriferous or aromatic chemicals, all the foregoing not mixed and not compounded, and not specially provided for, 45 per centum ad valorem; all mixtures or combinations contain-

SCHEDULE 1. Chemicals, oils, and paints.

ing essential or distilled oils, or natural or synthetic odoriferous or aromatic substances, 40 cents per pound and 50 per centum ad valorem: *Provided*, That only materials not marketable as perfumery, cosmetics, or toilet preparations, and not containing more than 10 per centum of alcohol, shall be classified for duty under this paragraph: *Provided further*, That all of the foregoing materials containing more than 10 per centum of alcohol shall be classified for duty under paragraph 61 as toilet preparations.

Proviso. Alcoholic restriction.

With higher alcoholic content.

Perfumery, toilet preparations, etc.

PAR. 61. Perfumery, including cologne and other toilet waters, articles of perfumery, whether in sachets or otherwise, and all preparations used as applications to the hair, mouth, teeth, or skin, such as cosmetics, dentifrices, tooth soaps, pastes, theatrical grease paints, pomades, powders, and other toilet preparations, all the foregoing, if containing alcohol, 40 cents per pound and 75 per centum ad valorem; if not containing alcohol, 75 per centum ad valorem; bath salts, if not perfumed, 25 per centum ad valorem; if perfumed (whether or not having medicinal properties), 75 per centum ad valorem.

Floral waters.

PAR. 62. Floral or flower waters containing no alcohol, not specially provided for, 20 per centum ad valorem; bay rum or bay water, whether distilled or compounded, 40 cents per pound and 60 per centum ad valorem.

Phosphorus.

PAR. 63. Phosphorus, 8 cents per pound; phosphorus oxychloride and phosphorus trichloride, 6 cents per pound.

Plasters.

PAR. 64. Plasters, healing or curative, of all kinds, and court-plaster, 20 per centum ad valorem.

Artists' paints, etc.

PAR. 65. (a) Paints, colors, and pigments, commonly known as artists', school, students', or children's paints or colors:

In tubes, jars, etc., not assembled in sets.

(1) In tubes, jars, cakes, pans, or other forms, not exceeding one and one-half pounds net weight each, and valued at less than 20 cents per dozen pieces, and not assembled in paint sets, kits, or color outfits, three-fourths of 1 cent per tube, jar, cake, pan, or other form;

Of higher values.

(2) in tubes, jars, cakes, pans, or other forms, not exceeding one and one-half pounds net weight each, and valued at 20 cents or more per dozen pieces, and not assembled in paint sets, kits, or color outfits: In tubes or jars, 2 cents per tube or jar and 40 per centum ad valorem; in cakes, pans, or other forms, 1¼ cents per cake, pan, or other form and 40 per centum ad valorem;

Assembled in paint sets, etc.

(3) in tubes, jars, cakes, pans, or other forms, not exceeding one and one-half pounds net weight each, when assembled in paint sets, kits, or color outfits, with or without brushes, water pans, outline drawings, stencils, or other articles, 70 per centum ad valorem on the value as assembled;

In bulk, etc.

(4) in bulk, or in any form exceeding one and one-half pounds net weight each, 8¼ cents per ounce.

Assembling in sets described.

(b) For the purposes of this paragraph, tubes, jars, cakes, pans, or other forms, shall not be considered as assembled in a paint set, kit, or color outfit, unless assembled in such form and container, and with such assortment of merchandise, as to be suitable for sale at retail to artists, students, or children, as a paint set, kit, or color outfit.

Pigments not specially provided for.

PAR. 66. Pigments, colors, stains, and paints, including enamel paints, whether dry, mixed, or ground in or mixed with water, oil, or solutions other than oil, not specially provided for, 25 per centum ad valorem.

Barytes.

PAR. 67. Barytes ore, crude or unmanufactured, $4 per ton; ground or otherwise manufactured, $7.50 per ton; precipitated barium sulphate or blanc fixe, 1¼ cents per pound.

SCHEDULE 1. Chemicals, oils, and paints.

Blue pigments. PAR. 68. Blue pigments and all blues containing iron ferrocyanide or iron ferricyanide, in pulp, dry, or ground in or mixed with oil or water, 8 cents per pound; ultramarine blue, dry, in pulp, or ground in or mixed with oil or water, wash and all other blues containing ultramarine, if valued at more than 10 cents per pound, 4 cents per pound; if valued at 10 cents per pound or less, 3 cents per pound.

Bone char, etc. PAR. 69. Bone black or bone char, and blood char, 20 per centum ad valorem; decolorizing, deodorizing, or gas-absorbing chars and carbons, whether or not activated, and all activated chars and carbons, 45 per centum ad valorem.

Chrome colors, etc. PAR. 70. Chrome yellow, chrome green, and other colors containing chromium, in pulp, dry, or ground in or mixed with oil or water, 25 per centum ad valorem.

Black pigments. PAR. 71. Gas black, lampblack, and all other black pigments, by whatever name known, dry or ground in or mixed with oil or water, and not specially provided for, 20 per centum ad valorem.

Lead pigments. PAR. 72. Lead pigments: Litharge, 2½ cents per pound; orange mineral, 3 cents per pound; red lead, 2¾ cents per pound; white lead, 2½ cents per pound; all pigments containing lead, dry or in pulp, or ground in or mixed with oil or water, not specially provided for, 30 per centum ad valorem.

Ochers, etc. PAR. 73. Ochers, siennas, and umbers, crude or not ground, one-eighth of 1 cent per pound; washed or ground, three-eighths of 1 cent per pound; iron-oxide and iron-hydroxide pigments not specially provided for, 20 per centum ad valorem.

Satin white. PAR. 74. Satin white and precipitated calcium sulphate, one-half of 1 cent per pound.

Spirit varnishes. PAR. 75. Spirit varnishes containing less than 5 per centum of methyl alcohol, $2.20 per gallon and 25 per centum ad valorem; spirit varnishes containing 5 per centum or more of methyl alcohol, and all other varnishes, including so-called gold size or japan, not specially provided for, 25 per centum ad valorem.

Vermilion reds. PAR. 76. Vermilion reds containing quicksilver, dry or ground in or mixed with oil or water, 35 cents per pound; cuprous oxide, 35 per centum ad valorem.

Zinc oxides, etc. PAR. 77. Zinc oxide and leaded zinc oxides containing not more than 25 per centum of lead, in any form of dry powder, 1¾ cents per pound; ground in or mixed with oil or water, 2¼ cents per pound; lithopone, and other combinations or mixtures of zinc sulphide and barium sulphate containing by weight less than 30 per centum of zinc sulphide, 1¾ cents per pound; containing by weight 30 per centum or more of zinc sulphide, 1¾ cents per pound and 15 per centum ad valorem.

Potassium. PAR. 78. Potassium: Chromate and dichromate, 2¼ cents per pound; citrate, 14 cents per pound; chlorate and perchlorate, 1½ cents per pound; ferricyanide or red prussiate of potash, 7 cents per pound; ferrocyanide or yellow prussiate of potash, 4 cents per pound; iodide, 25 cents per pound; bromide, 10 cents per pound; bicarbonate, 1½ cents per pound; carbonate, three-fourths of 1 cent per pound; hydroxide or caustic potash, 1 cent per pound; nitrate or saltpeter, refined, 1 cent per pound; and permanganate, 6 cents per pound.

Sodium, etc. PAR. 79. Sodium, potassium, lithium, beryllium, and caesium, 25 per centum ad valorem.

Soap. PAR. 80. Soap: Castile, 15 per centum ad valorem; toilet, 30 per centum ad valorem; all other soap and soap powder, not specially provided for, 15 per centum ad valorem.

Soda arsenates, etc. PAR. 81. Sodium: Arsenate, 1 cent per pound; borate or borax, refined, one-eighth of 1 cent per pound; bromide, 10 cents per pound;

carbonate, calcined, or soda ash, hydrated or sal soda, and monohydrated, one-fourth of 1 cent per pound; chlorate, 1½ cents per pound; chloride or salt, in bags, sacks, barrels, or other packages, 11 cents per one hundred pounds; in bulk, 7 cents per one hundred pounds; citrate, 12 cents per pound; chromate and dichromate, 1¾ cents per pound; formate, 2 cents per pound; ferrocyanide or yellow prussiate of soda, 2 cents per pound; hydroxide or caustic soda, one-half of 1 cent per pound; nitrite, 4½ cents per pound; oxalate, 2½ cents per pound; phosphate (except pyro phosphate) containing by weight less than 45 per centum of water, 1½ cents per pound; phosphate (except pyro phosphate) not specially provided for, three-fourths of 1 cent per pound; sesquicarbonate, one-fourth of 1 cent per pound; silicofluoride, 1½ cents per pound; sulphate, crystallized, or Glauber salt, $1 per ton; sulphate, anhydrous, $3 per ton; sulphide, containing not more than 35 per centum of sodium sulphide, three-eighths of 1 cent per pound; containing more than 35 per centum, three-fourths of 1 cent per pound; silicate, sulphite, bisulphite, metabisulphite, and thiosulphate, three-eighths of 1 cent per pound.

Salt.

Sodium hydrosulphite, etc.

PAR. 82. Sodium hydrosulphite, hydrosulphite compounds, sulphoxylate compounds, and all combinations and mixtures of the foregoing, 35 per centum ad valorem.

Starch.

PAR. 83. Starch: Potato, 2½ cents per pound; and all other starches not specially provided for, 1½ cents per pound.

Dextrine.

PAR. 84. Dextrine, made from potato starch or potato flour, 3 cents per pound; dextrine, not otherwise provided for, burnt starch or British gum, dextrine substitutes, and soluble or chemically treated starch, 2 cents per pound.

Strontium.

PAR. 85. Strontium: Carbonate, precipitated, nitrate, and oxide, 25 per centum ad valorem.

Strychnine.

PAR. 86. Strychnine, and salts of, 20 cents per ounce.

Thorium, cerium, etc.

PAR. 87. Thorium nitrate, thorium oxide, and other salts of thorium not specially provided for, cerium nitrate, cerium fluoride, and other salts of cerium not specially provided for, and gas-mantle scrap consisting in chief value of metallic oxides, 35 per centum ad valorem.

Tin chemical compounds.

PAR. 88. Tin bichloride, tin tetrachloride, and all other chemical compounds, mixtures, and salts, of which tin constitutes the element of chief value, 25 per centum ad valorem.

Titanium compounds.

PAR. 89. Titanium potassium oxalate, and all compounds and mixtures containing titanium, 30 per centum ad valorem.

Turpentine.

PAR. 90. Turpentine, gum and spirits of, and rosin, 5 per centum ad valorem.

Vanadic acids, etc.

PAR. 91. Vanadic acid, vanadic anhydride, and salts of the foregoing, 40 per centum ad valorem; chemical compounds, mixtures, and salts, wholly or in chief value of vanadium, not specially provided for, 40 per centum ad valorem.

Vanilla and tonka beans.

PAR. 92. Vanilla beans, 30 cents per pound; tonka beans, 25 cents per pound.

Zinc chloride, etc.

PAR. 93. Zinc chloride, 1$\frac{1}{10}$ cents per pound; zinc sulphate, three-fourths of 1 cent per pound; and zinc sulphide, 3 cents per pound.

Collodion.

PAR. 94. Collodion emulsion, 25 per centum ad valorem.

Azides, fulminates, etc.

PAR. 95. Azides, fulminates, fulminating powder, and other like articles not specially provided for, 12½ cents per pound.

Dynamite, etc.

PAR. 96. Dynamite and other high explosives, put up in sticks, cartridges, or other forms, suitable for blasting, 1¼ cents per pound.

Wood tar.

PAR. 97. Wood tar and pitch of wood, and tar oil from wood, 1 cent per pound.

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