UNITED STATES TARIFF COMMISSION
WASHINGTON

Tariff Information Series—No. 32

Census of Dyes
and other
Synthetic Organic Chemicals
1923

WASHINGTON
GOVERNMENT PRINTING OFFICE
1924

UNITED STATES TARIFF COMMISSION

Office: Eighth and E Streets NW., Washington, D. C.

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INTRODUCTION

This report is a survey of the domestic dye and synthetic organic chemical industry in 1923. It presents the results of a special investigation made by the United States Tariff Commission as to the production in the United States of coal-tar dyes and synthetic organic chemicals, both of coal-tar and of noncoal-tar origin. It includes a detailed census of dye imports and official pre and post war statistics for the imports and exports of coal-tar dyes by the large consuming and producing nations of the world.

The survey is divided into six parts, as shown in Table of Contents (pp. III to VI).

In the preparation of this report the Tariff Commission had the services of Warren N. Watson, Frank Talbot, and C. R. De Long, of the chemical division of the commission's staff, and of others.

PART I

SUMMARY OF THE CENSUS OF DYES AND OTHER SYNTHETIC ORGANIC CHEMICALS, 1923

PART I

SUMMARY OF THE CENSUS OF DYES AND OTHER SYNTHETIC ORGANIC CHEMICALS, 1923

INTRODUCTORY

The United States Tariff Commission has reported annually, beginning with 1917, the progress of the American dye and coal-tar chemical industry. Since 1919, the production figures on dyes and other coal-tar chemicals have been supplemented by a detailed census of dye imports. Since 1921 the annual census of the industry has included a census of synthetic organic chemicals other than those derived from coal tar. A discussion of the international dye trade is also included, developments in the foreign dye-producing countries are considered, and information is given on the production of dyes in France, Italy, and Japan. Official statistics as to exports and imports of the more important dye-consuming and producing countries of the world in post-war years are compared with those of pre-war years. A new feature of the present report is the account of the deliveries and the percentage distribution of reparation dyes, together with the agreements and protocols concerning the German deliveries of both dyes and pharmaceuticals to the allied and associated Governments.

Other reports prepared by the Tariff Commission relating to conditions in the dye industry include (1) Costs of Production in the Dye Industry, 1918 and 1919, and (2) Dyes and Other Coal-Tar Chemicals, December 12, 1918.

The general grouping of coal-tar chemicals adopted in the present report follows that of the tariff act of 1922, which conforms in general, although not in every detail, with common practice. Crudes, paragraph 1549, free, are contained in and separated from crude coal tar; intermediates, dutiable under paragraph 27 at 55 per cent and 7 cents per pound, are produced from the crudes by chemical processes; with some exceptions, they are used only for the manufacture of dyes and other finished products by further chemical treatment; dyes and other finished products are dutiable under paragraph 28 at 60 per cent and 7 cents per pound. The term "other finished products" includes color lakes, photographic chemicals, medicinals, flavors, perfume materials, synthetic resins, and synthetic tanning materials. Explosives, derived from coal-tar materials, although dutiable under paragraph 28, are not included in this census. A summary of the production of coal-tar products in 1923 according to the classes given above, is contained in Table 1. The figures of production of dyes and coal-tar chemicals in the United States are compiled from the returns of 206 companies, and are believed to form a complete record of the manufacture of such products in that year. In presenting the figures the quantity and value of each product are given in as great detail as is possible without revealing the operations of individual manufacturers.

Summary of Domestic Production, 1923

CRUDES

A new record for the output of by-product coke was established in 1923, when the total production was 37,604,743 tons, an increase of 6,770,792 tons over the 1920 output, hitherto the maximum. The total production of coke in 1923 was 55,565,000 tons; of this quantity 67.7 per cent was from by-product ovens and 32.3 per cent from beehive ovens. In 1913 only 27.5 per cent of this country's coke was produced by the by-product ovens and 72.5 per cent by the beehive. The increase in the production of by-product coke has resulted in (1) an increased yield of valuable by-products, including ammonium compounds, for fertilizer and other uses, (2) the supply of gas used for industrial heating and municipal lighting, and (3) a delivery of coal tar far in excess of the needs of the domestic coal-tar chemical industry. The tar is converted by distillation into crudes, which serve as the basic materials for the domestic coal-tar chemical industry. The production of tar in 1923 established a record, reaching 440,000,000 gallons, about one-half of which was used as fuel. Only a part of the remainder was distilled into refined products, owing to the large demand for such partly refined products as motor fuel, solvents, and pitches. In general, there was an increased output of crudes during 1923, conspicuous among them being "motor benzol" and naphthalene. For the first time, the total domestic production of crudes from all sources has been combined, as shown in Table 6. The Geological Survey collects information on by-products obtained from coke-oven operations, the data being in Table 5. The United States Tariff Commission collects data as to the output of crudes by firms primarily engaged in tar distillation, and the results are summarized in Table 7.

INTERMEDIATES

The total production of intermediates by 103 firms in 1923 was 231,393,871 pounds compared with 165,048,155 pounds for 1922. The sales during 1923 totaled 83,582,808 pounds, valued at $18,916,058. The average sales price of intermediates in 1923 was $0.226 as compared with $0.22 for 1922 and $0.33 in 1917. Although the average price of intermediates changed but slightly during 1922 and 1923, it should be borne in mind that in 1923 there was an increased output of the more costly products, tending to increase the average price of intermediates. The average sales price of aniline, the most important of all intermediates, was $0.16 for 1923 as compared with $0.15 for 1922. The sales price of H acid decreased from $0.73 in 1922 to $0.68 in 1923, b-naphthol (tech) receded from $0.24 to $0.22, and anthraquinone, required for the manufacture of alizarin, alizarin dyes and vat dyes (anthraquinone derivatives) fell from $1.34 to $0.95 per pound. The total number of intermediates reported during 1923 was 311, of which over 80 were not reported during the previous year. Many of these additions to the country's manufacturing program are essential materials for the manufacture of the faster types of dyes and are also used in the production of other important coal-tar derivatives. The manufacture of these in the United States constitutes a noteworthy advance in the domestic industry. Coal-tar intermediates are required not only for the manu-

facture of dyes but also in the production of explosives, medicinals, flavors, perfume materials, photographic chemicals, synthetic resins, synthetic tanning materials and accelerators for the vulcanization of rubber.

DYES

Record production during 1923.—The domestic output of coal-tar dyes in 1923 by 88 firms was 93,667,524 pounds, compared with 64,632,187 pounds in 1922. The sales for the year 1923 totaled 86,567,446 pounds, valued at $47,223,161. The present dye industry is largely a development of the war and post-war period. The pre-war production in 1914 of seven firms was 6,619,729 pounds, valued at $2,470,096. Production in that year was dependent upon foreign countries, as most of the intermediates were imported, chiefly from Germany. Among the more important factors responsible for the large output of dyes during 1923 may be mentioned (1) the activity of the domestic textile and dye-consuming industries, (2) the occupation of the Ruhr, which caused a reduction in the output of the German dye factories and consequently enabled domestic producers to increase their exports of indigo, sulphur black, and certain other dyes, principally to the markets of the Far East, (3) the relatively high foreign price level of dyes as compared with those of the pre-war period, and (4) the effect of the tariff act of 1922.

Further reduction in prices.—The average selling price of all dyes in 1923 was 10 per cent below that of 1922. The average sales price for 1923 was $0.545 per pound, compared with $0.60 in 1922, $0.83 in 1921, and $1.26 in 1917, the first year for which a census of dyes of coal-tar chemicals was compiled by the Tariff Commission.

Continued advancement in the production of new dyes.—During 1923 nearly 100 new dyes were produced for which no production had been shown in 1922. In addition, other colors, heretofore reported in small quantities, were manufactured on a substantial commercial scale. These comprise for the most part special dyes of greater complexity, and more difficult and costly to manufacture. In most cases they do not individually represent a large tonnage. Their production, however, affords a better balance to the country's manufacturing program and reduces the number of dyes previously imported for special uses. The additions include colors for use on silk, cotton, wool, color lakes and for other purposes, and are representative of the different classes of dyes by chemical classification. Their production has, in many cases, already been reflected in a decline in the corresponding imports. The domestic industry, although to some extent deficient in the production of certain vat dyes and other colors, supplies over 95 per cent of the domestic requirements.

Relation of production to consumption.—Imports of dyes in 1923 were 3.3 per cent of the total production by quantity and 6.2 per cent by value. They were, by quantity, 3.9 per cent of the apparent consumption, assuming this to equal production plus imports minus exports. Dyes produced in the United States accordingly supplied about 96 per cent of the apparent consumption of coal-tar dyes and there was, in addition, an exportable surplus of certain coal-tar dyes amounting to about 18,000,000 pounds.

Production of dyes by classes.—The output of dyes in 1923, grouped by classes according to the method of application, was as follows:

Acid dyes, 12,498,817 pounds, or 13.34 per cent of the total output; basic dyes, 4,157,373 pounds, or 4.44 per cent; direct cotton dyes, 16,858,387 pounds, or 18 per cent; mordant and chrome dyes, 4,078,504 pounds, or 4.35 per cent; sulphur dyes, 21,558,469 pounds, or 23.02 per cent; vat dyes, including indigo, 30,113,642 pounds, or 32.15 per cent; indigo, 28,347,259 pounds, or 30.26 per cent; other vat dyes, 1,766,383 pounds, or 1.89 per cent; lake and spirit-soluble dyes, 1,171,854 pounds, or 1.25 per cent; unclassified and specialty dyes, 3,230,478 pounds, or 3.45 per cent of the total.

Imports of dyes decline.—The total imports of coal-tar dyes for 1923 were 3,098,193 pounds, valued at $3,151,363, compared with 3,982,631 pounds, valued at $5,243,257, for the year 1922. Total imports during 1913, prior to the extensive development of the domestic dye industry, were 45,950,895 pounds. Of the total imports during the year 1923, 47 per cent came from Germany, 28 per cent from Switzerland, 12 per cent from Italy, 6 per cent from France, 4 per cent from England, and 3 per cent from all other countries. Dye imports in 1923, classified by method of application, were as follows: Acid dyes, 544,048 pounds; vat dyes, 1,207,554 pounds; mordant and chrome dyes, 453,415 pounds; direct dyes, 527,014 pounds; sulphur dyes, 114,023 pounds; basic dyes, 210,896 pounds; spirit-soluble and color lake dyes, 23,213 pounds; and unidentified, unclassified and special dyes 18,030 pounds. The Swiss dye manufacturers have a much larger share of the domestic import trade—28 per cent in 1923, 39 per cent in 1922, and about 20 per cent in 1914—than the size of the Swiss industry, compared with that of Germany, would imply. The Ruhr occupation undoubtedly favored Swiss dye exports. Swiss dyes are for the most part of the higher-cost specialty type, to which most of the dyes imported into this country belong. Dyes shipped from Italy appear to be of German manufacture and are doubtless dyes delivered to Italy by Germany in reparation payment and later sold to the United States. Italy received up to December 31, 1923, 6,274,601 kilos (13,832,985 pounds) out of a total delivery by Germany in reparation payment of 25,583,390 kilos (56,401,142 pounds) of coal-tar dyes.

Exports of dyes increase.—The exports of coal-tar dyes during 1923 totaled 17,924,200 pounds, with a value of $5,565,267, compared with a total of 8,344,187 pounds, with a value of $3,996,443, during 1922. This increase in the domestic exports of coal-tar dyes may be largely accounted for by the effect of the occupation of the Ruhr by the French, which resulted in a decreased production of dyes in the German factories and consequently gave domestic manufacturers an opportunity to increase their exports to Far Eastern markets.

OTHER FINISHED COAL-TAR PRODUCTS

Color lakes.—The total output of this class of pigments in 1923 was 13,079,115 pounds, compared with 10,578,664 pounds in 1922. The total sales of color lakes in 1923 amounted to 12,627,359 pounds, valued at $5,124,732.

Photographic chemicals.—The 1923 production of coal-tar chemicals used as photographic developers totaled 343,289 pounds, compared with 345,798 pounds in 1922. Sales in 1923 amounted to 321,083 pounds, valued at $443,697.

Medicinals.—This class of coal-tar products may be considered as essential to the national welfare. The highest technical skill and the most exhaustive research are required in the development and commercial production of these chemicals. The total production in 1923 was 3,273,085 pounds, and sales amounted to 2,995,448 pounds, valued at $4,720,253. The 1922 production amounted to 2,946,347 pounds, with sales of 3,092,915 pounds, valued at $4,233,443.

Perfumes and flavors.—These coal-tar products are closely related, certain members of the class being used both as flavors and as perfumes. The total output of flavors in 1923 was 1,458,024 pounds, compared with 1,215,668 pounds in 1922. Sales amounted to 1,442,387 pounds, valued at $1,780,313. The production of perfumes in 1923 was 1,365,449 pounds, compared with 793,148 pounds in 1922. Sales in 1923 amounted to 1,275,432 pounds, valued at $789,431.

Synthetic phenolic resins.—These products are used as substitutes for amber in making pipe stems and a great variety of other articles, also for electrical insulators, varnishes, and lacquers. The 1922 production was 5,944,133 pounds; the figures for 1923 can not be published without revealing the output of individual companies.

Synthetic tanning materials.—The output of these products amounted to 1,910,519 pounds in 1922, but here, again, the 1923 production figures can not be published without revealing the output of individual companies.

The total output of synthetic phenolic resins and synthetic tanning materials in 1923 was 9,763,685 pounds. Each of these classes of coal-tar products shows an increase in production for the past year. The total sales of synthetic phenolic resins and synthetic tanning materials for 1923 was 10,068,431 pounds, valued at $5,816,590.

STATISTICS OF PRODUCTION

TABLE 1.—*Summary of the production of dyes and coal-tar chemicals, 1918–1923*

	1918			1919		
	Number of manufacturers	Production		Number of manufacturers.	Production	
		Pounds	Value		Pounds	Value
Group II—Intermediates	128	357,662,251	$124,382,892	116	177,362,426	$63,210,079
Group III—Finished products		76,802,959	83,815,746	155	82,532,390	84,585,544
Dyes	78	58,464,446	62,026,390	90	63,402,194	67,598,855
Color lakes	29	9,590,537	5,020,023	34	7,569,921	4,179,964
Photographic chemicals	6	316,749	823,915	10	335,509	1,059,340
Medicinals	31	3,623,352	7,792,984	31	6,777,988	7,883,071
Flavors	7	458,256	4,926,627	9	610,825	1,318,654
Perfumes	6	116,263	584,695	6	41,419	164,302
Tanning materials	1	4,233,356	2,642,120	1	3,794,534	2,381,358
Synthetic phenolic resins	5			5		

TABLE 1.—*Summary of the production of dyes and coal-tar chemicals, 1918–1923*—Continued

	1920			1921			
	Number of manufacturers	Production		Number of manufacturers	Production	Sales	
		Pounds	Value		Pounds	Pounds	Value
Group II—Intermediates	119	257,726,911	$95,291,686	108	70,899,912	33,637,326	$8,483,463
Group III—Finished products	161	112,942,227	112,731,547	147	51,457,565	60,434,009	47,996,514
Dyes	82	88,263,776	95,613,749	74	39,008,690	47,513,762	39,283,956
Color lakes	43	10,983,538	5,871,820	43	6,152,187	6,424,612	2,863,189
Photographic chemicals	8	440,759	1,015,848	5	183,798	170,221	248,041
Medicinals	35	5,184,989	5,726,776	34	1,545,917	1,876,246	2,930,324
Flavors	15	166,884	527,493	17	901,245	933,662	1,002,018
Perfumes	12	99,740	332,008	15	119,335	119,691	175,815
Tanning materials	4	3,142,861	233,674	4	1,902,597	1,721,359	141,005
Synthetic phenolic resins	4	4,659,680	3,410,179	3	1,643,796	1,674,456	1,352,166

	1922			
	Number of manufacturers	Production	Sales	
		Pounds	Pounds	Value
Group II—Intermediates	106	165,048,155	58,004,435	$12,910,486
Group III—Finished products	164	88,368,131	93,370,065	57,067,326
Dyes	87	64,632,187	69,107,105	41,463,790
Color lakes	43	10,578,664	10,366,676	4,551,572
Photographic chemicals	7	345,798	347,647	483,269
Medicinals	35	2,946,347	3,092,915	4,233,443
Flavors	20	1,215,668	1,278,857	1,260,588
Perfumes	17	793,148	778,696	643,436
Tanning materials	4	1,910,519	1,981,588	103,598
Synthetic phenolic resins	5	5,944,133	6,415,931	4,315,196
Research chemicals	4	1,667	650	12,434

	1923			
	Number of manufacturers	Production	Sales	
		Pounds	Pounds	Value
Group II—Intermediates	103	231,393,871	83,582,808	$18,916,058
Group III—Finished products	164	122,950,171	115,297,586	65,898,177
Dyes	88	93,667,524	86,567,446	47,223,161
Color lakes	43	13,079,115	12,627,359	5,124,732
Photographic chemicals	5	343,289	321,083	443,697
Medicinals	32	3,273,085	2,995,448	4,720,253
Flavors	16	1,458,024	1,442,387	1,780,313
Perfumes	20	1,365,449	1,275,432	789,431
Tanning materials	3	9,763,685	10,068,431	5,816,590
Synthetic phenolic resins	2			

SYNTHETIC ORGANIC CHEMICALS NOT DERIVED FROM COAL TAR

The Tariff Commission in 1921 compiled for the first time a census of organic chemicals other than those derived from coal tar or directly from natural sources. These included acids, alcohols, esters, ketones, aldehydes, derivatives of alkaloids, carbocyclic compounds, etc., used as perfume and flavoring ingredients, solvents, medicinals, also in industrial and other processes.

The development in the production of organic chemicals of non-coal-tar origin has been comparatively unnoticed during past years, because of the greater interest in the progress made in coal-tar chemicals. The rapid development in the past few years in these non-coal-tar organic chemicals indicates the probability of further expansion in this field, with the result that new products of great economic value will continue to be placed on the market by domestic manufacturers.

The production in 1923 of synthetic organic chemicals other than those derived from coal tar was 90,597,712 pounds, with sales amounting to 67,727,067 pounds, valued at $13,875,521. Production in 1922 totaled 79,202,155 pounds.

Part IV of this report contains a detailed census of this group of organic chemicals, showing production and sales in so far as the publication of such figures does not disclose the output of individual manufacturers.

International Dye Trade

Pre-war.—Prior to the war, Germany, with an output totaling three-fourths of all synthetic dyes produced, dominated the world's dye markets. Of the remaining one-fourth, one-half was made from German intermediates, and its production was accordingly dependent upon Germany. Switzerland, although without a domestic source of raw materials, ranked second, with about 7 per cent of the world's production. Great Britain produced about one-tenth of her requirements, and France produced in French-owned and operated plants from 10 to 15 per cent of her consumption. In order to meet the patent requirements of France and Great Britain, German manufacturers operated plants in those countries where the final assembling operations were completed. The small dye industry of the United States was almost entirely dependent upon intermediates from Germany.

Developments since 1914.—The acute shortage of dyes arising in the various dye-consuming markets, due to the disappearance of German dyes shortly after the beginning of the war, was soon followed by prices of unprecedented levels, while certain dyes were not to be had at any price. This dye famine threatened the activities of the vast textile industries as well as other industries dependent upon dyes for their operation. The manufacture of dyes was soon entered upon in the United States, Great Britain, France, and Italy, and each of these countries has developed a dye industry capable of supplying from 80 to over 90 per cent of its requirements and has, in addition, exported significant quantities of dyes since the war. As a result of this remarkable period of expansion and development, the world's present capacity to produce dyes is nearly double that of the pre-war period. The estimated annual capacity to produce dyes by the seven leading producers—Germany, United States, Great Britain, Switzerland, France, Japan, and Italy—is considerably in excess of 600,000,000 pounds. The maximum estimated or officially reported output of the seven leading dye producers is as follows: Germany (1913), 280,000,000 pounds; United States (1923), 94,000,000 pounds; Great Britain (1920), 43,000,000 pounds; Switzerland (1920), 24,000,000 pounds; France (1923), 24,000,000 pounds; Japan (1919), 16,000,000

pounds; and Italy (1922), 10,000,000 pounds. This existing capacity to produce over and above normal requirements is resulting in an era of severe competition in the world's markets, which may eliminate many of the plants now in operation. Owing to the position of supremacy held by the German industry prior to the war, the future position of Germany's industry in the world's trade is of peculiar interest. Her export trade has suffered severely as a result of developments during and since the war. In 1913 the German export of synthetic dyes amounted to about 240,000,000 pounds, with a value of about $52,000,000, while in 1922 it amounted to about 114,000,000 pounds, with a value of about $80,000,000. For the year 1923 exports from Germany totaled about 74,000,000 pounds, with a value of about $17,000,000 (1913 basis) or $42,000,000 (1923 basis).

Table 22, page 126, shows the imports of dyes into the chief consuming countries for the years 1913, 1921, 1922, and 1923, and Table 21, page 125, shows the exports of coal-tar dyes from the chief producing countries for the same years. These two tables indicate the remarkable readjustment in the international dye trade due to developments during and since the war.

On account of the commanding position in the welfare of the German nation held by the chemical industry, it is highly probable that Germany will make every effort to regain her lost export trade, amounting to about nine-tenths of her total trade. One of the first steps in this direction has been to form affiliations in the new producing countries. Thus, in Italy it is reported that one of the largest dye producers, the Bianchi Co., has a working agreement under whose terms the Germans are to supply technical assistance and in return for which Germany shares profits; exports of dyes by this firm are restricted to the Italian colonies. In France, the Compagnie Nationale is reported to have effected a similar arrangement with the German "Interessen Gemeinschaft,"[1] but the conditions arising from the occupation of the Ruhr by the French are reported to have affected the operation of this agreement. Negotiations have been conducted for some time between the British Dyestuffs Corporation and the I. G., although no final agreement had been made up to June, 1924.

In the establishment of branch plants in the new producing countries, the Swiss appear to have been much more successful to date than the Germans. Three large Swiss manufacturers now operate, either collectively or individually, plants in the United States, Great Britain, Italy, and France. It has been reported that the Swiss and the German dye makers have concluded a working agreement. The German industry has certain advantages over the industries of the new producing countries, including cumulative experience, unified organization for buying and selling, and lower manufacturing costs. The high post-war price levels of dyes exported from Germany would appear to indicate a strong probability of price reductions during the next few years. The commercial warfare which is likely to follow may involve the utilization of such methods as full-line forcing and dumping, such as were practiced by the German chemical industry prior to the war. The

[1] This body is universally known as "I. G.," and will be so referred to throughout the remainder of this report.

retention of a tariff and other protective measures by the new producing countries will doubtless lead the German industry to form affiliations or to establish branch plants in those countries along the lines successfully followed by the Swiss manufacturers. In the case of tariff reductions in the new producing countries, it seems likely that Germany will attempt to recover these markets, and at the same time retain the domestic centralization of dye production. The war made clear the relationship of the coal-tar dye industry to the production of munitions, war gases, medicinals and other essential products, and demonstrated the desirability of home dye production as a means to prevent shortage in times of war. This will probably result in an effort by the large industrial nations to retain dye industries of sufficient size to meet peace requirements and to provide for war emergencies. Reduced production costs and constructive research will be vital factors in the maintenance of their competitive place in the world's trade.

The occupation of the Ruhr in 1923 resulted in a reduced production of dyes in Germany. The total output in 1923 was about 145,000,000 pounds, as compared with 193,000,000 pounds in 1922. This stimulated the export trade of the United States and Great Britain to meet the requirements of China, India, and other consuming nations, nonmanufacturers of dyes. The effects of the occupation had largely disappeared in the early part of 1924 and German dyes were again offered in sharp competition in the markets of the Far East. In the spring of 1923 the French and Belgian authorities seized about 6,500 tons of dyes, a large part consisting of indigo and alizarin red. The British Alizarin Co. purchased a large quantity of alizarin in order to prevent the demoralization of prices by the dumping of this dye on the market, and nearly 1,500,000 pounds of alizarin were imported into the United Kingdom in January, 1924.

PART II

PRODUCTION OF DYES AND COAL-TAR CHEMICALS, 1923

Part II

PRODUCTION OF DYES AND COAL-TAR CHEMICALS, 1923

Coal-Tar Crudes

Record output of by-product coke.—The preliminary figures for the domestic production of coke in 1923, as reported by the United States Geological Survey, show a total of 55,565,000 tons, an amount almost equal to that of 1917 and only 1.6 per cent less than the record set in the war year 1918. A new record in the output of by-product coke was established in 1923, the year's output of 37,604,743 net tons being an increase of 6,770,792 tons over the 1920 output, hitherto the maximum.

Since November, 1918, when the production of coke from by-product ovens passed the production of beehive ovens, the by-product coke has been continuously in the lead. In 1923, 67.7 per cent of the total was contributed by by-product ovens and 32.3 per cent by beehive ovens. These figures are especially significant when it is remembered that the year was one of heavy consumption and favorable prices, conditions which should call forth maximum activity in the beehive industry under the present ratio of capacity to demand.

Table 2.—*Production of beehive and by-product coke in the United States, 1913–1923*

Year	Net tons produced			Per cent of total output	
	Beehive	By-product	Total	Beehive	By-product
1913	33,584,830	12,714,700	46,299,530	72.5	27.5
1915	27,508,255	14,072,895	41,581,150	66.2	33.8
1917	33,167,548	22,439,280	55,606,828	59.6	40.4
1918	30,480,792	25,997,580	56,478,372	54.0	46.0
1919	19,042,936	25,137,621	44,180,557	43.1	56.9
1920	20,511,092	30,833,951	51,345,043	40.0	60.0
1921	5,538,042	19,749,580	25,287,622	21.9	78.1
1922	8,573,467	28,550,545	37,124,012	23.1	76.9
1923	17,960,000	37,604,743	55,565,000	32.3	67.7

The recovery in coke production was associated with great activity in the iron industry and with a shortage of household fuel. As stated in the census of 1921, the replacement of beehive ovens by the by-product variety, which recovers the tar, ammonia, and gas products entirely wasted by the old beehive type, is for the following reasons of great economic significance in the conservation of national resources: (1) The by-product ovens increase production of ammonium compounds for fertilizer and other uses; (2) the gas produced in these ovens is used for municipal lighting and industrial heating; and (3) the output of tar insures an abundant supply of coal tar for the preparation of crudes serving as a basis of the domestic coal-tar dye and chemical industry.

Production of tars.—The output of coal tar in 1923 was about 440,000,000 gallons, compared with 328,000,000 gallons in 1922. According to the preliminary figures sales of coal tar during 1923 were about 211,000,000 gallons, valued at $9,200,000. The domestic supply of tar is far in excess of the requirements of the domestic coal-tar chemical industry. Of the total production during 1923, 48 per cent was sold and 52 per cent consumed, largely as boiler fuel, in metallurgical plants. This indicates that about one-half of the total production of tar is used as a fuel. That a similar condition existed in 1921 and 1922, is indicated by the production and disposition of coke-oven tar in the United States during the years 1918–1923, as given in Table 4.

In times of fuel shortage the value of tar as fuel increases; in any case, the tar distiller must pay somewhat more than the fuel value of the tar. Of the total tar sold by the coke-oven operators only part is distilled into refined benzene, toluene, naphthalene, and anthracene; this is accounted for by the demand for such partly refined products as motor fuel, solvents, and soft pitches.

TABLE 3.—*Production and sales of coke-oven, coal-gas, water-gas, and oil-gas tar in the United States, 1918–1923*

[Compiled by the United States Geological Survey from reports of producers. The difference between production and sales is accounted for by tar used by the producer, and by changes in stock]

	Coke-oven tar	Coal-gas tar	Total coal tar	Water and oil-gas tar
Production (gallons):				
1918	263,299,470	52,694,826	315,994,296	160,985,156
1919	288,901,739	(1)	340,900,000	(2)
1920	360,664,124	51,264,956	411,929,080	116,073,907
1921	253,051,649	(1)	303,000,000	(2)
1922	327,779,734	48,082,228	375,861,962	104,555,028
1923 [3]	440,389,905	(1)	488,389,905	(2)
Sales (gallons):				
1918	200,233,002	47,727,839	247,960,841	55,283,484
1919	217,707,157	(1)	264,900,000	(2)
1920	174,363,696	46,604,133	220,967,829	59,238,730
1921	135,293,047	(1)	179,200,000	(2)
1922	162,204,417	41,266,074	203,470,491	47,338,489
1923 [3]	210,746,216	(1)	251,946,216	(2)
Value of sales:				
1918	$6,364,972	$1,863,580	$8,228,552	$1,805,865
1919	6,918,549	(1)	8,800,000	(2)
1920	6,378,040	2,010,186	8,388,226	2,109,388
1921	5,645,309	(1)	7,760,000	(2)
1922	6,419,743	1,955,950	8,375,693	1,879,490
1923 [3]	9,225,925	(1)	11,203,925	(2)

[1] No report. Estimate included in total.
[2] No report.
[3] Preliminary figures, subject to revision.

TABLE 4.—*Production and disposition of coke-oven tar in the United States, 1918–1923*

[Compiled by United States Geological Survey from reports of operators]

Year	Coke-oven tar		
	Gallons produced	Per cent sold [1]	Per cent used [1]
1918	263,299,470	76.0	24.0
1919	288,901,739	75.4	24.6
1920	360,664,124	48.3	51.7
1921	253,051,649	53.5	46.5
1922	327,779,734	49.5	50.5
1923 [2]	440,389,905	47.9	52.1

[1] No account is here taken of changes in stocks. [2] Preliminary figures, subject to revision.

Total commercial production of crudes.—The data on domestic production of crudes are collected either by the Tariff Commission or by the Geological Survey, according to the producer. Crudes distilled from tar at the by-product coke-oven plants are reported to the Geological Survey and the output by firms primarily engaged in the distillation of tar is reported to the Tariff Commission. For the first time, the total commercial production of benzene, "motor benzol," toluene, solvent naphtha, and naphthalene from all sources has been combined into a single compilation. This covers the period 1918–1923 and the production data shown in Table 6. An examination of this table shows that there was, in general, an increase in the output of these items in 1923. The production of "motor benzol" and naphthalene recorded notable increases over the figures for 1922.

The production of by-products obtained from coke-oven operations for the years 1921–1923, together with quantity and value of the sales, is given in Table 5. The production of crudes by firms engaged primarily in the distillation of coal tar is shown in Table 7. Noteworthy increases in the 1923 production are shown for naphthalene, cresylic acid, dead oil, anthracene oil, and other distillates.

TABLE 5.—*By-products obtained from coke-oven operations, 1921–1923*
[United States Geological Survey]

Product	Production	Sales		
		Quantity	Value	
			Total	Average
1921				
Tar—gallons	253,051,649	135,293,047	$5,645,309	$0.042
Ammonia:				
Sulphate—pounds	528,638,763	530,041,716	13,100,703	.025
Ammonia liquor (NH_3 content)—do	31,899,398	35,102,561	3,515,416	.100
Other forms (NH_3 content)—do	191,162	53,993	10,135	.188
Sulphate equivalent of all forms—do	(657,001,003)	(670,667,932)	16,626,254	
Gas:				
Used under boilers, etc.—M cubic feet	[1] 310,188,713	12,122,777	1,120,087	.092
Used in steel or affiliated plants—do		98,352,049	10,593,204	.108
Distributed through city mains—do		43,826,172	14,249,961	.325
	[1] 310,188,713	154,300,998	25,963,252	.168
Light oil and derivatives:				
Crude light oil—gallons	[2] 76,917,269	2,433,078	240,111	.099
Benzol—				
Crude—do	1,494,329	1,536,312	343,463	.224
Refined—do	4,912,131	5,302,709	1,268,258	.239
Motor benzol—do	48,052,882	50,022,573	8,966,686	.179
Toluol—				
Crude—do	26,529	26,529	4,410	.166
Refined—do	942,982	808,964	228,968	.283
Solvent naphtha—do	3,822,776	2,881,656	510,509	.177
Other miscellaneous products—do	590,173	291,635	12,310	.042
	59,841,802	63,303,456	11,574,715	.183
Naphthalene:				
Crude—pounds	2,827,756	1,652,466	40,659	.025
Refined—do	115,229	331,057	18,676	.056
	2,942,985	1,983,523	59,335	.030
Other products			121,813	
Value of all by-products sold			59,990,678	
1922				
Tar—gallons	327,779,734	162,204,417	6,419,743	.0396
Ammonia:				
Sulphate—pounds	695,543,349	714,752,882	17,818,236	.0249
Ammonia liquor (NH_3 content)—do	50,036,646	48,523,937	4,559,535	.0940
Other forms (NH_3 content)—do	693,782	192,549	12,041	.0625
			22,389,812	
Sulphate equivalent of all forms—do	898,465,061	909,618,826		

[1] Includes gas wasted and gas used for heating retorts.
[2] Of this amount 75,760,334 gallons were refined on the premises to make the derived products listed.

TABLE 5.—*By-products obtained from coke-oven operations, 1921–1923*—Contd.

Product	Production	Sales		
		Quantity	Value	
			Total	Average
1922				
Gas:				
Used under boilers, etc.....M cubic feet	[3] 442,671,114	19,123,814	$1,251,325	$0.0654
Used in steel or affiliated plants.....do		144,976,030	15,942,446	.1100
Distributed through city mains.....do		56,930,253	20,326,648	.3570
Sold for industrial use.....do		10,352,921	1,104,096	.1066
		231,383,018	38,624,515	.1669
Light oil and derivatives:				
Crude light oil.....gallons	[4] 101,437,555	5,138,095	630,768	.1228
Benzol—				
Crude.....do	2,666,177	2,665,889	698,437	.2620
Refined.....do	10,419,504	9,590,459	2,736,944	.2854
Motor benzol.....do	57,025,699	54,930,203	10,491,309	.1910
Toluol—				
Crude.....do	38,159	3,938	652	.1656
Refined.....do	1,955,119	1,906,122	556,363	.2919
Solvent naphtha.....do	2,983,858	2,861,482	538,512	.1882
Other light oil products.....do	580,058	212,712	14,949	.0703
	75,668,574	77,308,900	15,667,934	.2027
Naphthalene:				
Crude.....pounds	6,107,742	3,298,851	52,103	.0158
Refined.....do	1,810,972	1,589,084	79,149	.0498
	7,918,714	4,887,935	131,252	.0269
Other products			154,507	
Value of all by-products sold			83,387,763	
1923 [5]				
Tar.....gallons	440,390,000	210,746,000	9,226,000	.044
Ammonia:				
Sulphate.....pounds	904,465,000	875,163,000	25,595,000	.029
Ammonia liquor [6] (NH_3 content).....do	60,659,000	59,573,000	5,771,000	.097
			31,366,000	
Sulphate equivalent of all forms.....do	1,147,101,000	1,113,455,000		
Gas:				
Used under boilers, etc.....M cubic feet	[7] 598,412,000	34,382,000	1,813,000	.053
Used in steel or affiliated plants.....do		197,149,000	22,402,000	.114
Distributed through city mains.....do		68,902,000	24,348,000	.353
Sold for industrial use.....do		17,709,000	3,594,000	.203
		318,142,000	52,157,000	.164
Light oil and derivatives:				
Crude light oil.....gallons	135,166,000	8,990,000	941,000	.105
Benzol—				
Crude.....do	16,252,000	16,279,000	3,596,000	.221
Refined.....do				
Motor benzol	77,418,000	77,453,000	12,533,000	.162
Toluol—				
Crude.....do	51,000	6,000	1,000	.167
Refined.....do	2,793,000	2,676,000	765,000	.286
Solvent naphtha.....do	4,413,000	3,727,000	641,000	.172
Other light oil products.....do	441,000	200,000	16,000	.080
	101,368,000	109,331,000	18,493,000	.169
Naphthalene:				
Crude.....pounds	11,541,000	9,698,000	206,000	.021
Refined.....do	1,180,000	1,238,000	68,000	.055
	12,721,000	10,936,000	274,000	.025
Other products			200,000	
Value of all by-products sold			111,716,000	

[3] Includes gas wasted and gas used for heating retorts.
[4] 98,432,100 gallons, including 4,200,000 gallons of purchased oil, was refined on the premises to make the derived products listed.
[5] Preliminary figures, subject to revision.
[6] Includes a small amount of other forms of ammonia.
[7] Includes gas wasted and gas used for heating retorts.

TABLE 6.—*Total commercial production of benzene, toluene, solvent naphtha, and naphthalene from all sources in the United States, 1918–1923*

[Data for coke ovens and gas works from reports to United States Geological Survey; for tar refineries and others to United States Tariff Commission]

	By-product coke plants (sales)[1]	Gas works (sales)[1]	Tar refineries and all other establishments (production)	Total commercial production[2]
Benzene (all grades except motor benzol):				
Gallons—				
1918	43,441,980	2,177,168	3,015,848	48,634,996
1919[3]	63,077,463	(4)	1,826,373	[3] 65,403,836
1920	17,230,776	(4)	875,561	18,141,337
1921	6,839,021	(4)	2,171,631	9,045,642
1922	12,256,348	(4)	[5] 774,940	13,071,288
1923	16,279,000	(4)	394,906	16,708,906
Value—				
1918	$11,966,367	$572,950	$994,161	$13,533,478
1919[3]	11,643,645	(4)	560,547	12,296,192
1920	4,497,823	(4)	287,586	4,794,409
1921	1,611,721	(4)	463,205	2,082,926
1922	3,435,381	(4)	[5] 215,136	3,664,517
1923	3,596,000	(4)	118,505	3,725,505
Motor benzol:				
Gallons—				
1918				
1919	Included under benzene above		(6)	(6)
1920	[7] 55,764,265	467,126	(6)	(6)
1921	50,022,573	[8] 350,000	(6)	(6)
1922	54,930,203	(9)	(9)	55,622,482
1923	77,453,000	(4)	(9)	80,637,520
Value—				
1918				
1919	Included under benzene above		(6)	(6)
1920	[7] 12,644,931	112,849	(6)	(6)
1921	8,966,686	[8] 70,000	(6)	(6)
1922	10,491,309	(9)	(9)	10,657,074
1923	12,533,000	(4)	(9)	13,238,871
Toluene, all grades:				
Gallons—				
1918	8,541,366	3,965,518	1,596,353	14,103,237
1919	1,353,827	(4)	510,957	1,884,784
1920	2,470,364	[8] 2,000	(10)	(10)
1921	835,493	[8] 1,000	(10)	(10)
1922	1,910,060	(10)	(10)	(10)
1923	2,682,000	[8] 2,000	(10)	(10)
Value—				
1918	$12,249,702	$5,597,353	$3,044,890	$20,891,945
1919	355,990	(4)	235,321	596,511
1920	740,722	[8] 300	(10)	(10)
1921	233,378	[8] 270	(10)	(10)
1922	557,015	(10)	(10)	(10)
1923	766,000	[8] 570	(10)	(10)
Solvent naphtha, crude and refined, including xylene:				
Gallons—				
1918	[11] 3,284,037	1,442,267	[12] 965,458	5,691,762
1919	[13] 3,649,066	(4)	(9)	4,128,747
1920	4,695,464	(4)	(9)	5,384,560
1921	2,881,656	(4)	(9)	3,627,488
1922	2,861,482	(9)	(5) (9)	3,680,811
1923	3,927,000	(4)	(9)	4,568,593
Value—				
1918	[11] $458,689	$191,475	[12] $232,003	$882,167
1919	[13] 557,416	(4)	(9)	672,685
1920	851,048	(4)	(9)	994,205
1921	510,509	(4)	(9)	644,548
1922	538,512	(9)	(5) (9)	773,336
1923	657,000	(4)	(9)	849,614
Naphthalene, all grades:				
Pounds—				
1918	15,890,447	896,080	40,138,092	56,924,619
1919	6,702,040	(4)	12,612,203	20,114,243
1920	14,448,762	1,760,293	26,393,411	42,602,466
1921	1,983,523	(4)	16,949,464	19,432,987
1922	4,887,935	(4)	19,323,393	25,411,328
1923	10,936,000	(4)	41,453,002	54,189,002

[For footnotes see page 20.]

TABLE 6.—*Total commercial production of benzene, toluene, solvent naphtha, and naphthalene from all souces in the United States, 1918–1923*—Continued.

	By-product coke plants (sales)	Gas works (sales)	Tar refineries and all other establishments (production)	Total commercial production
Naphthalene, all grades—Continued				
Value—				
1918	$650,229	$14,282	$1,281,440	$1,945,951
1919	191,364	(4)	327,201	542,565
1920	487,974	63,449	791,403	1,342,826
1921	59,335	(4)	380,167	462,502
1922	131,252	(4)	352,957	536,209
1923	274,000	(4)	652,148	1,006,148

[1] Sales instead of production are here given to avoid double counting between production of crude and pure grades, and because such of the product as is used in the coke plant or gas works is not available for commercial use.
[2] Totals include estimates for firms not reporting, or actual figures for items that can not be shown separately without disclosing individual returns.
[3] Includes motor benzol and 13,000 gallons of gasoline used in blending.
[4] Reports incomplete. Estimate included in total.
[5] Revised figure, to eliminate duplication through certain plants reporting both to the Tariff Commission and to the Geological Survey.
[6] Data not collected from tar refiners prior to 1922.
[7] Includes 1,333,000 gallons of gasoline used in blending.
[8] Estimate.
[9] Included in total, but can not be shown separately without disclosing individual returns.
[10] A certain quantity of toluene was produced both at gas works and at tar refineries, but the figures can not be given without disclosing individual returns.
[11] Includes 52,847 gallons of xylene, valued at $9,937, and 107,375 gallons of crude heavy solvent, valued at $8,769.
[12] Includes 192,969 gallons of xylene, valued at $67,935.
[13] Includes 23,088 gallons of xylene, valued at $4,563.

TABLE 7.—*Production of coal-tar crudes, 1923, by firms not primarily engaged in the operation of coke-oven plants and gas houses*

[The numbers in the second column refer to the numbered alphabetical list of manufacturers given on page 195. An X indicates that the corresponding product was made by a manufacturer who did not consent to the publication of his name in connection therewith. A blank in the third and fourth columns indicates that there was actual production of the corresponding article, but that the figures can not be published without revealing the output of individual firms.]

Name	Manufacturers' identification numbers according to list on page 195	Unit of quantity	1923		
			Quantity	Value	Value per unit
Total crudes [1]				$25,067,086	
Benzene	16, 21, 49, 152, X, X	Gallons	394,906	118,505	$0.300
Toluene	16, X	do			
Xylene	16	do			
Naphthalene (crude)	8, 15, 16, 34, 49, 53, 97, 114, 134, 152, 158, 167, 181, X.	Pounds	41,453,002	652,148	.016
Anthracene (crude, less than 30 per cent).	158, 167	do			
Carbazole (crude, less than 65 per cent).	158, 185	do			
Cresol or cresylic acid (crude).	13, 16, 42, 49, 114, 158	Gallons			
Pyridine	16, 130	do			
Solvent naphtha	13, 16, 49, 97, 167, X	do	501,754	142,122	.283
Dead or creosote oil	8, 13, 16, 21, 34, 42, 49, 53, 97, 101, 114, 134, 158, 167, 181, 201, X.	do	38,636,974	4,266,785	.110
Anthracene oil	8, 158, 167	do			
Pitch of tar	8, 13, 16, 21, 34, 42, 49, 53, 97, 101, 114, 134, 158, 167, 181, X, X.	Tons	675,628	9,684,547	14.334
Other distillates	8, 16, 34, 42, 49, 101, 114, 158, 181, X, X	Gallons	14,801,569	1,941,495	.131
Refined tar	8, 16, 21, 34, 42, 53, 97, 101, 114, 134, 167, 181, X, X.	Barrels	1,675,213	5,944,085	3.548
Motor fuel	49, 152, X	Gallons			

[1] The instructions sent to manufacturers were as follows: Include under dead or creosote oil only products which may be used for creosoting. Include under other distillates shingle stain oils, disinfectant oils, and flotation oils which do not contain over 5 per cent of phenol. Include under refined tars those tars which are used for road treatment, saturating felt, and for protective coatings. Phenol and all distillates which, on being subjected to distillation, yield in the portion distilling below 190° C. a quantity of tar acids equal to or more than 5 per cent of the original distillate, or which, on being subjected to distillation, yield in the portion distilling below 215° C. a quantity of tar acids equal to or more than 75 per cent of the original distillate, are not to be included here but are to be placed under intermediates.

Imports.—Domestic imports for consumption are given in the Appendix in Part VI of this publication. In general, imports of crudes in 1923 registered an increase over those of 1922. One of the principal reasons for this was the large raw material requirements of the timber preserving and chemical industries. Dead or creosote oil, used largely as a timber preservative, led this group both in quantity and value, with a total of 64,199,636 gallons, valued at $10,071,393. This was approximately a 54 per cent increase over the figures for 1922.

The imports of naphthalene ranked second, totaling 20,992,439 pounds, valued at $575,702, compared with 3,144,332 pounds, valued at $54,029, for 1922. Owing to the demand for this product, imports were large during the first seven months of 1923. The increase in price stimulated production and during the latter part of the year the price receded to the January level. Imports of crude cresylic acid totaled 5,761,011 pounds, with a value of $489,824. Other coal-tar crudes showing an increased importation during 1923 include anthracene (purity less than 30 per cent), 869,780 pounds, valued at $23,925; pyridine, 764,918 pounds, valued at $266,184; and benzene, 701,857 pounds, valued at $21,903.

Intermediates

DESCRIPTION

This class of coal-tar chemicals does not occur as such in coal tar, but is prepared from the crudes (benzene, toluene, naphthalene, and anthracene) by chemical treatment with sulphuric acid, nitric acid, alkalies, chlorine, or other chemicals. From fewer than 10 coal-tar crudes 200 to 300 intermediates are prepared for use in the production of hundreds of dyes. The various chemical stages in the conversion of crudes to intermediates are (1) nitration, (2) reduction, (3) sulphonation, (4) caustic fusion, (5) chlorination, (6) alkylation, (7) liming, (8) condensation, (9) carboxylation, (10) oxidation, and (11) diazotization.

Intermediates are therefore the raw materials which are converted by complex chemical processes into dyes, medicinals, perfumes, flavors, photographic chemicals, and synthetic resins and tanning materials. They are also used as accelerators in the vulcanization of rubber, as camphor substitutes, in the direct production of dyes on the fiber, and for increasing the fastness of dyed colors, in which case they are known as "developers." After purification, many intermediates are used directly as drugs, perfumes, and flavors.

PRODUCTION

The production of intermediates in the United States in 1923 is given in Table 8 in as great detail as is possible without revealing the output of individual manufacturers. The total output in 1923 was 231,393,871 pounds, compared with 165,048,155 pounds in 1922. Sales in 1923 totaled 83,582,808 pounds, with a value of $18,916,058. The average price of intermediates sold in 1923 was

$0.226, as compared with $0.223 for 1922. Although the average price of the total sales for 1923 and 1922 shows practically no change, there were marked decreases in the average sales prices of certain basic intermediates. As an offset to these declines there were increased quantities of the special and more costly intermediates entering into the production of the faster types of dyes. The average sales price of aniline showed little change, being $0.158 for 1923, as compared with $0.151 for 1922. It is of interest to note, in this connection, that aniline oil was quoted at $0.10⅛ in 1913 and that the invoice value of imports in the fiscal year 1913–14 was $0.071. During the war it was quoted as high as 40 to 50 cents per pound. H acid decreased from $0.73 in 1922 to $0.675 in 1923, while b-naphthol, tech., declined from $0.24 to $0.22. Naphthalene, refined, declined from $0.06 to $0.058 per pound, and anthraquinone (100 per cent), required for the manufacture of synthetic alizarin and anthraquinone vat dyes, receded from $1.34 to $0.947 per pound.

The total number of intermediates reported was 311, of which over 80 were not reported during 1922. Many of these new products comprised intermediates of great complexity, and their production represents notable progress in the dye industry. They are almost entirely required for the manufacture of the fast and special types of colors, in which field the industry made a conspicuous expansion during 1923.

Aniline.—Aniline manufactured from benzene, through the intermediate product nitrobenzene, is the most important of all finished intermediates. It ranked, in 1923, first in value and quantity. Aniline is used in the production of dyes of almost every class, whether the classification be based on the method of application or on the chemical constitution. Three of the leading domestic dyes by quantity of output, namely, Indigo, Direct black EW, and Agalma black 10B, require aniline in their manufacture. The output of aniline in 1923 was 26,671,961 pounds, compared with 21,401,864 pounds in 1922. The largest output was in 1920, when the total was 39,234,186 pounds, valued at $10,923,648.

Naphthalene derivatives.—The most important intermediate derived from naphthalene is b-naphthol. The output in 1923 was 5,741,355 pounds, compared with a production of 3,255,901 pounds in 1922. Sales in 1923 were 4,528,236 pounds, valued at $994,635, or 22 cents per pound, a decrease of 2 cents per pound from that of the previous year.

H acid (1-amino-8-naphthol-3:6-disulphonic acid) ranks second among naphthalene derivatives and is one of the most important intermediates required for the production of direct cotton and acid dyes of the azo class. Production of H acid in 1923 was 3,462,664 pounds, with sales amounting to 1,392,506 pounds, valued at $940,272.

Phthalic anhydride is another intermediate derived from naphthalene. It is essential to the preparation of synthetic anthraquinone, which, in turn, is the intermediate used in the production of synthetic alizarin and the anthraquinone vat dyes, including the indanthrenes and most of the algols. In addition, phthalic anhydride is used in the preparation of fluorescein, the eosine dyes, and the rhodamines.

The domestic production of phthalic anhydride in 1923 established a new record, 2,343,802 pounds, compared with 1,629,182 pounds in 1922.

Fumaric and maleic acid.—In 1923 production was reported for the first time of these two acids by a synthetic process—the direct oxidation of benzene with air in the presence of a catalyst. This is a notable discovery of the domestic chemical industry. These two acids appear to hold considerable promise of application in the chemical and associated industries. Maleic acid may serve as the base for the manufacture of many hitherto rare compounds. It is now converted into malic acid, which is used as a food acidulant. Fumaric acid is used in the textile industry.

Anthraquinone.—The large increase in the production of anthraquinone in 1923 represents one of the significant stages of progress in that year. Anthraquinone is used in the manufacture of certain vat dyes (including indanthrenes and most of the algol dyes, synthetic alizarin, and other alizarin derivatives.) Anthraquinone is produced in the United States by the oxidation of anthracene, the latter being derived from coal tar, and by synthesis from phthalic anhydride and benzene. There has been a marked tendency to increase the proportion of the total domestic output by the synthetic process. The total production of anthraquinone in 1923 was 857,190 pounds, compared with 395,107 pounds in 1922. Approximately one-half of the total 1923 output was produced by the synthetic process, this representing a very large increase in the proportion produced by this process over that of 1922.

Special intermediates register large increase.—An examination of the intermediates used in the preparation of fast and special dyes, these being consumed in relatively small quantities as compared with bulk colors, shows a greatly increased output of these special products in 1923. Among these may be mentioned Chicago acid (1-amino-8-naphthol-2:4-disulphonic acid), J-acid urea, diethyl-m-aminophenol, ethyl benzyl aniline, xylidine, Broenner's acid, 2-chloro-5-toluidine-4-sulphonic acid, J-acid (2-amino-5-naphthol-7-sulphonic acid), pyrazolone, Michler's ketone, benzoyl chloride, and the anthraquinone derivatives.

New intermediates.—In 1923 production of 311 coal-tar intermediates was reported, of which over 80 were new products not reported during the year 1922. These new products comprise for the most part intermediates used in the manufacture of the more complex dyes and other coal-tar products and several used in the vulcanization of rubber. The developments of the year are indicated by the production of these more complex products, presenting many technical problems in their production on a commercial scale. Among these recent additions are included chloropyrazolone, dehydrothio-m-xylidine, dibenzylsulphoxide, dimethyltetra aminodiphenylmethane, ethyl carbazole, fumaric acid, maleic acid, methyl anthraquinone, phenazine, quinaldine, tetraaminoditolylmethane, and several anthraquinone derivatives.

INVESTIGATION OF PHENOL AND CRESYLIC ACID UNDER SECTION 315

Phenol.—An investigation under the provisions of section 315, Title III of the act of 1922, was ordered by the Tariff Commission on May 4, 1923, in response to a request for a decrease in the duty on phenol.

The foreign (Great Britain) and domestic costs investigations were completed during the period from June to November, 1923, and on December 13, 1923, after giving due notice as required by law, the commission ordered a public hearing for January 24, 1924. The hearing was completed on that date and further oral argument was waived. Interested parties were given until March 15, 1924, for the filing of briefs.

The present annual consumption of phenol is estimated to be about 11,000,000 pounds. The production of natural phenol from coal tar is only a fraction of this, and the production from this source in the United States is supplemented by synthetic phenol.

The cost of manufacture of synthetic phenol is higher than that of natural phenol. A comparison of the cost of manufacture of phenol (natural) in England, obtained by the Tariff Commission, with a weighted average of the cost of the domestic natural and synthetic phenol show that if the total English cost is taken as 100 the domestic weighted average is 142.5.

The manufacturer in Great Britain has the advantage of cheaper raw materials (tar acids) than the American manufacturer, and furthermore the percentage of phenols is higher in the British tar than in the American tar.

The lower-cost natural phenol at the time of the investigation supplied a greater part of consumption than the synthetic product. The output of synthetic phenol is increasing and in future will be a factor of increasing importance in supplying requirements.

Large increase in output of phenol: The large output of phenol in 1923 represents one of the notable expansions in the industry during that year. The production for 1923 was 3,310,911 pounds, compared with 1,285,978 pounds in 1922. Total sales during 1923 were 2,180,244 pounds, valued at $589,822 ($0.27 per pound), as against a total sales of 1,266,552 pounds, valued at $268,311, in 1922 ($0.21 per pound).

The Government war stock carry-over of phenol, which amounted to approximately 35,000,000 pounds, was believed to be sufficient for a four years' normal supply based upon pre-war consumption of about 9,000,000 pounds a year. Owing to the increased demand for phenol in the manufacture of synthetic phenolic resins, the war stocks were exhausted sooner than was anticipated.

Several manufacturers started producing synthetic phenol in 1923. One of the large manufacturers of phenolic resins has built a synthetic phenol plant and estimates that its production will be at the rate of 7,000,000 pounds a year by the end of 1924. The Barrett Co. estimates its production of phenol for the year 1924 at from 2,000,000 to 2,500,000 pounds.

The synthetic phenol will probably be a factor of increasing importance in supplying domestic requirements.

Cresylic acid.—On May 4, 1923, the commission ordered an investigation of cresylic acid for the purposes of section 315 of the tariff act of 1922, in response to requests for a decrease in the duty on cresol or cresylic acid.

The foreign and domestic costs investigations were completed during the period from June to November, 1923, and on December 13, 1923, the commission ordered a public hearing for January 24, 1924, which was postponed at that time to February 14, 1924. The hearing was completed on that date and further oral argument was waived. Interested parties were given until March 15, 1924, for the filing of briefs. As a result of the cost investigation conducted by the Tariff Commission, it was found that, taking the domestic cost of manufacture of cresylic acid as 100, the cost of manufacture in the United Kingdom was 50.46 in 1923.

It is difficult accurately to estimate domestic consumption of cresylic acid. In the period from 1917 to 1920, inclusive, when imports were fairly uniform and when there was little domestic production, the total imports indicate an annual consumption of cresylic acid of between 8,000,000 and 10,000,000 pounds. Although the total potential capacity of domestic producers of cresylic acids is estimated at approximately 9,500,000 pounds, domestic production has been about one-half of the maximum capacity.

Taking into consideration the expansion of the consuming industries, it seems likely that the present consumption of cresol and cresylic acid is between 10,000,000 and 12,000,000 pounds per year.

In the manufacture of cresols and cresylic acid from coal-tar distillates as carried on both in the United States and abroad phenol is one of the by-products obtained. The crude tar acids, after removal of the crude phenol fraction, yield various grades of cresols and cresylic acids. In American practice the fractions usually obtained, in their order after the crude phenol fraction, are (1) ortho cresol, (2) meta and para cresol, (3) cresol U. S. P., (4) refined cresylic acid, (5) crude cresylic acid 97–99 per cent straw color, and (6) crude cresylic acid 95 per cent dark. Both in the United Kingdom and in this country the companies consider that the production cost of cresylic acid and the production cost of crude carbolic acid are the same, because they are produced simultaneously in the same plant.

Cresylic acid records large increase in production: As in the case of phenol, the production of cresylic acid registered a notable increase, being about double that of the previous year.

The production of cresylic acid has shown a large increase since the passage of the tariff act of 1922. During recent months the imports of duty-free cresylic acid have increased greatly. These imports comprised in large part a grade of cresylic acid just below the specifications of the dutiable grades of paragraph 27 of the act, a grade which is readily converted into a refined cresylic acid by a simple distillation.

STATISTICS OF PRODUCTION.

TABLE 8.—*Production and sales of coal-tar intermediates, 1923*

[The numbers in the second column refer to the numbered alphabetical list of manufacturers printed on page 195. An X signifies that the manufacturer did not consent to the publication of his identification number in connection with the designated product. A blank in the third and fourth columns indicates that sales figures can not be published without revealing information in regard to the output of individual firms. A blank in the sixth column indicates that the production of the corresponding product in the United States can not be published without revealing information in regard to the output of individual firms. The figures thus concealed are, however, included in the total]

Name	Manufacturers' identification numbers according to list on page 195	Sales			Total production
		Quantity	Value	Average price per pound	
Total intermediates		*Pounds* 83,582,808	$18,916,058	$0.23	*Pounds* 231,393,871
Acetanilide, tech	7, 80, 122, 128, 166, 167.	249,099	65,306	.26	
Acetyl-p-phenylenediamine (p-amino acetanilide).	6, 7, 63, 82, 88, 131, 167.				133,214
Acetyl-o-toluidine	63				
Acetyl-p-toluidine	39, 63, 167				237,927
Acridine, base	151				
Aldehyde aniline derivatives	X				
b-Amino anthraquinone	63, 137				
Aminoazobenzene	7, 32, 36, 64, 74, 88, 91, 131, 133.				122,370
Aminoazobenzene sulfonic acid	63, 133				
Aminoazobenzene disulfonic acid	131,133				
Aminoazotoluene	32, 63, 64, 88, 91, 131, 133, 155.				95,202
Aminoazotoluene sulfonic acid	133				
Aminoazotoluene disulfonic acid	63				
Aminoazoxylene	131				
p-Aminobenzoic acid	63, 126, 166				18,241
p-Aminodimethylaniline	85				
Aminodiphenylamine sulfonic acid	202				
1-Amino-2-naphthol-4-sulfonic acid	6, 19, 32, 39, 63, 88, 133, 167, X, X.			.60	792,639
1-Amino-8-naphthol-4-sulfonic acid	39, 63, 131, 137				143,945
1-Amino-8-naphthol-2:4-disulfonic acid (Chicago acid).	39, 63, 131, 137				101,570
1-Amino-8-naphthol-3:6-disulfonic acid (H acid).	25, 63, 88, 125, 131, 137.	1,392,506	940,272	.68	3,462,664
2-Amino-5-naphthol-7-sulfonic acid (J acid).	39, 63, 131, 137, X				145,540
2-Amino-8-naphthol-6-sulfonic acid (gamma acid).	25, 32, 39, 63, 131, 137, X.			1.51	306,605
2-Amino-8-naphthol-3:6-disulfonic acid.	137				
o-Aminophenol	82, 195, 202	14,483	33,812	2.33	
p-Aminophenol and hydrochloride	9, 57, 63, 68, 82, 137, 195, 202.	60,859	68,646	1.13	135,564
o-Aminophenol-p-sulfonic acid	7, 25, 63, 131, 202				30,119
Aminosalicylic acid	6, 39, 52, 63, 88, 131, 137.				62,136
Anhydroformaldehyde aniline	63				
Anhydroformaldehyde p-toluidine	63				
Aniline disulfonic acid	131, X				
Aniline hydrochloride	27, 87, 131	775,571	174,850	.23	800,350
Aniline oil	27, 63, 87, 122, 124, 128, 131, 132.	14,506,027	2,293,639	.16	26,671,961
Aniline sulfate	63, 91, 131, 132, 151	13,279	3,958	.30	
Aniline for red	131				
Anisidine	63, 137, 202	3,717	9,628	2.59	15,418
Anthracene, refined (average content 86 per cent).	8, 63, 185				
Anthranilic acid (o-aminobenzoic acid).	62, 63, 128, 190			1.03	45,312
Anthraquinone 100 per cent	18, 63, 107, 131, 163, 185.			.95	857,190
Anthraquinone-1:5-disulfonic acid	88, 131				
Anthraquinone hydrazine	137				
Anthraquinone-2-sodium sulfonate (silver salt).	18, 63, 131, 137				450,701
Anthrarufin	131				
Benzaldehyde	44, 78, 142, 180, 192, X	227,521	165,431	.73	263,007
Benzanthrone	63, 122, 137				
Benzidine, base	32, 39, 63, 78, 88, 131	202,590	162,775	.80	768,880
Benzidine sulfate and hydrochloride.	3, 88, 131, 137, X				

TABLE 8.—*Production and sales of coal-tar intermediates, 1923*—Continued

Name	Manufacturers' identification numbers according to list on page 195	Sales			Total production
		Quantity	Value	Average price per pound	
		Pounds			*Pounds*
Benzoate of soda	44, 95, 166, X	749, 645	$450, 889	$0. 60	749, 885
Benzoic acid, tech	44, 63, 95, 137, 166			. 59	118, 058
Benzoic acid, U.S.P	44, 166, X	38, 381	25, 911	. 68	62, 822
Benzotrichloride	142				
Benzoyl benzoic acid	131				
Benzoyl chloride	17, 95, X				
Benzyl chloride	131, 142, 192				
Benzylamine	132				
Bromobenzene	62				
Broenner's acid. (*See* 2-naphthylamine-6-sulfonic acid.					
Carbazole, refined (average content 95 per cent).	63, 185				
Chloroacetophenone	68				
p-Chloro-o-aminophenol	202				
o-Chloroaniline	202				
o-Chloroaniline sulfonic acid	202				
p-Chloroaniline sulfonic acid	202				
Chlorobenzaldehyde	131				
Chlorobenzanthrone	63, 137				
Chlorobenzene (mono)	62, 95, 107, X	5, 293, 974	390, 940	. 07	7, 024, 604
Chloroisodibenzanthrone	137				
Chlorometanilic acid	80, 133				
1-Chloro-2-methyl anthraquinone	X				
2-Chloro-4-nitroaniline	63				
p-Chloro-o-nitrophenol	202				
Chloro-m-phenylenediamine	133				
Chloropyrazolone	63				
o-Chlorotoluene	131				
o-Cholorotoluene sulfonic acid	63				
2-Chloro-5-toluidine-4-sulfonic acid	63, 121, 167, 202				
Chromotropic acid. (*See* 1:8-dihydroxy naphthalene-3: 6-disulfonic acid.)					
Cresol, ortho, meta and para	118				
o-Cresotinic acid	93				
Cresylic acid, refined (distillates yielding below 215° C. tar acids equal to or more than 75 per cent of the original distillate.)	13, 16				
Dehydrothio-p-toluidine sulfonic acid.	19, 70, 80, 137, 147, X				62, 011
Dehydrothio m-xylidine	137				
Diaminochlorobenzene sulfonic acid	133				
Diaminostilbene disulfonic acid	6, 63, 70, 80, 131, 137				129, 625
Dianisidine	39, 63, 131, 137			3. 69	89, 929
Diazoamine H acid	131				
1-Diazo-2-naphthol-4-sulfonic acid	32, 39, 88, 131, 133, X				249, 714
Dibenzanthrone	137				
Dibenzysulfoxide	132				
1:3-Dibromo-2-amino anthraquinone.	137				
Dibromo anthraquinone azine	137				
p-Dibromobenzene	62				
Dichloroaniline	39, 202				
Dichloroaniline sulfonic acid	151				
o-Dichlorobenzene	62, 107, X				
p-Dichlorobenzene	62, 95, 107, 138, X	1, 315, 546	200, 434	. 15	1, 419, 879
Dichlorophenylhydrazine sulfonic acid.	151				
Dichlorophthalic anhydride	56				
Diethyl-m-aminophenol	63				
Diethylaniline	63, 131, 180, 205			. 48	125, 713
Diethylaniline sulfonic acid	63				
Dihydroxyanthraquinone sulfonic acid.	190				
5:5-Dihydroxy-7:7-disulfonic-2:2-dinaphthyl urea (J acid urea).	131, 137, X				
1:5-Dihydroxynaphthalene	6, 88				
1:8-Dihydroxynaphthalene-3:6-disulfonic acid (chromotropic acid).	125, 131, 137				151, 303
Dimethylaniline	7, 27, 63, 85, 87, 131	1, 502, 265	562, 992	. 38	2, 681, 751
2:2-Dimethyl-1:1-dianthraquinonyl	63				
Dimethylphenazine (tolazine)	131				
Dimethyltetraaminodiphenylmethane.	151				
Dinitroanthraquinone	84, 131				

TABLE 8.—*Production and sales of coal-tar intermediates, 1923*—Continued

Name	Manufacturers' identification numbers according to list on page 195	Sales			Total production
		Quantity	Value	Average price per pound	
		Pounds			*Pounds*
Dinitrobenzanthrone	137				
Dinitrobenzene	27, 63, 131, 195	575,089	$107,258	$0.19	2,064,150
m-Dinitrobenzene	12				
Dinitrochlorobenzene	12, 63, 88, 107, 131	1,039,333	166,277	.16	7,445,467
Dinitrochlorobenzene-p-sulfonic acid.	133				
2:6-Dinitrochlorobenzene-4-sulfonic acid.	202				
Dinitrophenol, and sodium salt	12, 88				
Dinitrosalicylic acid	133				
Dinitrotolnene	12, 63, 64, 81, 91, 131	1,243,945	183,016	.15	4,304,198
Diphenylamine	63				
Diphenylguanidine	12, 61, 63, 131, 149, X	846,431	914,618	1.09	867,019
Diphenylmethane sulfonate	131				
Diphenyl sulfoxide	132				
Distilbenediphenol	131				
Dithiobenzoyldisulfide	132				
o-Ditolylguanidine	63				
Ditolylmethane	131				
p-Ditolylsulfoxide	132				
Ditolylthiourea	X				
o-Ditolylthiourea	63, 85, 132				
Ethyl acetanilide	131				
Ethyl-p-aminoacetanilide	131				
Ethyl-p-amino benzoate	126				
Ethylaniline (mono)	36, 63, 131, 205				
Ethylbenzylaniline	36, 63, 131, 180, 205			1.14	213,034
Ethylbenzylaniline disulfonic acid	36, 63				
Ethylbenzylaniline sulfonic acid	36, 80, 131				
Ethyl carbazole	63				
Ethylidene aniline	132				
m-Ethoxyphenyl-p-toluidine	X				
Fluorescein	7, 56, 63, 91				61,636
Formaldehyde-p-amino aniline	85				
Formanilide	63, 132, 167, X				
Fumaric acid	131				
Gamma acid. (*See* 2-amino-8-naphthol-6-sulfonic acid.)					
H acid. (*See* 1-amino-8-naphthol-3:6-disulfonic acid.)					
Heptylidene aniline	132				
b-Hydroxy naphthoic acid	39, 63				
b-Hydroxy naphthoic anilide (naphthol AS).	63, 131				
p-Hydroxy phenyl arsonic acid and sodium salt.	108, 120				
m-Hydroxy phenyl-o-toluidine	X				
Indanthrene RS	137				
Indophenol	X				
Isodibenzanthrone	137				
J acid. (*See* 2-amino-5-naphthol-7-sulfonic acid.)					
Laurent's acid. (*See* 1-naphthylamine-5-sulfonic acid.)					
Lead dithiobenzoate	X				
Maleic acid	131				
dl-Malic acid	131				
Mercaptobenzothiazol and derivatives.	X				
Metanilic acid	6, 39, 63, 64, 88, 91, 131, 133.				412,791
Methylaniline (mono)	205				
Methylaniline sulfonic acid	X				
Methyl anthraquinone	163, X				
4:4-Methyl diphenylsulfone	132				
Methyl ester of p-tolyl sulfonic acid.	131				
Methylene dianilide	63				
Methylene p-toluidine	137, X				
Michler's hydrol. (*See* Tetramethyldiamino benzhydrol.)					
Michler's ketone. (*See* Tetramethyldiamino benzophenone.)					
Naphthalene, solidifying 79° C. or above (refined, flake).	13, 16, 27, 34, 35, 114, 137, 182, 201, X.	21,871,196	1,270,722	.06	28,183,784
1:5-Naphthalene disulfonic acid	63, 131, 137				85,502
2:7-Naphthalene disulfonic acid	63, 167				

TABLE 8.—*Production and sales of coal-tar intermediates, 1923*—Continued

Name	Manufacturers' identification numbers according to list on page 195	Sales			Total production
		Quantity	Value	Average price per pound	
		Pounds			*Pounds*
1:3:6-Naphthalene trisulfonic acid	167				
1:8-Naphthasulfone-3-sulfonic acid	137				
a-Naphthol	7, 32, 39, 91, 96, 131, 171, 184.	57,274	$35,674	$0.62	233,578
b-Naphthol, tech	27, 32, 39, 91, 167, 171	4,528,236	994,635	.22	5,741,355
b-Naphthol, U.S.P	27				
1-Naphthol-8-chloro-3:6-disulfonic acid (chloro H acid).	131				
1-Naphthol-4-sulfonic acid (Nevile & Winther's acid).	7, 32, 52, 63, 88, 131, 137.				285,317
1-Naphthol-5-sulfonic acid	6, 39, 63, 88, 125, 131, 133, 137.				166,191
1-Naphthol-3:6-disulfonic acid	167				
1-Naphthol-3:8-disulfonic acid	63				
1-Naphthol-3:6:8-trisulfonic acid	32, 131, 137				
2-Naphthol-1-sulfonic acid	63				
2-Naphthol-6-sulfonic acid (Schaeffer's acid).	6, 32, 39, 63, 64, 88, 131, 137, X.				146,755
2-Naphthol-7-sulfonic acid	39, 63, 167				
2-Naphthol-8-sulfonic acid	63, X				
2-Naphthol-3:6-disulfonic acid	3, 25, 27, 32, 39, 63, 88, 131, 137, 167, 190, 198, X.	150,149	75,911	.51	613,777
2-Naphthol-6:8-disulfonic acid	25, 27, 32, 39, 131, X				
Naphtho - 1:8 - sultam - 2:4 - disulfonic acid.	63				
Naphtho - 1:3 - sulton - 8 - sulfonic acid.	39				
a-Naphthylamine	16, 63, 137	862,518	260,218	.30	
b-Naphthylamine	6, 39, 63, 131			.75	505,819
1-Naphthylamine-4-sulfonic acid (naphthionic acid).	7, 32, 39, 52, 63, 91, 131, 137, X	121,694	49,054	.40	1,491,963
1-Naphthylamine-5-sulfonic acid (Laurent's acid).	6, 32, 63, 88, 91, 131, 133, X				277,288
1-Naphthylamine-6-sulfonic acid	131				
1-Naphthylamine-6 and 7-sulfonic acid.	39, 131, 137, X				341,295
1-Naphthylamine-8-sulfonic acid	6, 63, 131, 133				
1-Naphthylamine-3:6-disulfonic acid (Freund's acid).	6				
1-Naphthylamine-3:8-disulfonic acid.	39, 63, 137				55,577
1-Naphthylamine-4:8-disulfonic acid.	39, 63, 131, 137				595,493
1-Naphthylamine-3:6:8-trisulfonic acid.	63, 131, 137				3,524,246
2-Naphthylamine-1-sulfonic acid	28, 39, 66, 167	169,018	159,567	.94	281,738
2-Naphthylamine-6-sulfonic acid (Broenner's acid).	6, 39, 63, 131				28,884
2-Naphthylamine-4:8-disulfonic acid.	39, 63, 137				
2-Naphthylamine-5:7-disulfonic acid.	39, 63, 131, 137, X				247,501
2-Naphthylamine-6:8-disulfonic acid.	32, 39, 63, 131, 137, X				552,010
2-Naphthylamine-3:6:8-trisulfonic acid.	137				
Nevile & Winther's acid. (*See* 1-naphthol-4-sulfonic acid.)					
p-Nitroacetanilide	25, 39, 63, 167				104,496
Nitroaminophenol	64, 88, 133				25,138
Nitroaminosalicyclic acid	133				
m-Nitroaniline	63, 195				
p-Nitroaniline	7, 25, 166, 167, X	1,530,837	1,054,881	.69	2,008,003
p-Nitroaniline-o-sulfonic acid	63, 80, 88, 167, 202	8,217	8,203	1.00	22,260
o-Nitroaniline-p-sulfonic acid	202				
o-Nitroanisole	63, 137				
p-Nitro-o-anisidine	63				
Nitroarsanilic acid	126				
Nitrobenzene (oil of mirbane)	27, 63, 87, 131, 132, 137.	2,523,592	261,780	.10	45,068,881
p-Nitrobenzoic acid	1, 63, 166				40,162
Nitrobenzoyl chloride	X				
Nitrochlorobenzene	63				
o-Nitrochlorobenzene	63, 128				
p-Nitrochlorobenzene	63, 128				

TABLE 8.—*Production and sales of coal-tar intermediates, 1923*—Continued

Name	Manufacturers' identification numbers according to list on page 195	Sales			Total production
		Quantity	Value	Average price per pound	
		Pounds			*Pounds*
o-Nitrochlorobenzene-p-sulfonic acid.	133, 202				
p-Nitrochlorobenzene-o-sulfonic acid.	131, 202				
8-Nitro-1-diazo-2-naphthol-4-sulfonic acid.	39, 63				
o-Nitro-p-dichlorobenzene	202				
3-Nitro-4-hydroxyphenyl arsonic acid.	108, 120, 126				
Nitronaphthalene	16, 63, 137				
o-Nitrophenol	195, 202				
p-Nitrophenol	46, 63, 128, 137, 195, 202.				133, 989
Nitroso-b-naphthol	X				
Nitrosodimethylaniline and hydrochloride.	27, 46, 63, 88, 107, 131, 132, 137, 204, 205, X.	23, 279	$27, 327	$1.17	284, 873
Nitrosophenol	6, 9, 12, 18, 68, 88, 131, X, X.				399, 308
Nitrosulfoanthrarufin	131				
Nitrotoluene	63, 64, 81, 91, 131, 137				7, 005, 352
o-Nitrotoluene	12, 63, 81, 131, 137, X				3, 764, 647
m-Nitrotoluene	12, 63				
p-Nitrotuluene	12, 63, 81, 131, 137, X	220, 784	112, 982	.51	2, 285, 120
o-Nitrotoluene sulfonic acid	80				
p-Nitrotoluene-o-sulfonic acid	6, 39, 63, 80, 131, 137, 202.				891, 537
m-Nitro-p-toluidine	39, 63, 167	158, 350	317, 308	2.00	160, 016
p-Nitro-o-toluidine	39, 63, 131, 190				
Nitroxylene	27, 39, 63, 131, 137				648, 192
Oxalyl arsanilic acid	126				
Oxalyl-p-nitroaniline	63				
Oxalyl-m-phenylenediamine	63				
Oxalyl-p-phenylenediamine	63				
Phenazine	107				
Phenol	16, 62, 93, 118, 128, 148, 171, X.	2, 180, 244	589, 822	.27	3, 310, 911
Phenylglycine, and sodium salt	62, 63, 131				11, 166, 650
Phenylhydrazine, base and hydrochloride.	179				
Phenyl hydrazine-o-sulfonic acid	88				
Phenyl hydrazine-p-sulfonic acid	27, 63, 151, 183				200, 632
Phenyl-1: 8-dihydroxnaphthalene-disulfonic acid (phenyl 1 acid).	131				
Phenyl-a-naphthylamine	63				
Phenyl-1-naphthylamine-8-sulfonic acid.	6, 63, 88, 131, 133				328, 836
Phenylmethylpyrazolone	63				
Phenyl pyrazolone	133				
Phenyl rosinduline	63				
Phenyl sulfide	132				
Phenyl thiourea	132				
m-Phenylenediamine	6, 27, 32, 39, 52, 63, 88, 91, 131, 137, 140, 195, X.				900, 412
m-Phenylenediamine sulfonic acid	X				
p-Phenylenediamine	74, 82, 167, X	282, 204	372, 124	1.32	280, 656
Phthalamide	128, 190				
Phthalic acid and anhydride	63, 128, 131, X	2, 091, 100	596, 508	.29	2, 343, 802
Picramic acid	25, 27, 131, X				149, 310
Primuline, base	19, 63, 80, 131, 147				166, 580
Pyrazolone	133, 151				
Quinaldine	26, 131				
Resorcinol, tech	148, X				
Resorcinol, U.S.P	148, X				
Salicylic acid, tech	62, 63, 93, 124, 128, X			.31	2, 857, 281
Salicylic acid, U.S.P	93, 124, 128, X	1, 244, 028	393, 343	.32	1, 330, 048
Sulfanilic acid	27, 32, 39, 63, 87, 88, 91, 118, 131, 151, 183, 195.	186, 480	31, 104	.17	1, 861, 884
Sulfoanilide	133				
o-Sulfobenzoic acid	99				
o-Sulfobenzoic acid, ammonium salt.	99				
o-Sulfobenzoic acid, chloride of	99				
Tetraaminoditolylmethane	63				
Tetrachlorophthalic anhydride	56				

TABLE 8.—*Production and sales of coal-tar intermediates, 1923*—Continued

Name	Manufacturers' identification numbers according to list on page 195	Sales			Total production
		Quantity	Value	Average price per pound	
		Pounds			*Pounds*
Tetraethyldiaminobenzhydrol (ethylhydrol).	131				
Tetraethyldiaminodiphenylmethane (ethylmethane).	131				
Tetramethyldiaminobenzhydrol (Michler's hydrol).	63, 80				
Tetramethyldiaminobenzophenone (Michler's ketone).	63				
Tetramethyldiaminodiphenylmethane.	63, 80, 88, 131				
Tetramethylthiouramdisulfide	132				
Thioaniline	6				
Thiocarbanilide	12, 85, 131, 132, X, X.	2, 113, 059	$517, 748	$0. 25	3, 309, 414
Tolidine and salts	39, 63, 131, 137				166, 121
Tolidine disulfonic acid	X				
o-Toluene sulfamide	X				
p-Toluene sulfamide	X				
p-Toluene sulfochloride	128				
Toluenesulfonyl ethyl ester	131				
Toluidine	63, 81, 131				
o-Toluidine	12, 39, 63, 81, 131, 137, X.	807, 795	107, 936	. 13	1, 440, 884
p-Toluidine	12, 39, 63, 81, 131, 137, 202, X.	293, 212	253, 399	. 86	1, 060, 848
Toluidine sulfonic acid	39, 63, 88, 91, 133, 202.				101, 348
p-Tolyl-o-benzoic acid	137				
m-Tolylenediamine	6, 12, 32, 39, 52, 63, 64, 88, 91, 107, 131, 137, X.	351, 172	326, 326	. 93	1, 179, 457
p-Tolylenediamine	12				
Tolylenediamine, meta and para	137				
m-Tolylenediamine sulfate	131				
m-Tolylenediamine sulfonic acid	131				
o-Tolylthiourea	132				
Tolyl-1-naphthylamine-8-sulfonic acid (tolyl-peri acid).	131				
Tribromophenol	62				
Trichlorofluorescein	63				
Tricresyl phosphate	31				
Triphenylguanidine	131, 132				
Xylidine and salt	27, 39, 63, 131, 137	168, 752	72, 726	. 43	363, 029
m-Xylidine acetate	131				
Zinc dimethyl dithiocarbamate	132				
Zinc dithiobenzoate	X				
All other intermediates	137				

TABLE 8A.—*Production of intermediates, by groups, according to unit values, 1921, 1922, and 1923*

Group	1923		1922		1921	
	Pounds	Per cent of total	Pounds	Per cent of total	Pounds	Per cent of total
0–15 cents	104, 419, 258	45. 127	94, 688, 278	57. 372	28, 682, 310	40. 455
16–25 cents	50, 233, 638	21. 709	26, 233, 604	15. 894	16, 986, 701	23. 959
26–50 cents	42, 556, 640	18. 391	24, 399, 085	14. 783	11, 457, 747	16. 160
51–75 cents	16, 486, 159	7. 125	8, 289, 387	5. 022	4, 329, 047	6. 106
$0.76–$1	9, 664, 153	4. 176	5, 918, 904	3. 586	4, 689, 343	6. 614
$1.01–$1.50	5, 587, 436	2. 415	3, 957, 355	2. 398	2, 517, 764	3. 551
$1.51–$2	914, 837	. 395	568, 339	. 344	1, 204, 584	1. 699
$2.01–$3	951, 521	. 411	721, 637	. 437	731, 758	1. 032
$3.01–$4	136, 302	. 059	197, 071	. 119	110, 316	. 156
Over $4	443, 927	. 192	74, 495	. 045	190, 348	. 268
Total	231, 393, 871	100. 00	165, 048, 155	100. 00	70, 899, 912	100. 00

Dyes and Other Finished Coal-Tar Products

INTRODUCTORY

Finished coal-tar products are divided into the following eight classes: (1) Dyes, (2) color lakes, (3) photographic chemicals (developers), (4) medicinals, (5) flavors, (6) perfume materials, (7) synthetic phenolic resins, (8) synthetic tanning materials. In previous reports the Tariff Commission has emphasized the close relationship existing between the manufacture of explosives, poisonous gases, and dyes, also the fact that many explosive plants since the signing of the armistice have been converted into dye factories. During the war the dye plants of Germany supplied the army of that country with poisonous gases and explosives. The dye industry is also closely connected with the manufacture of flavors, perfume materials, photographic chemicals, medicinals, and other coal-tar products, which, although produced in smaller quantities than dyes, use as raw materials many of the by-products obtained in the manufacture of coal-tar dyes.

The production of dyes and other finished products in 1923 is shown in Table 12 in as great detail as is possible without revealing the output of individual manufacturers.

The total production of dyes and other finished coal-tar chemicals in 1923, by 164 firms, was 122,950,171 pounds, compared with a 1922 production, by 164 firms, of 88,368,131 pounds. Total sales in 1923 amounted to 115,297,586 pounds, with a value of $65,898,177. Production during 1923 represented a 39 per cent increase in quantity compared with that of 1922.

SUMMARY OF DYE PRODUCTION IN 1923

Large increase in output.—The output of dyes by 88 firms was 93,667,524 pounds, compared with 64,632,187 pounds in 1922. Sales for the year 1923 totaled 86,567,446 pounds, with a value of $47,223,161. In this connection it is of interest to compare the size of the industry in 1923 with that existing prior to the war, the output in 1914, by 7 firms, being 6,619,729 pounds, with a value of $2,470,096. This production was almost entirely from imported intermediates, chiefly from Germany.

Among the more important factors responsible for the large output of dyes in 1923 may be included (1) the activity of the domestic textile and dye-consuming industries, (2) the occupation of the Ruhr, which caused a reduction in the output of the German dye factories and consequently enabled the domestic producers to increase their exports to Far East markets, (3) the relatively high foreign price levels of dyes compared with those of the pre-war period, and (4) the effect of the tariff act of 1922, giving special protection to coal-tar products.

In contrast with other ad valorem rates in that act, the rates under paragraphs 27 and 28, on imported coal-tar products competitive with the same or similar domestic products, are assessed on the American selling price of the domestic articles. As against this, products noncompetitive with domestic products are assessed on the "United States value," being the selling price of the imported dyes in the domestic markets. In determining the dutiable value, cer-

tain statutory deductions are made from the selling price to cover transportation, duty, importer's expenses, and profits.

Another new feature was the basing of the specific duty on dyes upon standards of strength in ordinary commercial use.

Further price reduction in dyes.—The average selling price of dyes during 1923 was $0.545 per pound, compared with $0.60 in 1922 and $1.26 in 1917. The 1923 selling price is a 10 per cent decline from that of 1922.

The average selling price of Indigo, which led in quantity of production, was $0.23 for 1923 as against $0.24 for 1922. The average price of Sulphur black for 1923 was $0.20 compared with $0.21 for 1922. This dye was second in quantity of production. The third dye—Direct deep black EW—showed little change; the average price for 1923 was $0.428 compared with $0.42 in 1922. In the case of Agalma black 10B, the average price receded from $0.79 in 1922 to $0.71 in 1923. Reductions were also recorded in the average prices of many of the so-called special colors, which do not comprise a large proportion of the total output, as is shown in the following table.

Table 9 presents a comparison of the domestic sales prices of 100 dyes for the years 1917–1923, together with the invoice prices of the same dyes imported during the year 1914. The colors for which statistics are given in this table represent about 90 per cent of the domestic production. It should be noted that the domestic sales price is not directly comparable with the invoice prices in 1914. Invoice prices do not represent the cost to the consumer, as they do not include the importer's profit, or, in most cases, "charges for containers and packing, freight, and insurance to seaport, consular certification, minor shipping charges at point of departure and at seaport."

The Schultz number as indicated in column 1 is that of "Farbstoff-Tabellen" (Dyestuff Tables), by Gustav Schultz, 1914 edition. Column 2 gives the common name of the dye as adopted by the Tariff Commission for designating all dyes reported under a given Schultz number (column 1). The invoice price (1914), shown in column 3, represents the weighted average of all dyes classified under a given Schultz number in "Artificial Dyestuffs Used in the United States," Department of Commerce, Special Agents Series No. 121. This weighted average price for all types is usually higher than the invoice price per pound for dyes representing the bulk of the importation under a given Schultz number. The individual dyes imported under given Schultz numbers in the Norton Census show a wide variation in price, frequently amounting to several hundred per cent. This is due chiefly to the great divergence in concentration of the different dyes and also to the variation in prices of special and pure brands, which are more costly than the ordinary brands. Column 4 gives the domestic sales price as reported to the Tariff Commission, representing the weighted average price of all manufacturers for the dyes reported under a given Schultz number. Most of these prices were published in the "Census of Dyes and Coal-Tar Chemicals, for the years 1917–1922."

TABLE 9.—*Domestic sales prices of 100 dyes, 1917–1923, compared with invoice values of the same dyes imported, 1914*

Schultz No.	Name	1914 invoice value imported dyes (weighted average of all types)	Average price per pound						
			1917	1918	1919	1920	1921	1922	1923
9	Direct yellow R	$0.178	$2.55	$2.61	$1.74	$1.49	$1.07	$0.88	$0.81
10	Stilbene yellow	.162	-------	-------	-------	1.53	1.22	-------	1.00
11	Chloramine orange G	.239	3.32	2.86	1.99	1.88	1.60	1.32	1.22
23	Tartrazine	.200	1.50	1.91	2.04	1.86	1.80	1.08	.87
33	Chrysoidine Y	.136	1.09	.77	1.04	.87	.77	.63	58
34	Chrysoidine R	.165	1.22	1.22	1.12	.79	.78	.63	.57
37	Croceine orange	.133	1.13	.89	.88	1.04	.86	.77	.58
38	Orange G	.148	1.25	.92	1.04	1.22	.96	.58	.59
42	Amido naphthol red G	.150	3.04	1.16	.97	1.78	1.46	.83	.71
48	Alizarin yellow G	.077	.59	.68	.72	.63	.53	.50	.52
58	Alizarin yellow R	.154	.83	.91	.84	.86	.69	.61	.61
66	Amido naphthol red 6 B	.604	-------	.88	.81	1.51	1.25	.66	.78
82	Ponceau 2 R	.095	1.15	.79	.80	.80	.73	.61	.58
112	Bordeaux B	.159	1.46	1.02	.91	.93	.84	.75	.73
119	Diamine rose	.411	-------	5.50	5.15	5.33	3.89	3.01	2.46
134	Metanil yellow	.164	2.24	1.61	1.65	1.64	1.20	.92	.80
137	Acid yellow G	.176	1.32	.85	-------	.43	1.04	1.03	.87
141	Azo yellow	.249	2.04	2.02	1.95	2.08	1.85	1.30	1.06
145	Orange II	.081	.98	.68	.63	.62	.51	.38	.37
154	Palatine chrome brown	.256	1.90	2.00	1.68	1.55	1.53	1.34	1.09
157	Diamond black P. V	.130	-------	-------	-------	1.65	1.25	-------	-------
161	Fast red A	.118	1.19	1.03	1.05	1.04	.96	.83	.78
163	Azo rubine	.198	2.71	1.51	1.43	1.43	1.26	.92	.85
164	Fast red V. R	.188	2.25	1.25	2.20	2.28	1.96	1.50	1.27
168	Amaranth	.138	1.31	.88	2.98	2.11	3.23	.86	.71
169	Cochineal red	.127	1.44	1.16	1.32	1.26	.99	.76	.73
173	Lithol red R	.083	1.25	2.38	.39	1.52	1.63	1.25	1.15
177	Mordant yellow	.149	.74	1.35	1.89	.81	.98	.76	.65
181	Salicine black U	.156	2.92	1.62	1.25	1.10	.75	.55	.53
188	Sulphon acid blue R	.252	2.25	2.25	2.02	1.95	1.67	.91	.85
217	Agalma black 10 B	.134	1.08	1.26	1.47	1.29	1.09	.79	.71
227	Brilliant croceine	.165	1.35	1.92	2.41	2.23	1.56	1.09	-------
236	Wool red B	.143	2.50	2.10	2.67	2.64	1.41	1.02	1.16
257	Sulphon cyanine G	.166	2.25	2.25	2.21	2.26	1.74	1.21	.91
265	Sulphon cyanine black	.110	2.25	2.10	1.91	1.80	1.48	1.14	-------
266	Naphthylamine black D	.144	1.89	.84	1.01	.87	.94	.66	.86
275	Diamond black	.172	2.50	1.40	1.48	1.55	1.25	.94	.87
283	Bismark brown	.186	1.17	.81	1.01	.84	.78	.66	.60
284	Bismark brown 2 R	.183	1.48	.97	1.04	.91	.85	.63	.58
304	Chrysophenine G	.270	12.64	5.71	2.53	2.81	2.03	1.70	1.03
307	Congo red	.179	2.47	2.01	1.12	.86	.89	.65	.59
327	Diamine violet N	.255	-------	-------	3.32	2.97	2.17	1.44	1.39
333	Oxamine black B H N	.133	2.50	3.25	2.72	2.49	1.48	.91	.73
337	Benzo blue 2 B	.041	2.00	1.37	1.00	.88	.69	.48	.41
340	Benzo orange R	.231	2.00	1.56	.88	1.07	.86	.89	.80
342	Chrysamine G	.189	1.97	1.53	1.36	1.08	.99	.93	1.15
343	Diamine fast red F	.362	-------	-------	2.72	2.59	2.09	1.39	1.20
344	Diamine brown	.194	-------	2.60	2.20	1.99	1.65	1.10	.95
363	Benzo purpurine 4 B	.133	2.82	2.46	1.80	1.46	1.20	.90	.89
391	Benzo blue 3 B	.209	2.32	2.23	1.69	1.67	1.03	.78	.54
405	Benzo purpurine 10 B	.234	-------	4.73	2.07	2.47	2.33	1.64	1.67
410	Benzazurine G	.267	-------	3.00	3.18	1.98	1.53	1.28	-------
419	Chicago blue R W	.222	-------	-------	2.40	1.88	1.67	1.45	1.51
424	Chicago blue 6 B	.275	-------	-------	3.08	2.11	1.90	1.52	1.40
426	Benzamine pure blue	.440	5.00	4.40	1.97	2.43	1.39	1.22	.97
462	Direct deep black E W	.144	.75	.85	1.04	1.03	.79	.42	.43
463	Erie direct black R X	.139	-------	-------	1.04	.99	.71	.61	.52
474	Oxamine green B	.174	2.30	2.20	1.85	1.51	1.21	.92	.82
475	Oxamine green G	.230	2.16	2.09	2.14	1.20	1.03	.98	.83
476	Benzamine brown 3 G O	-------	1.80	1.70	1.65	1.60	1.15	.73	.64
477	Congo brown G	.194	2.00	2.25	1.83	1.58	1.45	.88	.94
485	Benzo brown G	.170	1.80	1.50	1.23	1.39	1.06	.93	.78
493	Auramine	.240	3.08	3.76	3.08	2.48	2.02	1.66	1.72
495	Malachite green	.241	6.28	5.60	3.26	3.32	1.97	1.22	1.60
499	Brilliant green	.221	-------	5.63	4.66	4.23	3.68	-------	-------
502	Guinea green	.255	8.50	8.10	5.12	5.22	3.94	1.77	1.72
512	Magenta	.294	9.10	7.72	4.57	4.67	3.28	2.26	2.08
515	Methyl violet	.248	3.84	2.78	2.44	2.39	1.66	1.29	1.25
521	Aniline blue	.368	4.85	5.56	4.86	6.82	2.91	4.56	-------
530	Acid violet	.281	8.50	7.00	4.93	5.20	3.64	1.86	1.86
536	Alkali blue	.409	4.71	8.33	6.35	5.90	3.42	2.42	2.39
543	Patent blue	.305	10.78	8.68	-------	-------	-------	-------	-------
559	Victoria blue B	.312	11.91	8.46	3.65	5.14	3.86	-------	-------

TABLE 9.—*Domestic sales prices of 100 dyes, 1917–1923, compared with invoice values of the same dyes imported, 1914*—Continued

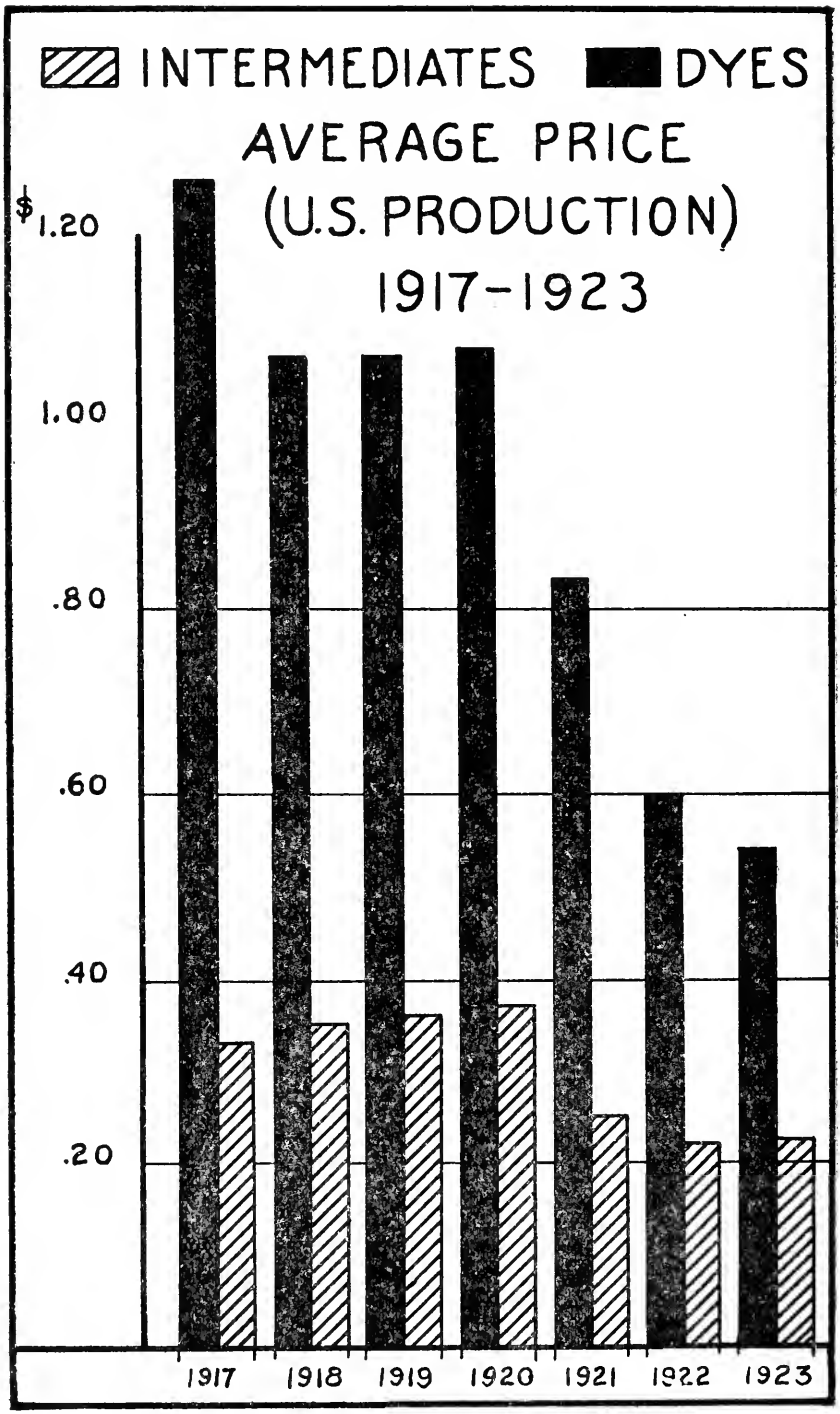
Schultz No.	Name	1914 invoice value imported dyes (weighted average of all types)	Average price per pound						
			1917	1918	1919	1920	1921	1922	1923
566	Wool green S	$0.353	$6.98	------	$5.95	$4.99	$1.88	$1.10	$0.83
573	Rhodamine B	.415	10.00	$15.92	6.90	6.72	------	------	------
587	Eosine	.418	8.58	7.81	6.30	4.19	2.51	1.90	1.84
606	Phosphine	.352	6.00	6.00	3.86	4.17	3.70	2.05	1.93
616	Primuline	.144	4.43	3.04	1.71	1.59	1.37	1.07	.70
617	Columbia yellow	.136	3.00	3.56	2.66	2.36	1.59	1.29	1.17
626	Gallocyanine	.347	5.96	5.12	3.03	3.06	2.44	1.92	1.93
659	Methylene blue	.390	3.09	2.80	3.03	2.94	1.94	1.40	1.47
679	Safranine	.359	5.93	5.85	4.02	3.88	2.60	1.69	1.45
697	Induline (spirit-soluble)	.198	5.41	1.46	.53	1.21	.75	.94	.93
698	Nigrosine (spirit-soluble)	.126	1.11	.71	.71	.88	.70	.54	.52
699	Induline (water-soluble)	.258	1.51	.70	.67	1.03	.96	.82	.83
700	Nigrosine (water-soluble)	.149	.80	.63	.59	.72	.68	.53	.46
	Sulphur yellow	------	.99	1.09	.83	.71	.73	.78	.73
720	Sulphur black	.100	.60	.29	.37	.25	.23	.21	.20
	Sulphur blue	------	1.63	1.45	1.11	.98	.64	.60	.50
725	Sulphur brown	.107	.55	.48	.47	.35	.38	.40	.39
	Sulphur tan	------	.90	.65	.34	.47	.59	.56	.48
739	Sulphur maroon	.186	------	------	1.23	1.62	.95	.79	.77
763	Indanthrene dark blue B O	.227	------	------	------	2.12	2.31	1.65	2.00
778	Alizarin	.100	3.38	1.95	1.58	1.45	.65	------	.55
779	Alizarin orange	.224	------	------	1.45	1.46	------	------	------
782	Alizarin brown	.290	.88	.80	1.58	1.68	1.32	1.86	1.24
842	Indanthrene blue G C D	.354	------	------	6.96	2.40	2.41	------	1.63
849	Indanthrene yellow	.334	------	------	17.62	4.68	3.76	------	1.24
874	Indigo synthetic	.128	1.42	.88	.59	.74	.45	.25	.23
877	Indigo extract	.340	.38	.62	.64	1.00	.65	.45	.58

Relation of production to consumption.—Imports of synthetic dyes in 1923 were 3,098,193 pounds,[1] valued at $3,151,363. Production in that year amounted to 93,667,524 pounds, valued at $51,517,138. Imports were accordingly 3.3 per cent of the total output by quantity and 6.2 per cent by value. As the cost of the imported dyes to the consumer is greater than the invoice value, the true ratio of sales value of imports to the value of production is greater than the estimate of 6.2 per cent given.

The domestic exports of "color lakes and other colors, dyes, and stains" derived from coal tar for 1923 were 17,924,200 pounds, valued at $5,565,267. The domestic consumption of dyes is assumed to equal domestic production plus imports minus exports, or 78,841,517 pounds per year. This does not, however, take into consideration any stocks carried over. Imports constituted by quantity 3.9 per cent of the apparent consumption, and dyes produced in this country supplied the remaining 96.1 per cent. In 1914 imports were about nine-tenths of the domestic consumption.

Effect of the Ruhr occupation on domestic exports.—The general effect of the occupation of the Ruhr by the French, together with the export restrictions, the conflict between the French and German authorities, difficulties of transportation, and other conditions, resulted

[1] This total poundage is in excess of the quantity actually imported, most of the vat dyes having been reduced to a single-strength basis in order to facilitate comparison of imports and production of vat dyes on a uniform-strength basis.


INTERMEDIATES
DYES
AVERAGE PRICE
(U.S. PRODUCTION)
1917-1923
$1.20
1.00
.80
.60
.40
.20
1917
1918
1919
1920
1921
1922
1923

in a large decrease in the total production of dyes in Germany, which amounted in 1923 to 25 per cent less than for the previous year. The occupation of the Ruhr had little effect on the supply of dyes for the domestic textile and other industries, as over nine-tenths of the domestic consumption is manufactured in this country.

The reduced production in Germany materially curtailed exports from that country, and important consuming countries in Far East markets, such as China, looked to the United States to supply a part of their requirements. As a result exports from the United States during 1923 were about double in quantity those of 1922 and they increased in value from $3,996,443 to $5,565,267. During the latter part of 1923 the output of dyes by Germany steadily increased, and the economic effect of the occupation of the Ruhr was being gradually overcome. Early in 1924 German dyes were again offering sharp competition to both domestic and British dyes in the markets of the Far East.

Continued production of new dyes.—An examination of the dyes for which production was recorded in 1923 shows the addition of nearly 100 new dyes to the United States manufacturing program. These were not restricted to any one class either by chemical derivation or by application on the fiber; they include dyes for silks, cotton, wool, color lakes, and for other purposes. The additions are almost entirely dyes of the special types consumed in relatively small quantities and are mostly colors of great complexity and difficult to manufacture, representing a creditable advance in the industry. The industry is still deficient to some extent in the production of certain vat dyes and certain other products, as shown by the analysis of imports, Table 15.

Reduction in duty.—Under the provisions of the tariff act of 1922 the ad valorem rates on the coal-tar products covered by paragraphs 27 and 28 will be reduced 15 per cent on September 22, 1924. The ad valorem rate on dyes and other finished products, paragraph 28, will be reduced from 60 per cent to 45 per cent, and that on intermediates, paragraph 27, from 55 per cent to 40 per cent. The specific duty will remain at 7 cents per pound.

In considering the effect of this reduction it should be borne in mind that the specific duty is more effective on the lower-priced dyes, while the ad valorem rate is more effective on the higher-priced products; the reduction in the ad valorem rate will therefore more directly affect the higher-priced dyes. The reduction will probably not greatly affect the larger tonnage of color produced in the United States, nor is it probable that it will seriously restrict the development of the dye industry, as the 15 per cent reduction is a minor factor when compared with the protection afforded by other provisions of the act.

The following table shows the actual and the equivalent ad valorem duty on seven groups of dyes ranging from $0.25 to $3 per pound under the tariff act of 1922, both for competitive and noncompetitive products. The duties resulting from the 60 per cent ad valorem rate (September 22, 1922, to September 22, 1924) and the 45 per cent ad valorem rate (beginning September 22, 1924) are separately tabulated.

TABLE 9A.—*Duty on dyes under the tariff act of 1922.*

Competitive dyes								Noncompetitive dyes							
7 cents plus 60 per cent ad valorem Sept. 22, 1922, to Sept. 22, 1924					7 cents plus 45 per cent ad valorem after Sept. 22, 1924			7 cents plus 60 per cent ad valorem Sept. 22, 1922, to Sept. 22, 1924					7 cents plus 45 per cent ad valorem after Sept. 22, 1924		
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Value of dye per pound	60 per cent duty	B plus 7 cents	Ad valorem equivalent of 7 cents	Ad valorem equivalent of C	45 per cent duty	F plus 7 cents	Ad valorem equivalent of G	Domestic selling price of imported dyes	"United States value"	60 per cent duty	K plus 7 cents	Equivalent ad valorem of L	45 per cent duty on J	N plus 7 cents	Equivalent ad valorem of O
			Per cent	*Per cent*			*Per cent*					*Per cent*			*Per cent*
$0.25	$0.15	$0.22	28	88	$0.113	$0.18	72	$0.25	$0.0697	$0.0418	$0.1118	44.7	$0.0314	$0.1014	40.6
.50	.30	.37	14	74	.225	.295	59	.50	.202	.1212	.1912	38.2	.0909	.1609	32.2
.75	.45	.52	9.3	69.3	.338	.408	54.4	.75	.334	.20	.27	36	.1503	.2203	29.4
1.00	.60	.67	7	67	.45	.52	52	1.00	.4665	.28	.35	35	.2099	.2799	28
1.50	.90	.97	4.7	64.7	.68	.745	49.7	1.50	.73	.438	.508	33.9	.3285	.3985	25.6
2.00	1.20	1.27	3.5	63.5	.90	.97	48.5	2.00	.995	.597	.667	33.35	.4478	.5178	25.9
3.00	1.80	1.87	2.3	62.3	1.35	1.42	47.33	3.00	1.52	.912	.98	32.7	.684	.754	25.1

PRODUCTION OF DYES BY CLASSES

The dyes produced in the United States in 1923 are classified according to method of application as follows: (1) Acid dyes, (2) basic dyes, (3) direct dyes, (4) lake and spirit-soluble dyes, (5) mordant or chrome dyes, (6) sulphur dyes, (7) vat dyes, subdivided into indigo and other vats, and (8) unclassified dyes. While in certain cases the classification of a color is arbitrary, because a dye may have properties which permit of its application by more than one method, it is believed that the above classifications facilitate the comparison of production and import figures.

The production of dyes in the United States from 1917 to 1923, inclusive, as compared with imports during the fiscal year 1914 and the calendar years 1920 to 1923, inclusive, are arranged according to the classes given in Table 10.

TABLE 10.—*Comparison of imports of dyes, by classes, fiscal year 1914, with domestic production, calendar years 1917–1923*

Class	1914		1917		1918	
	Imports	Per cent of total	United States production	Per cent of total	United States production	Per cent of total
	Pounds		*Pounds*		*Pounds*	
Acid	9,286,501	20.2	9,372,121	20.4	9,799,071	16.8
Basic	3,002,480	6.5	2,073,043	4.5	2,879,639	4.9
Direct	10,264,757	22.3	11,181,761	24.3	12,285,683	21.1
Lake and spirit-soluble	1,512,605	3.3	934,360	2.2	1,068,466	1.8
Mordant and chrome	4,450,442	9.7	4,164,902	9.1	5,447,192	9.3
Sulphur	7,053,879	15.4	15,588,222	33.9	23,698,826	40.5
Vats (including indigo)	10,352,663	22.5	289,296	.6	3,281,337	5.6
(*a*) Indigo	8,407,359	18.3	274,771	.55	3,083,888	5.3
(*b*) Other vats	1,945,304	4.2	14,525	.05	197,449	.3
Unclassified	27,568	.1	2,368,541	5.0	4,232	
Total	45,950,895	100.0	45,977,246	100.0	58,464,446	100.0

Class	1919		1920			
	United States production	Per cent of total	United States production	Per cent of total	Imports	Per cent of total
	Pounds		*Pounds*		*Pounds*	
Acid	12,195,968	19.2	17,741,538	20.1	733,405	21.5
Basic	4,036,532	6.4	4,993,001	5.7	192,163	5.7
Direct	14,444,934	22.8	19,882,631	22.5	571,581	16.8
Lake and spirit-soluble	1,813,199	2.8	2,205,281	2.5	17,527	.5
Mordant and chrome	3,985,050	6.3	3,900,209	4.4	709,482	20.9
Sulphur	17,624,418	27.8	20,034,500	22.7	229,140	6.7
Vats (including indigo)	9,252,982	14.6	19,338,099	21.9	932,464	27.4
(*a*) Indigo	8,863,824	14.0	18,178,231	20.6	171,101	5.0
(*b*) Other vats	389,158	.6	1,159,868	1.3	761,363	22.4
Unclassified	49,111	.1	168,517	.2	16,820	.5
Total	63,402,194	100.0	88,263,776	100.0	3,402,582	100.0

TABLE 10.—*Comparison of imports of dyes, by classes, fiscal year 1914, with domestic production, calendar years 1917–1923*—Continued.

Class	1921				1922			
	United States production	Per cent of total	Imports	Per cent of total	United States production	Per cent of total	Imports	Per cent of total
	Pounds		*Pounds*		*Pounds*		*Pounds*	
Acid	7,843,009	20.11	1,455,823	34.24	9,880,014	15.29	601,395	15.10
Basic	1,853,094	4.75	163,527	3.84	2,937,585	4.54	155,084	3.89
Direct	7,053,761	18.08	537,664	12.64	11,931,737	18.46	671,621	16.86
Lake and spirit-soluble	720,406	1.85	43,553	1.02	1,009,512	1.56	76,853	1.93
Mordant and chrome	3,997,442	10.25	695,961	16.36	3,749,701	5.80	716,790	18.00
Sulphur	10,239,255	26.25	220,938	5.20	16,913,767	26.17	194,883	4.89
Vats (including indigo)	7,019,120	17.99	1,116,345	26.25	16,926,744	26.19	1,549,024	38.90
(*a*) Indigo	6,673,968	17.11	70,975	1.66	15,850,752	24.52	505	.01
(*b*) Other vats	345,152	.88	1,045,370	24.59	1,075,992	1.67	1,548,519	38.89
Unclassified	282,603	.72	19,100	.45	1,283,127	1.99	16,981	.43
Total	39,008,690	100.00	4,252,911	100.00	64,632,187	100.00	3,982,631	100.00

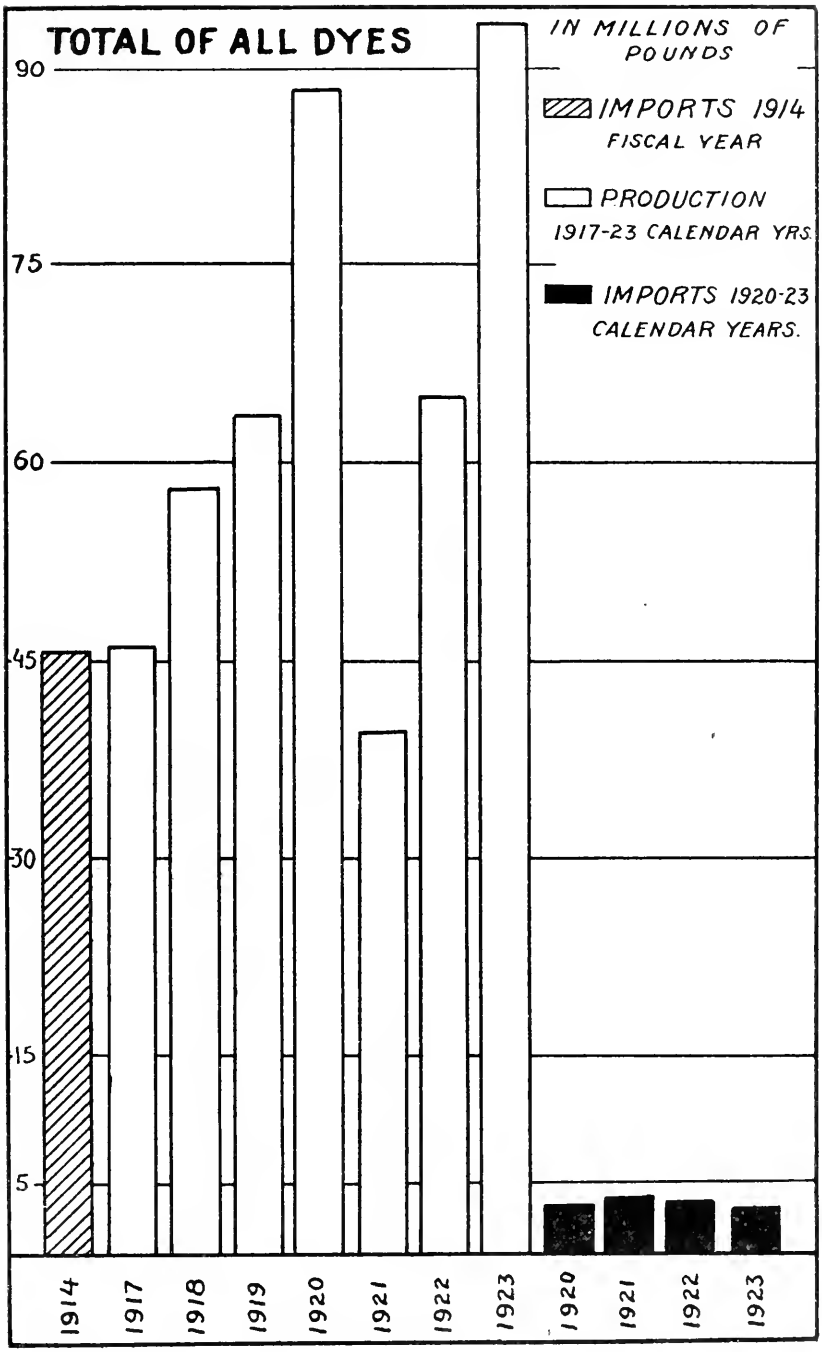
Class	1923			
	United States production	Per cent of total	Imports	Per cent of total
Acid	12,498,817	13.34	544,048	17.56
Basic	4,157,373	4.44	210,896	6.81
Direct	16,858,387	18.00	527,014	17.01
Lake and spirit-soluble	1,171,854	1.25	23,213	.75
Mordant and chrome	4,078,504	4.35	453,415	14.63
Sulphur	21,558,469	23.02	114,023	3.68
Vats (including indigo)	30,113,642	32.15	1,207,554	38.98
(*a*) Indigo	28,347,259	30.26		
(*b*) Other vats	1,766,383	1.89	1,207,554	
Unclassified and special	3,230,478	3.45	18,030	.58
Total	93,667,524	100.00	3,098,193	100.00

TABLE 10A.—*Production of dyes, by groups, according to unit value*

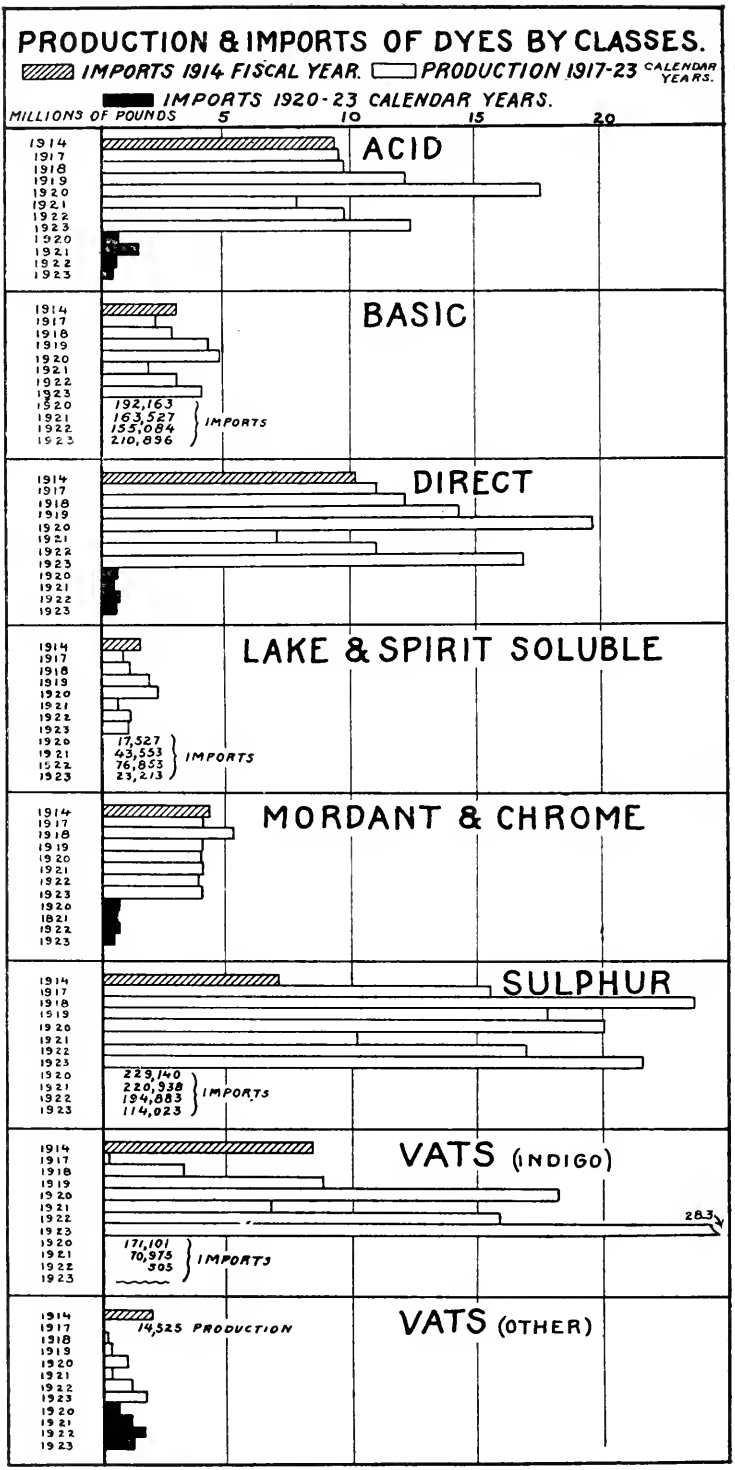
Group	1923		1922		1921	
	Pounds	Per cent of total	Pounds	Per cent of total	Pounds	Per cent of total
0–25 cents	44,651,483	47.670	28,728,401	44.449	7,832,696	20.079
26–50 cents	15,205,298	16.234	10,237,825	15.840	7,941,977	20.360
51–75 cents	12,717,546	13.577	8,418,271	13.025	6,843,004	17.542
$0.76–$1	8,604,351	9.186	6,992,018	10.818	4,762,791	12.209
$1.01–$1.50	8,207,420	8.762	6,833,577	10.573	6,329,421	16.226
$1.51–$2	2,318,343	2.475	2,010,413	3.111	3,321,581	8.515
$2.01–$3	1,244,493	1.329	838,849	1.298	1,220,966	3.130
Over $3	718,590	.767	572,833	.886	756,254	1.939
Total	93,667,524	100.00	64,632,187	100.00	39,008,690	100.00

ACID DYES

Description.—The acid dyes are commonly applied in an acid bath; they have acid properties and are usually sodium salts of a color acid. They constitute the most important group used in wool dyeing, being especially adapted to the dyeing of hosiery and carpet yarns, suitings, dress goods, and hat materials; they have, in addition, considerable


TOTAL OF ALL DYES
IN MILLIONS OF POUNDS
IMPORTS 1914 FISCAL YEAR
PRODUCTION 1917-23 CALENDAR YRS.
IMPORTS 1920-23 CALENDAR YEARS.
90
75
60
45
30
15
5
1914
1917
1918
1919
1920
1921
1922
1923
1920
1921
1922
1923

1760—24†——4


PRODUCTION & IMPORTS OF DYES BY CLASSES.
IMPORTS 1914 FISCAL YEAR.
PRODUCTION 1917-23 CALENDAR YEARS.
IMPORTS 1920-23 CALENDAR YEARS.
MILLIONS OF POUNDS
5
10
15
20
ACID
1914
1917
1918
1919
1920
1921
1922
1923
1920
1921
1922
1923
BASIC
192,163
163,527
155,084
210,896
IMPORTS
DIRECT
LAKE & SPIRIT SOLUBLE
17,527
43,553
76,853
23,213
IMPORTS
MORDANT & CHROME
SULPHUR
229,140
220,938
194,883
114,023
IMPORTS
VATS (INDIGO)
283
171,101
70,975
305
IMPORTS
VATS (OTHER)
14,525 PRODUCTION

application on silk. They are little used on cotton or linen because of their lack of affinity for vegetable fibers, but are of value in the dyeing of jute. In general they are used on goods not requiring repeated washings.

Acid dyes yield clear, bright shades. They are superior to the direct and mordant dyes in purity of shade, but are not equal to basic dyes in this respect. They have a wide color range, and in fastness they show great individual variation; as a rule they are fairly fast to light and acids, and have a tendency to bleed in washing. They yield faster shades on wool than on silk. Some of the more complex acid dyes produce shades of good general fastness. A considerable part of this group is of the lowest-priced dyes produced. Their method of application in an acid bath is simple and of low labor cost.

The line of demarcation between acid dyes and certain colors of the direct and mordant groups is arbitrary. Certain acid dyes when "aftertreated" with sodium or potassium dichromate yield shades of good fastness to milling, light, washing, and other agents. These dyes, known as acid chrome colors, are used chiefly on wool, especially on loose wool yarns and piece goods, such as men's suitings. Most of the acid dyes are chemically included in one of the following groups: (1) Nitro compounds, (2) azo compounds, (3) sulphonated basic dyes (mostly triphenylmethane derivatives).

Production and imports.—Acid dyes ranked fourth in 1923 in order of quantity produced, with a total of 12,498,817 pounds, or 13.34 per cent of all dyes manufactured. Imports of this group amounted to 544,048 pounds, or 17.56 per cent of the total imoprts and 0.6 per cent of the total production. In the pre-war year 1914 they amounted to 9,286,501 pounds, or one-fifth of the total imports of that year.

Agalma black 10B was first in quantity of production of the acid dyes, with a total of 2,568,458 pounds. This dye ranked fourth of all dyes manufactured during that year. Sales amounted to 2,377,290 pounds, with a value of $1,694,148. Orange II ranked second in this group in quantity of production, with a total of 1,617,668 pounds, followed by Nigrosine (Water soluble), with a total of 1,389,106 pounds, by Tartrazine with a total of 735,608 pounds, and by Azo rubine with an output of 526,596 pounds. Among the new acid dyes reported during 1923 are Naphthalene green V, Eosine BN, and Azo acid violet. Notable increases were reported in the output of Sulphon acid blue R, Eriocyanine, and Fast light yellow.

The eight leading acid dyes imported in 1923 were Patent blue, 66,279 pounds; Alizarin rubinol 3G, 5G, GW, R, 48,826 pounds; Xylene light yellow, 46,886 pounds; Erioglaucine, 38,254 pounds; Palatine black, 33,500 pounds; Cyanol, 19,979 pounds; Eriocyanine 19,202 pounds; and Fast green, 17,190 pounds.

Basic Dyes

Description.—The basic dyes surpass all others in depth, brilliancy of shade, and purity of tone. They possess high tinctorial power, but as a class lack fastness, especially to light and washing.

Basic colors are used on cotton in dyeing and printing where bright shades or color tints are desired without special requirements

for fastness. They are also employed in the dyeing of paper and jute and for lithographic inks, typewriter ribbons, copy paper, and pencils. With the exception of Rhodamine B and a few others they have little application on wool. Dyes of this class are chemically basic in character and are fixed on vegetable fibers with an acid mordant, namely, tannic acid.

They are historically the oldest of the coal-tar dyes. Mauve or Perkin violet, discovered by W. H. Perkin in 1856, was the first aniline dyestuff produced on a commercial scale. Basic dyes are not as important as formerly; for cotton dyeing they have been superseded by direct and sulphur dyes, which possess advantages in economy of application and in many cases excel in fastness. In wool dyeing the acid dyes have almost entirely displaced the basic colors. Chemically the basic dyes include a large number of the triphenylmethane derivatives and, in addition, members of the following classes: (1) Azines, (2) azos, (3) thioazines, (4) thioazols, and (5) acridines.

Production and imports.—Basic dyes in 1923 ranked fifth in quantity of production, with an output of 4,157,373 pounds, or 4.44 per cent of the total. Imports in that year amounted to 210,896 pounds, or one-fourth of 1 per cent of production. The production of this group of dyes is well developed in this country. Bismarck brown 2R leads this group, with an output of 672,544 pounds, followed by Methyl violet, with an output of 578,183 pounds, and Chrysoidine Y, with an output of 545,836 pounds. The output of Auramine, 471,359 pounds, showed a conspicuous increase over that of 1922, when the production was only 344,827 pounds. Large increases in the production of Phosphine and Rhodamine B constitute the outstanding development in the production of this group of dyes during 1923.

The five leading basic dyes (by quantity) imported in 1923 were Phosphine, 42,176 pounds; Rhodamine 6G, 31,242 pounds; Rhodamine B, 29,083 pounds; Thioflavine T, 20,283 pounds; and Euchrysine, 9,483 pounds.

Direct Cotton Dyes

Description.—The direct or substantive dyes have been introduced within the past 25 years. Their method of application is simple, as they dye vegetable fibers full shades in a neutral or alkaline bath, "directly," without the use of mordants. Although their principal application is on cotton, they are of special value in dyeing fabrics containing both cotton and wool, or silk and cotton (union goods). They are also used on linen, silk, and paper and to an increasing extent on wool, especially for knitting yarns, worsted and shoddy yarns, and loose wool.

In fastness, individual dyes of this group show a wide variation. On account of their high solubility they have a tendency to run when washed. Many direct dyes, particularly those first introduced, are sensitive to acids and fade on exposure to sunlight; others, especially the newer direct dyes, have good fastness to both acids and light as well as to other agents. Certain direct colors are of good fastness, particularly to washing, after a treatment of the dyed fiber by "coupling" with certain intermediates. An aftertreatment with metallic

salts or formaldehyde also improves the fastness of certain direct dyes. These "developed" direct dyes were not available in the early part of the war; the ordinary direct dyes then used for hosiery were unsatisfactory to consumers. Developed blacks, such as Zambesi black V, are now manufactured in this country for hosiery.

With a few exceptions the direct dyes are chemically "azo" compounds and are nearly all derivatives of benzidine, tolidine, diamino stilbene, or a group closely approximating one of these. A small but valuable group of direct colors belongs in the thiazol class.

Production and imports.—The direct cotton dyes, with a production of 16,858,387 pounds, ranked third in quantity of production, comprising 18 per cent of all dyes produced. Imports of this group in 1923 were 527,014 pounds, which may be contrasted with 10,264,757 pounds in 1914. The first direct cotton dye by quantity of production was Direct black EW, with an output of 6,957,581 pounds. This ranked third, or 7.4 per cent, of all dyes produced in that year. Sales of this color in 1923 were 6,720,905 pounds, with a value of $2,875,928.

Benzo blue 2B ranked second in this group, with an output of 1,065,539 pounds, followed by Benzamine brown 3GO, with a production of 999,554 pounds, and Oxamine black BHN, with a total of 905,491 pounds. Congo red ranked fifth, with a production of 590,548 pounds.

One of the more important developments in the production of this group of dyes consists in the continued addition to the range of "developed" direct dyes capable of producing shades of good fastness on cotton and silk. Production of Zambesi blacks recorded a notable increase, and among the new direct colors are Erica B, Terra cotta F, Neutral gray B, Diaminogene B, Congo rubine, Benzo fast red, Chicago blue 2R, Diazo indigo blue M, and Direct black V.

The eight leading direct dyes, by quantity, imported in 1923, were Diaminogene blue, 88,778 pounds; Diaminogene B, 32,903 pounds; Trisulphon brown B, 26,980 pounds; Diphenyl red, 21,160 pounds; Diamine fast orange EG, ER, R, 17,793 pounds; Diphenyl brown BN, 17,534 pounds; Benzo fast blue, 17,036 pounds; and Trisulphon brown GG, 16,150 pounds.

Mordant and Chrome Dyes

Description.—These colors, in conjunction with metallic mordants, such as salts of chromium, aluminum, iron, and tin, dye both vegetable and animal fibers. The resulting shades are, in general, of exceptional fastness to color-destroying agents. The mordant dyes yield on wool the fastest shades to light, washing, and other agents. They are also important in textile printing, particularly on cotton piece goods, but are little used on silk.

The mordant dyes are frequently designated as chrome colors. As many of these colors are derived from alizarin, they were formerly called alizarin dyes. Certain dyes may be acid, acid chrome, or chrome, according to the method of application. The true alizarins are generally used with a mordant; some of the new alizarins, known as acid alizarins, can be used either with or without. In the application of chrome dyes on wool, the mordant may be applied before, during, or after the dyeing operation. The labor cost of dyeing with mordant and chrome dyes is higher than for other groups.

The most important dye of this class, alizarin, is used in the production of the well-known Turkey red on cotton. This is one of the shades produced in ancient times from madder root. Alizarin has been prepared synthetically from anthracene for about 50 years.

Chemically, the mordant dyes are members of the following classes: (1) Anthracene, (2) azo, (3) oxazine, (4) triphenylmethane, (5) nitroso, (6) oxyquinone, and (7) xanthone.

Production and imports.—The output of mordant and chrome dyes was 4,078,504 pounds, or 4.35 per cent of all dyes manufactured in 1923. Imports of this class in that year were 453,415 pounds, or one-half of 1 per cent of production and 14.6 per cent of the total import. Imports in the pre-war year 1914 amounted to 4,450,442 pounds.

Salicine black U ranked first in quantity among the mordant and chrome dyes, with a production by 14 firms of 1,242,283 pounds and sales of 1,290,536 pounds, valued at $686,266. Other leading dyes of this group include Alizarin yellow G, with an output of 395,361 pounds; Alizarin saphirol B, 309,124 pounds; and Metachrome brown B, 308,559 pounds.

The rapid increase in the production of Eriochrome black T and A during the last two years is reflected in a decrease in the imports of these two dyes. Notable increases were recorded in the output of Alizarin brown, Alizarin GI, Palatine chrome red B, and Alizarin. Among the new mordant and chrome dyes produced in 1923, not reported in 1922, are Anthracene blue, Acid alizarin black R, and several unidentified chrome browns.

The five leading mordant and chrome dyes, by quantity, imported in 1923 were Alizarin blue black, 70,917 pounds; Gallamine blue, 29,244 pounds; Alizarin, 27,716 pounds; Alizarin saphirol B, 26,615 pounds; and Alizarin red, 25,017 pounds.

Sulphur Dyes

Description.—This group of dyes produces heavy deep shades of blue, green, brown, and black. They are used almost entirely in cotton dyeing, being especially adapted to uniform cloths, hosiery, gingham yarns, and cotton warps to be woven with wool and later dyed with acid dyes. Their greatly extended use during the war served to increase permanently their application in cotton dyeing. Sulphur colors are also used in the dyeing of linen and artificial silk.

The sulphur dyes possess excellent fastness to washing, fulling, alkalies, and acids in cross dyeing. With some exceptions, their fastness to light is good. As they are not fast to chlorine, they do not withstand the repeated bleaching action of hypochlorites in the modern laundry treatment. They are applied in a sodium sulphide solution with, in certain cases, aftertreatment with metallic salts to improve their fastness. The first dye discovered in this group, "Cachou de Laval," was made in 1867 by the fusion of sawdust with sodium sulphide and sulphur. Sulphur dyes are now prepared by the fusion of various intermediates (containing the nitro, amino, or imino groups) with sodium sulphide and sulphur. These dyes are not pure, distinct compounds, and the presence of other substances renders them of comparatively low color value. Recent developments, however, have greatly increased the tinctorial value and shade range of many of them.

Production and imports.—This group of dyes ranked second in quantity of production, with a total of 21,558,469 pounds, equivalent to 23.02 per cent of all dyes produced in 1923. The domestic production of sulphur dyes has been well developed both in quantity and variety for several years. This is indicated by the relatively small quantity of sulphur colors imported, constituting in 1923 only one-tenth of 1 per cent of the total production. Sulphur black ranked second among all dyes manufactured in 1923, with an output of 16,276,409 pounds, or 17.4 per cent of the total. Sales during 1923 were 15,212,142 pounds, valued at $3,017,207. The production of sulphur browns totaled 2,203,893 pounds; of sulphur blues, 1,349,864 pounds; of sulphur yellow, 670,023 pounds; and of sulphur maroon, 373,899 pounds.

The five leading sulphur dyes imported in 1923 were:

	Pounds
Thionol brown	28, 802
Cross dye green B	26, 242
Eclipse brown	10, 000
Thional brown G	9, 228
Pyrogene blue	8, 929

Vat Dyes

Description.—Because of their exceptional fastness, variety, and beauty of shade, vat dyes are of special importance for cotton goods where laundry-fast dyes are desired. They are used on both dyed and printed shirtings, on blouse material, dress goods, ginghams, muslin curtains, and other cotton wash goods, and have a limited application on silk and wool. Because of their high cost, they have a comparatively limited use in solid or heavy shades, but they are used for color stripes or for small printed patterns on a white background. They possess technical advantages in application over the alizarin mordant dyes.

Vat dyes as a class possess exceptional fastness to light, washing, acids, alkalies, and to chlorine. Some of them are not fast to all of these agents. With a gradual increase in demand by the ultimate consumer of textiles for fast-dyed fabrics, the consumption of vat dyes is increasing. As cotton goods dyed with these colors withstand the severe treatment of the modern laundry, the relatively high cost of dye per yard is a minor factor compared with the increased life of a fabric dyed with fast colors.

With the exception of indigo, one of the oldest dyes known, vat dyes are of recent origin. They are among the most complex of dyes, difficult to manufacture, and relatively high in cost. Chemically divided, they consist of indigoids (including thioindigoids), anthraquinone derivatives, and the carbazole derivatives.

Production and imports.—The production of vat dyes, including indigo, again led by quantity, in 1923 totaling 30,113,642 pounds (32.15 per cent of the total output), compared with 16,926,744 pounds for the previous year.

The indigo output of 28,347,259 pounds was greater than that of any other single dye, comprising 30.26 per cent of the total domestic output. This represents a very large increase over the 1922 output of 15,850,752 pounds. This increase may be accounted for in large part by the exports of this dye to China, as a result of the reduced exports of Germany following the occupation of the Ruhr district.

The output of vat dyes (other than indigo) in 1923 was 1,766,383 pounds—the largest in the history of the domestic industry and an increase of 690,391 pounds over that of 1922.

Among the vat dyes other than indigo, Indanthrene yellow led in quantity of production, with an increase in output of 170 per cent over that of 1922. Indanthrene blue GCD, second in quantity of output, showed an increase over the 1922 production. Among the new vat dyes reported as produced during 1923 are, Indanthrene violet B, Indanthrene blue 3G, Hydron pink FF, and Indanthrene golden orange R.

In 1914 imports of vat dyes other than indigo were 1,945,304 pounds, and none of these dyes were produced in this country in that year; in 1920, a year of great business activity, domestic production plus imports was 1,921,231 pounds. In 1921, a year of business reaction, the corresponding total was 1,390,522 pounds, and for 1922, 2,624,511 pounds, increasing to a maximum of 2,973,937 pounds in 1923.

The nine leading vat dyes, by quantity, imported in 1923 were:

	Pounds
Indanthrene yellow (single strength)	87, 946
Indanthrene golden orange R (single strength)	79, 717
Indanthrene blue GCD (single strength)	70, 546
Indanthrene golden orange G (single strength)	67, 265
Ciba violet B (single strength)	64, 517
Hydron pink FB, FF (single strength)	55, 428
Algol brown B (single strength)	55, 081
Helindone pink B, R, RN (single strength)	47, 771
Indanthrene green B (single strength)	40, 420

Color-lake and Spirit-soluble dyes

These dyes constitute one of the smaller groups. The color lake dyes are used in the preparation of a class of pigments known as color lakes, discussed in detail under that heading.

The spirit-soluble dyes are insoluble in water, but dissolve in either oils, fats, or various organic solvents; they consequently find application for coloring varnishes (both spirit and oil), fats, oils, waxes, and similar products. As many of the spirit-soluble dyes are converted by chemical treatment, such as sulphonation, into water-soluble dyes for use in textile dyeing, they may be considered as partly completed dyes.

The output of lake and spirit-soluble dyes in 1923 was 1,171,854 pounds, or 1.25 per cent of the total dye production. Of these, 57 per cent were lake dyes and 43 per cent spirit-soluble dyes. In 1922 the output was 1,009,512 pounds. Imports of this group in 1923 amounted to 23,213 pounds, or 0.75 per cent of the total imports of coal-tar dyes.

Food Dyes

Dyes classified under this group include a limited number of selected dyes which meet the specifications of the Bureau of Chemistry, Department of Agriculture. There are also included the figures for a highly refined grade of methyl violet, used for marking meats and certain other food products. The total production of food dyes in 1923 was 230,343 pounds, with sales of 228,686 pounds, valued at $860,077. Production in 1922 was 186,600 pounds, and in 1921, the first year in which they were separately compiled, 50,709 pounds. The average value of the sales was $3.76 per pound in 1923, $3.82 in 1922, and $5.80 in 1921.

DYES EXPORTED FROM THE UNITED STATES

Large increase in 1923.—The total exports of "color lakes" and "other colors, dyes, and stains" in 1923 amounted to 17,924,200 pounds, valued at $5,565,267. This is slightly more than double the quantity exported in 1922 and a 40 per cent increase by value.

Prior to 1922 the Department of Commerce reported only the value of exports of domestic dyes and dyestuffs, using the following groups: (1) Aniline dyes, (2) logwood extracts, (3) all other dyes and dyestuffs. The third classification covers both coal-tar dyes and natural dyes, other than logwood extract. Since logwood extract is by far the most important natural dye exported from the United States it is reasonable to assume that a large part of the figures returned for all other dyes and dyestuffs covers coal-tar dyes. The most important natural dye included in Group 3 is derived from the bark of the black oak (*Quercus velutina*) in two forms, viz., quercitron and flavine. These were exported in considerable amounts during the war and in smaller amounts previously. In 1922 the Department of Commerce adopted a new classification, grouping coal-tar dyes under (1) color lakes and (2) other colors, dyes, and stains. For the first time the quantity as well as the value of the exports was published. Table 11 shows by months the total exports of dyes from the United States from 1919 to April, 1924, inclusive.

The countries to which dyes are exported are shown in detail in Part VI, Appendix.

The combined value of exports of "aniline dyes" and "all other dyes" was $15,728,499 in 1919, compared with $29,823,591 for 1920, the highest in the history of the industry. This was during a year of world-wide business activity, prior to the reappearance of German dyes in international trade.

Exports of "color lakes" in 1922 were 28,228 pounds, with a value of $19,928, and the total exports of "other colors, dyes, and stains" were 8,315,959 pounds, with a value of $3,976,515, making a total of 8,344,187 pounds and a value of $3,996,443. The total export of "coal-tar colors, dyes, and stains" for 1923, as reported in the Monthly Summary of Foreign Commerce, was 17,924,200 pounds, with a value of $5,565,267. No exports of color lakes were reported in that year. In January, 1924, exports of "other colors, dyes, and stains" were 1,432,721 pounds, valued at $494,666, and for the month of February 1,739,400 pounds, valued at $571,776. The large increase in exports of dyes in 1923, compared with 1922, was largely due to the effect of the occupation of the Ruhr by the French in 1923, as a result of which German production was greatly reduced and the export trade of that country in dyes and chemicals was severely affected. The monthly production of the German dye plants increased rapidly in the later months of 1923 and in the early months of 1924, indicating that interference with Germany's dye production had practically disappeared. In fact, there have been, in 1924, unceasing efforts by German manufacturers in the Far East and other large dye markets to recapture those lost markets by the initiation of a price-cutting campaign.

TABLE 11.—*Domestic exports of dyes, by months, 1919–1924 (four months)*

Month	1919			1920		
	Aniline dyes	All other dyes [1]	Total	Aniline dyes	All other dyes [1]	Total
January	$1,405,017	$755,382	$2,160,399	$917,574	$372,468	$1,290,042
February	1,231,355	617,050	1,848,405	1,850,662	379,825	2,230,487
March	492,291	278,591	770,882	2,648,615	850,695	3,499,310
April	777,123	359,512	1,136,635	1,829,771	891,467	2,721,238
May	585,970	239,744	825,714	2,180,606	817,713	2,998,319
June	858,661	475,571	1,334,232	2,389,515	1,239,191	3,628,706
July	574,274	267,425	841,699	1,770,780	947,411	2,718,191
August	761,009	350,491	1,111,500	1,151,196	623,181	1,774,377
September	785,497	557,005	1,342,502	2,114,915	551,113	2,666,028
October	1,037,708	453,390	1,491,098	1,802,142	334,167	2,136,309
November	887,710	300,041	1,187,751	2,006,534	211,465	2,217,999
December	1,327,456	350,226	1,677,682	1,788,170	154,415	1,942,585
Total	10,724,071	5,004,428	15,728,499	22,450,480	7,373,111	29,823,591

Month	1921		
	Aniline dyes	All other dyes [1]	Total
January	$943,595	$349,114	$1,292,709
February	397,123	72,641	469,764
March	574,969	95,322	670,291
April	305,760	59,250	365,010
May	278,331	91,753	370,084
June	444,273	81,477	525,750
July	310,357	65,626	375,983
August	513,012	70,663	583,675
September	322,477	70,228	392,705
October	349,981	73,706	423,687
November	372,244	78,703	450,947
December	254,878	94,656	349,534
Total	5,067,000	1,203,139	6,270,139

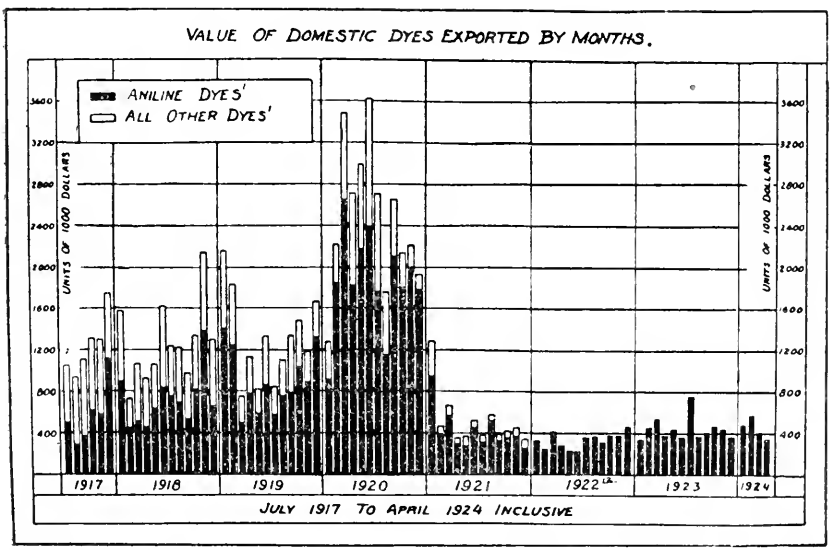
Month	1922					
	Color lakes		Other colors, etc.		Total	
	Pounds	Value	Pounds	Value	Pounds	Value
January	5,059	$4,188	364,971	$325,048	370,030	$329,236
February	6,796	5,124	298,364	230,544	305,160	235,668
March	3,612	3,162	708,792	405,250	712,404	408,412
April	8,446	2,105	581,367	271,571	589,813	273,676
May	401	500	328,733	227,898	329,134	228,398
June	282	361	398,975	222,370	399,257	222,731
July	356	249	726,624	364,737	726,980	364,986
August	593	411	896,701	383,692	897,294	384,103
September	341	607	664,348	304,022	664,689	304,629
October	576	890	954,922	399,439	955,498	400,329
November	1,702	2,228	1,084,890	395,579	1,086,592	397,807
December	64	103	1,307,272	446,365	1,307,336	446,468
Total	28,228	19,928	8,315,959	3,976,515	8,344,187	3,996,443

[1] Commerce and Navigation reports under domestic exports of "dyes and dyestuffs"—"aniline dyes," "logwood extract," and "all other dyes and dyestuffs." Under this last-named designation may be included both natural and coal-tar dyes. However, since logwood extract—shown separately—is the most important natural dye exported from the United States, it may be assumed that a considerable portion of the exports under "all other dyes and dyestuffs" are coal-tar dyes.

TABLE 11.—*Domestic exports of dyes, by months, 1919–1924 (four months)*—Continued

Month	1923		Month	1923	
	Other colors, dyes, and stains			Other colors, dyes, and stains	
	Pounds	Value		Pounds	Value
January	821,847	$332,008	August	1,008,878	$388,815
February	1,338,395	443,505	September	1,514,228	402,751
March	1,606,168	513,129	October	1,543,869	474,215
April	1,690,402	498,421	November	1,390,927	433,892
May	1,830,068	539,358	December	1,261,631	377,684
June	1,002,256	383,321			
July	2,915,531	778,168	Total	17,924,200	5,565,267

Month	1924		Month	1924	
	Other colors, dyes, and stains			Other colors, dyes, and stains	
	Pounds	Value		Pounds	Value
January	1,432,721	$494,666	March	1,244,264	$408,029
February	1,739,400	571,776	April	1,014,824	344,605



[1] The domestic exports of dyes, as shown by the Commerce Department, are divided into 3 groups—(1) aniline dyes, (2) logwood extract, and (3) all other dyestuffs.

The third classification may include both natural dyes (other than logwood extracts, shown separately) as well as coal-tar dyes. Since logwood extract, however, is the most important natural dye exported from the United States, it is reasonable to assume that a considerable portion of "all other dyes and dyestuffs" represents coal-tar dyes.

In 1922, however, the Commerce Department adopted a new classification. Coal-tar dyes were grouped under coal-tar finished products and were divided into (1) color lakes and (2) other colors, dyes and stains.

Other Finished Coal-Tar Products

COLOR LAKES

Description.—A color lake is an insoluble color pigment consisting of a precipitating agent, the coloring matter (a coal-tar dye), and a carrier (the base). The desired properties of a color lake are good coloring power, easy workability, brightness, and fastness to weather, light, alkali, and acids. The precipitating agents used for coal-tar colors include barium chloride, lead salts, aluminium hydroxide, and tannin or tannin tartar-emetic. Among the more important carriers are aluminium hydroxide, zinc white, lithopone, barytes, whiting, China clay and certain native clays, and ocher. The principal requirements of a carrier are (1) ready reduction to a finely divided state and (2) absence of any deleterious effect on the shade of the finished lake. The coloring matter includes those coal-tar dyes known as acid dyes, basic dyes, and mordant dyes, as well as certain azo dyes produced directly on the carrier. An example of the latter is the preparation of Para red from the intermediates p-nitroaniline and b-naphthol. Another group of color lakes is made by the precipitation of a water-soluble acid dye, with the aid of the mineral salt to form an insoluble product.

After precipitation the soluble lake is filtered, dried, and ground with or without oil; it is then ready for use as a pigment in paints, lithographic inks, artists' colors, wall paper, rubber products, and for similar coloring purposes.

Production.—The total production of color lakes in 1923 amounted to 13,079,115 pounds, and sales to 12,627,359 pounds valued at $5,124,732, with an average value per pound of 40.6 cents. This is an increase over 1922, when the output was 10,578,664 pounds. Sales in that year amounted to 10,366,676 pounds, valued at $4,551,572, or an average value per pound of 44 cents.

PHOTOGRAPHIC CHEMICALS

Owing to their strong reducing properties, coal-tar chemicals of this class are used for developing photographic films, plates, and prints. They are popularly known as "developers," and are sold under various trade names.

The total output of photographic chemicals in 1923 was 343,289 pounds, a slight decrease from the 1922 figure of 345,798 pounds. Sales for 1923 were 321,083 pounds, valued at $443,697, with an average value per pound of $1.38. The quantity of each photographic chemical made in 1923 can not be published without disclosing the output of individual manufacturers. The developer produced in largest quantity was hydroquinol, followed by p-hydroxyphenylglycine. The 1923 production of the latter shows a large increase, while that of metol (methyl-p-aminophenol sulphate) shows a decrease.

MEDICINALS

Description.—From the standpoint of national welfare this class of coal-tar derivatives is of high importance. Chemically, it includes a variety of products used for a diversity of purposes. The develop-

ment of medicinals constitutes one of the most creditable accomplishments of the coal-tar industry, as the highest technical skill is required in their manufacture.

Production.—The total production of medicinals in 1923 was 3,273,085 pounds; sales were 2,995,448 pounds, valued at $4,720,253, an average price of $1.58 per pound. Production in 1922 was 2,946,347 pounds, with sales of 3,092,915 pounds valued at $4,233,443.

Arsphenamine, known also as salvarsan and as "606," the hydrochloride of 3-diamino-4-dihydroxy-1-arsenobenzene, used for combating syphilis and other protozoan infections, is one of the most important medicinals of this group. Its production by 7 manufacturers in 1923 was 616 pounds; sales were 576 pounds, valued at $173,381, or $301.01 per pound, as compared with 917 pounds, valued at $257,022—$280.28 per pound—in 1922. Neoarsphenamine (3-diamino-4-dihydroxy-1-arsenobenzene methanol sulphoxylate) had a total production, by 6 manufacturers, of 3,365 pounds. Total sales were 3,035 pounds, valued at $1,029,121, an average price of $339.08 per pound.

Aspirin (acetylsalicylic acid) led all coal-tar medicinals in quantity produced with an output, by 4 firms, of 1,525,795 pounds, compared with 1,482,998 pounds in 1922. Sales in 1923 were 1,337,998 pounds, valued at $1,088,977. This shows an increase in the price per pound from 74 cents in 1922 to 81.3 cents in 1923. Acetanilide, of which 564,498 pounds were produced by 4 firms, ranked second in quantity manufactured; total sales were 520,390 pounds, valued at $156,111, or 30 cents per pound. This shows a large increase in production over 1922, when 222,517 pounds were recorded.

Sodium salicylate, of which 416,382 pounds were produced, ranked third, with sales of 410,840 pounds, valued at $165,759. Phenol sulphonates (calcium, sodium, zinc, etc.), with a production of 208,902 pounds, ranked fifth. Other medicinals showing a relatively large production were phenolphthalein, salol, acetphenetidin, chloramine T, and cincophen.

Some of the medicinals reported in 1923 but not in 1922 are: sulphoarsphenamine, with a production by 4 firms of 164 pounds; peralga (1-diethylbarbituric-2-amidopyrene) and dihydroxy-dihydroxy-mercury benzophenone sodium sulphonate.

FLAVORS AND PERFUME MATERIALS

Description.—There is no sharp line of demarcation between these two classes of coal-tar chemicals, many of them being used both as flavors and perfumes; a separate classification is, therefore, in certain cases arbitrary. They serve as perfume materials for soaps and other toilet articles, and for other similar products, and as flavors for food and food products.

Production.—The total production of flavors in 1923 was 1,458,024 pounds; sales amounted to 1,442,387 pounds, valued at $1,780,313. In 1922, production amounted to 1,215,668 pounds.

Some of these products show a large increase in production, notably saccharin, used as a sugar substitute, and methyl salicylate, used largely as an artificial wintergreen flavor. The total 1923 production of methyl salicylate was 967,505 pounds.

The output of perfume materials in 1923 was 1,365,449 pounds, this being a large increase over 1922, when 793,148 pounds were

produced. Sales of these products in 1923 totaled 1,275,432 pounds, valued at $789,431.

Diethylphthalate ranked first in quantity of production and value of sales. The production in 1923 was 1,250,280 pounds; sales were 1,170,939 pounds, valued at $592,039. Production in 1922 was 725,984 pounds. Diethylphthalate is used under a special formula as an ethyl alcohol denaturant. The production of benzyl benzoate for 1923 was 29,185 pounds, an increase over that of 1922. Two other benzyl compounds showing increases in production for 1923 are benzyl alcohol and benzyl acetate, with a production of 12,080 and 21,937 pounds respectively.

Other products of this group made in quantity are amyl salicylate, diphenyl oxide, benzylidene acetone, methyl anthranilate, and phenyl acetic acid. The production of phenyl ethyl alcohol shows a large increase over the 1922 figure, but the quantity produced is still far below the domestic consumption. Production of phenylacetic aldehyde and cinnamyl alcohol is also below the domestic demand; artificial musks are not reported at all, although large quantities are imported.

Among products reported in 1923 but not in 1922 were benzyl propionate, para cresyl acetate, para cresyl phenyl acetate, dibenzyl ketone, ethyl fumarate, and phenyl glycol acetate.

SYNTHETIC PHENOLIC RESINS

The manufacture of synthetic resins is distinctly an American development and has resulted only from the most careful research and engineering skill. These were first made by the condensation of phenol with formaldehyde and ammonia and later with hexamethylenetetramine, but in recent years para-cumarone, as well as cresol, has been used as a base. Synthetic resins are used as a substitute for amber in the manufacture of pipe stems, cigarette holders, and similar articles. There is also a large consumption for electric insulating materials and for varnishes and lacquers. The consumption for radio equipment has shown a rapid increase. With a total production for 1922 of 5,944,133 pounds, sales were 6,415,931 pounds, valued at $4,315,196. Production for 1923 shows an increase, but figures cannot be published without disclosing the operations of individual concerns.

SYNTHETIC TANNING MATERIALS

The synthetic tanning materials known as "syntans" are of very recent development, having come into commercial use in Germany and England since 1912. They give considerable promise for use in the tanning of leather in conjunction with natural tanning extracts.

Synthetic tans are made by condensation of certain coal-tar derivatives, such as the sulphonated phenols, cresols, and naphthols, with formaldehyde in the presence of an acid. They are commonly used in conjunction with the natural tanning extracts. Their use is reported to result in (1) an economy of the time required for tanning, (2) a satisfactory leather of light color, and (3) a reduction in the amount of natural extract required.

The total production in 1922 was 1,910,519 pounds, with sales amounting to 1,981,588 pounds, valued at $103,598. Production for 1923 shows an increase.

The combined production of synthetic phenolic resins and synthetic tanning materials in 1923 was 9,763,685 pounds, with sales amounting to 10,068,431 pounds and valued at $5,816,590.

STATISTICS OF PRODUCTION

TABLE 12.—*Production and sales of dyes and other finished coal-tar products, 1923*

[The number in the first column identifies the dyes according to the 1914 edition of the Schultz tables. The second column gives the common name of the product. The numbers in the third column refer to the numbered alphabetical list of manufacturers printed on page 195. An X signifies that a manufacturer did not consent to the publication of his identification number in connection therewith. A blank in the fourth and fifth columns indicates that the sales figures can not be published without revealing information in regard to the output of individual firms. A blank in the seventh column indicates that the production of the corresponding dye in the United States can not be published without revealing information in regard to the output of individual firms. The figures thus concealed are, however, included in the total.]

Schultz No.	Common name	Manufacturers' identification number according to list on p. 195	Sales			Production
			Quantity	Value	Average price per pound	
	Total finished coal-tar products.		*Pounds* 115,297,586	$65,898,177	$0.57	*Pounds* 122,950,171
	NITROSO DYES					
4	Naphthol green	6, 64				
	NITRO DYES					
7	Naphthol yellow S	32, 91, 96, 184	47,578	45,135	.95	44,508
8	Pigment chlorine	190				
	STILBENE DYES					
9	Direct yellow R	6, 7, 32, 39, 70, 80, 131, 137, 146, 147.	506,785	412,343	.81	569,910
10	Stilbene yellow	63, 70, 80				
11	Chloramine orange G	6, 7, 70, 80, 131, 137	144,421	175,494	1.22	147,422
	PYRAZOLONE DYES					
19	Fast light yellow	7, 63, 88, 131, 133, 151.				112,752
22	Xylene yellow	39, 151				
23	Tartrazine	27, 88, 131, 151, 183, 184, 205.	712,329	618,163	.87	735,608
29	Eriochrome red B	63, 133				
	AZO DYES					
	MONOAZO DYES					
32	Butter yellow	7, 32, 45, 91, 137, X	96,191	48,259	.50	101,249
33	Chrysoidine Y	6, 7, 12, 27, 32, 45, 63, 88, 91, 131.	569,596	332,768	.58	545,836
34	Chrysoidine R	6, 12, 32, 45, 63, 64, 88, 91, 131.	167,524	95,767	.57	152,370
35	Sudan G	45				
36	Sudan I	32, 91, 131, 137, X	32,115	27,899	.87	36,668
37	Croceine orange	6, 39, 107, 131	38,819	22,521	.58	
38	Orange G	27, 32, 63, 131, 167	123,950	73,178	.59	119,639
40	Chromotrope 2R	131, 133, 137, X	10,736	13,238	1.23	29,444
41	Fast acid fuchsine B	7, 32, 36, 46, 131, 137	20,879	13,474	.65	22,082
42	Amino naphthol red G	6, 7, 32, 39, 63, 80, 88, 131, 146.	145,149	102,913	.71	159,889
45	Brilliant lake red R	121				
48	Alizarin yellow G	7, 27, 39, 46, 63, 88, 131, 140, X, X, X.	348,043	182,499	.52	395,361
56	Paranitraniline red	X				
57	Chromotrope 2B	137				
58	Alizarin yellow R	6, 7, 27, 39, 46, 63, 88, 137, 167, X, X.	175,417	106,387	.61	168,777
61	Victoria violet	6, 39, 80, 131, 137, 146, X.	136,155	142,766	1.05	172,925
64	Lanafuchsine	137, 167				
65	Azo coralline	80, 88				

TABLE 12.—*Production and sales of dyes and other finished coal-tar products, 1923*—Continued

Schultz No.	Common name	Manufacturers' identification number according to list on p. 195	Sales			Production
			Quantity	Value	Average price per pound	
	AZO DYES—Continued					
	MONOAZO DYES—continued		*Pounds*			*Pounds*
66	Amino naphthol red 6B	6, 7, 32, 63, 80, 88, 131, 137.	112,915	$88,402	$0.78	126,503
67	Chromotrope 6B	131, 137, 146	97,299	78,336	.81	108,408
68	Spirit yellow R	32, 45, 131, X	46,735	44,298	.95	43,926
72	Pigment orange R	190				
73	Helio fast red	X				
76	Sudan II	7, 32, 45, 63, 91, 131	41,915	44,768	1.07	43,817
82	Ponceau 2R	6, 7, 27, 32, 39, 63, 131, 137, 167.	419,573	241,334	.58	342,140
88	Acid anthracene brown R	63				
89	Metachrome brown B	6, 27, 63, 131, X	323,871	223,353	.69	308,559
93	Sudan R	137				
94	Azo eosine C	137				
102	Diamond flavine G	25, 88, 133, X	14,890	12,021	.81	26,003
105	Sudan brown	7				
106	Autol red RLP	32				
112	Bordeaux B	6, 7, 27, 32, 39, 45, 88, 131, 137, 167.	215,552	156,208	.73	223,714
114	Chromotrope 10B	7, 137				
117	Erica 2 GN	70, 147				
119	Diamine rose	19, 70, 131, 147				
121	Erica B	70, 137				
134	Metanil yellow	7, 39, 63, 64, 88, 91, 131.	412,255	330,349	.80	405,563
137	Acid yellow G	7, 63, 64, 131	4,453	3,875	.87	4,614
139	Orange IV	184				
141	Azo yellow	7, 32, 63, 64, 88, 131, 184.	137,892	145,779	1.06	138,012
143	Tropaeoline	91				
144	Orange I	32				
145	Orange II	6, 7, 27, 32, 39, 45, 63, 91, 131, 135, 146, 167.	1,442,413	526,736	.37	1,617,668
147	Azo fuchsine 6B	63				
151	Orange R	7, 63, 91, 131	77,157	32,436	.42	88,781
152	Permanent red 4B	39, 63, 121	48,233	126,039	2.61	68,435
153	Lake red C	121, 167, 170	143,932	196,583	1.37	160,791
154	Palatine chrome brown	25, 46, 107, 131, 133	35,411	38,581	1.09	38,254
155	Acid alizarin garnet R	6, 25, 131				
156	Palatine chrome violet	25, 63, 88, 131, 133	7,801	8,502	1.09	4,289
157	Diamond black PV	88, 131				
158	Chrome brown RR	46				
159	Acid alizarin black R	25				
160	Fast brown N	88				
161	Fast red A	7, 27, 32, 39, 63, 91, 131, 137, 140, 167,	221,263	171,915	.78	225,461
163	Azo rubine	6, 7, 32, 39, 45, 63, 88, 107, 131, 137,	518,908	440,008	.85	526,596
164	Fast red VR	6, 39, 131, 133, 137	155,405	197,888	1.27	205,646
166	Fast red E	6				
167	Croceine scarlet 3 BX	39				
168	Amaranth	32, 39, 63, 131, 137, 167.	50,863	36,263	.71	45,246
169	Cochineal red	27, 32, 63, 131, 167				
173	Lithol red R	28, 39, 66, 167, 170, 190, X.	273,570	315,614	1.15	265,787
177	Mordant yellow	6, 39, 131	60,728	39,208	.65	38,722
178	Crumpsall yellow	131				
179	Lake bordeaux B	190				
180	Eriochrome blueblack B	39, 96, 107, 131, 133				
181	Salicine black U	6, 7, 19, 25, 32, 39, 45, 63, 88, 131, 133, 137, 167, X	1,290,536	686,266	.53	1,242,283
183	Eriochrome black T	25, 39, 63, 96, 133				
184	Eriochrome black A	39, 63, 88, 131, 133	118,143	92,374	.78	162,962
186	Lanacyl violet B	63				
188	Sulphon acid blue R	6, 39, 63, 88, 131, 133	282,023	240,261	.85	362,736
189	Sulphon acid blue B	131				
190	Alkali brown	147				
193	Stanley red	147				
194	Thiazine red R	70, 137				
195	Rosophenine SG	70, 147, X	11,869	21,636	1.82	13,715

TABLE 12.—*Production and sales of dyes and other finished coal-tar products, 1923*—Continued

Schultz No.	Common name	Manufacturers' identification number according to list on p. 195	Sales			Production
			Quantity	Value	Average price per pound	
	AZO DYES—(Continued)					
	MONOAZO DYES—continued		*Pounds*			*Pounds*
197	Thiazine red G	80, 88, 147	1,076	$1,575	$1.46	
198	Mimosa C	19, 137, 147	706	1,234	1.75	2,183
200	Lake red D	190				
202	Palatine chrome red B	7, 32, 39, 63, 131, 137, 190, X.	91,816	90,677	.99	106,833
	DISAZO DYES					
209	Terra cotta F	88				
211	Resorcin brown	6, 7, 63, 80, 91, 131, 140, 146, X, X.	160,944	128,076	.80	169,340
213	Fast brown	7, 32, 131, X				25,116
217	Agalma black 10B	6, 7, 25, 32, 39, 46, 63, 88, 107, 131, 137, 140, 146, 167, X.	2,377,290	1,694,148	.71	2,568,458
220	Palatine black	39				
221	Anthracene acid brown	63				
223	Sudan III	32				
227	Brilliant croceine	32, 63, 88, 131, 167				
228	Ponceau 5R	32				
229	Azo acid violet	64				
230	Cloth red 3G	63				
232	Sudan IV	7, 32, 39, 45, 91, 131, 137, X	37,253	34,576	.93	41,421
233	Cloth red B	7, 88				
234	Cloth red G	39, 64				
236	Wool red B	6, 39, 64, 131, 133	45,183	52,551	1.16	51,845
241	Neutral gray G	137				
246	Cloth scarlet G	64, 91				
247	Scarlet EC	7, 64, 131, 133	33,701	44,781	1.33	54,730
250	Milling orange G	64, 133				
257	Sulphoncyanine G	6, 63, 88, 131, 133	426,779	388,284	.91	481,141
261	Buffalo black 10B	6, 131, 133	28,657	26,600	.93	23,325
264	Fast sulphon black F	25, 88				
265	Sulphoncyanine black	63, 88, 131				
266	Naphthylamine black D	6, 63, 88, 137	11,673	10,026	.86	
270	Brilliant Croceine 9B	32				
274	Diaminogen	63				
275	Diamond black	6, 52, 63, 107, 131	176,662	152,800	.87	
276	Diamond green	6, 63, 88	13,184	14,748	1.12	12,122
279	Benzofast scarlet	63, 131, 137				
283	Bismarck brown	7, 12 32, 52, 63, 70, 88, 91, 131	200,677	120,457	.60	177,419
284	Bismarck brown 2R	6, 7, 12, 32, 39, 45, 52, 63, 64, 88, 91, 131, X	698,317	405,241	.58	672,544
288	Palatine chrome black	133				
289	Acid alizarin black SN	133				
294	Fast mordant yellow	6				
296	Benzo fast yellow	63				
297	Benzo fast pink 2BL	63				
303	Paper yellow	6, 7, 63, 131, 137	71,654	97,078	1.36	54,347
304	Chrysophenine G	7, 63, 70, 131, 137	413,494	423,892	1.03	447,963
307	Congo red	7, 63, 107, 131, 137, 140	504,068	297,725	.59	590,548
311	Orange TA	131				
312	Congo corinth G	6, 7, 32, 52, 88, 131, 137, 140	157,659	168,633	1.07	144,321
313	Congo rubine	39, X				
319	Diamine scarlet	63, 131, X	32,184	51,684	1.61	36,095
322	Trisulphon violet B	39, 131, 137	42,694	50,282	1.18	39,605
323	Dianil blue R	147				
327	Diamine violet N	7, 25, 32, 39, 63, 107, 131, 137, 140, X	41,269	57,477	1.39	41,177
328	Diamine black R O	7				
332	Benzo fast red	63				
333	Oxamine black BHN	6, 7, 25, 32, 39, 63, 107, 131, 137, 140, 146	866,800	634,140	.73	905,491
336	Benzo cyanine R	131				

TABLE 12.—*Production and sales of dyes and other finished coal-tar products, 1923*—Continued

Schultz No.	Common name	Manufacturers' identification number according to list on p. 195	Sales			Production
			Quantity	Value	Average price per pound	
	DISAZO DYES—continued		*Pounds*			*Pounds*
337	Benzo blue 2B	6, 7, 25, 32, 39, 45, 46, 131, 137, 140, 146, X, X	883, 882	$360, 164	$0. 41	1, 065, 539
340	Benzo orange R	39, 46, 63, 88, 137	82, 891	66, 235	.80	96, 484
341	Crumpsall direct fast red R	X				
342	Chrysamine G	7, 39, 46, 63, 131, X	19, 184	21, 996	1. 15	27, 455
343	Diamine fast red F	6, 7, 25, 32, 39, 63, 70, 107, 131, 137, 140	75, 967	90, 945	1. 20	63, 383
344	Diamine brown	6, 7, 25, 32, 39, 63, 70, 80, 107, 131, 137, 140	169, 148	160, 209	.95	127, 868
349	Diamine brown B	140, X				
351	Cresotine yellow G	52, 131				
355	Anthracene red	137				
362	Oxydiamine orange	64, 131				
363	Benzopurpurine 4B	7, 32, 39, 63, 107, 131, 137.	413, 250	368, 923	.89	470, 51
365	Benzopurpurine B	6, 52				
378	Trisulphon blue R	137				
382	Azo mauve B	131				
384	Chicago blue 2R	63				
385	Oxamine blue 4R	131				
386	Benzo blue BX	39, 131, 137	41, 249	35, 373	.86	35, 216
391	Benzo blue 3B	7, 12, 32, 39, 45, 107, 131, 137.	174, 141	94, 072	.54	215, 587
392	Toluylene orange G	131, 137				
393	Diphenyl brown 3 GN	45				
400	Acid anthracene red	X				
405	Benzopurpurine 10B	7, 63, 131, 137	25, 964	43, 280	1. 67	33, 837
410	Benzazurine G	63, 131, 137				
415	Dianil blue G	137				
419	Chicago blue RW	7, 39, 63, 131, 137	95, 427	143, 970	1. 51	111, 517
421	Oxamine blue B	131				
424	Chicago blue 6B	7, 63, 131, 137				
426	Benzamine pure blue	6, 7, 39, 63, 131, 137, 146.	225, 615	218, 222	.97	221, 905
	TRIAZO DYES					
436	Columbia black	6, 7, 39, 46, 63, 131	169, 970	161, 005	.95	177, 185
441	Diazo blue black RS	131, 137				
442	Direct black V	137				
456	Benzo fast blue	63				
462	Direct deep black EW	6, 7, 32, 39, 46, 63, 131, 137, 140, X.	6, 720, 905	2, 875, 928	.43	6, 957, 581
463	Erie direct black RX	6, 7, 39, 46, 63, 131, 137.	349, 659	180, 559	.52	455, 768
464	Erie direct green ET	7, 46, 52, 131	51, 495	43, 755	.85	37, 040
470	Chloramine green B	137				
471	Chloramine blue 3G	137				
473	Diamine black HW	7, 140, 147	4, 098	5, 002	1. 22	
474	Oxamine green B	6, 7, 32, 39, 52, 63, 70, 131, 137.	306, 023	250, 980	.82	312, 511
475	Oxamine green G	6, 12, 32, 39, 63, 137, 140, X, X.	84, 896	70, 526	.83	99, 869
476	Benzamine brown 3 GO	6, 7, 32, 39, 45, 52, 70, 88, 131, 133, 137, 140, X.	931, 242	596, 366	.64	999, 554
477	Congo brown G	7, 63, 88, 131, 137, 147, X.	207, 793	194, 688	.94	245, 198
480	Congo brown R	63				
	TETRAKISAZO DYES					
485	Benzo brown G	32, 52, 63.17 1' 40	154, 208	120, 914	'78	138, 437
487	Benzo brown B	70, 137				
	All other azo dyes		1, 948, 206	2, 287, 417	1. 17	2, 372, 765
	Total azo dyes		30, 292, 072	21, 597, 247	.71	32, 348, 948
	DIPHENYLMETHANE DYES					
493	Auramine	63, 77, 106, 131	393, 189	677, 192	1. 72	471, 359

TABLE 12.—*Production and sales of dyes and other finished coal-tar products, 1923*—Continued

Schultz No.	Common name	Manufacturers' identification number according to list on p. 195	Sales			Production
			Quantity	Value	Average price per pound	
	TRIPHENYLMETHANE DYES		*Pounds*			*Pounds*
495	Malachite green	63, 106, 131	178,271	$285,585	$1.60	183,684
499	Brilliant green	106, 131				
502	Guinea green	36, 63, 131				
503	Brilliant milling green B	131				
505	Light green	63				
506	Erioglaucine	131				
511	Para fuchsine	131				
512	Magenta (or fuchsine)	39, 55, 91, 98, 131, 157, X.	75,051	156,081	2.08	87,717
513	New fuchsine O	131				
515	Methyl violet	32, 55, 63, 91, 104, 131, 135, X.	563,579	702,515	1.25	578,183
516	Crystal violet	25, 63				
517	Methyl violet 5B	131				
521	Aniline blue	39, 91, 98				
524	Acid magenta	39, 98				
528	Fast violet 10B	36, 63, 137	21,413	46,063	2.15	15,541
530	Acid violet	36, 39, 63, 80, 131, 146	137,887	255,733	1.86	148,258
531	Eriocyanine	131				
536	Alkali blue	39, 55, 98, 131, 135, 157, 167, X.	157,877	377,527	2.39	154,845
537	Methyl blue for silk	91				
538	Methyl blue for cotton	98				
539	Soluble blue	39, 55, 98, 131	10,694	36,907	3.45	15,366
543	Patent blue V	131				
545	Patent blue A	36, 131				
548	Acid violet 6 BN	63				
555	Aurine	63, 155				
558	Victoria blue R	63				
	Total triphenylmethane dyes.		1,539,140	2,677,418	1.74	1,608,653
	DIPHENYL-NAPHTHYLMETHANE DYES					
559	Victoria blue B	25, 63				
562	Fast acid blue	63				
564	Naphthalene green V	131				
566	Wool green S	25, 63, 80, 88, 131, 146	382,427	317,370	.83	375,858
	XANTHONE DYES					
571	Rhodamine 6G	63				
573	Rhodamine B	63				
580	Fast acid violet B	63				
582	Fast acid violet A 2R	63				
585	Uranine	7, 56, 91, 135	957	2,978	3.11	2,398
587	Eosine	7, 56, 91, 135	100,745	185,814	1.84	80,648
590	Eosine BN	7				
592	Erythrosine B	7, 56, 63, 91, 135	8,506	41,973	4.94	7,250
593	Phloxine P	56				
596	Phloxine	63, 91				
597	Rose bengale B	63, 91				
599	Gallein	208				
600	Coerulein	208				
	Total xanthone dyes		267,511	555,071	2.08	254,639
	ACRIDINE DYES					
606	Phosphine	63, 91, 131, 151	86,500	166,667	1.93	122,853
	QUINOLINE DYES					
613	Quinoline yellow	26, 131, 137				
	THIOBENZENYL DYES					
615	Thioflavine S	147				
616	Primuline	19, 70, 80, 131, 137, 147, X.	224,784	157,912	.70	227,824
617	Columbia yellow	19, 70, 80, 131, 137, 147.	215,810	252,347	1.17	188,595

TABLE 12.—*Production and sales of dyes and other finished coal-tar products, 1923*—Continued

Schultz No.	Common name	Manufacturers' identification number according to list on p. 195	Sales			Production
			Quantity	Value	Average price per pound	
	OXAZINE AND THIAZINE DYES		*Pounds*			*Pounds*
622	Delphine blue B	7, 46, 131				
626	Gallocyanine	7, 27, 46, 131, 208	82,512	$159,279	$1.93	52,577
631	Chromocyanine V	131				
636	Prune pure	7				
649	Cotton blue or Meldola's blue.	7, 46, 107, 131	56,116	93,787	1.67	58,307
659	Methylene blue	27, 46, 131, 204	410,003	601,118	1.47	424,174
660	Methylene green	131				
667	Brilliant alizarin blue	80, 88				
	AZINE DYES					
672	Azo carmine	63				
679	Safranine	63, 131, 155	126,151	183,365	1.45	99,414
681	New fast gray	27, 137				
683	Safranine MN	131				
687	Rosolane O	63				
697	Induline (spirit-soluble)	19, 32, 39, 88, 91, 131	20,929	19,435	.93	12,086
698	Nigrosine (spirit-soluble)	19, 27, 32, 88, 91, 131, 133.	284,235	148,006	.52	342,739
699	Induline (soluble in water)	19, 39, 88, 91, 131	89,500	74,130	.83	113,817
700	Nigrosine (soluble in water).	19, 27, 88, 91, 131, 133.	1,374,363	633,742	.46	1,389,106
	SULPHUR DYES					
720	Sulphur black	12, 46, 63, 88, 94, 107, 131.	15,212,142	3,017,207	.20	16,276,409
	Sulphur blue	12, 18, 46, 63, 88, 107, 131, 137, X, X, X.	1,213,085	610,171	.50	1,349,864
	Sulphur brown	7, 12, 39, 46, 47, 56, 63, 88, 107, 131, 165, 173, 187, 206, X, X.	2,049,475	806,684	.39	2,203,893
	Sulphur green	6, 12, 46, 63, 107, 131, 137, 165, 206	164,344	140,651	.86	
	Sulphur maroon	6, 12, 46, 63, 107, 206.	387,158	297,104	.77	373,899
	Sulphur olive	19, 46, 47, 63, 70, 88, 137, 173, 206.	168,356	85,687	.51	220,093
	Sulphur orange	46, 88, 173, 206	47,083	23,107	.49	
	Sulphur tan	6, 39, 47, 88, 165, 206, X.	202,824	97,997	.48	255,877
	Sulphur yellow	12, 46, 63, 87, 88, 131, 137, 165, 173, X, X.	561,461	408,771	.73	670,023
	Total sulphur dyes		20,005,928	5,487,379	.27	21,558,469
	CARBAZOLE DYES					
748	Hydron blue R, G	63, 107				
	ANTHRAQUINONE DYES					
761	Indanthrene golden orange R.	63				
763	Indanthrene dark blue BO	63, 122, 137	25,130	50,167	2.00	
765	Indanthrene black and green B.	63, 122, 137	20,673	42,805	2.07	25,001
767	Indanthrene violet RR	63				
768	Indanthrene violet B	63				
778	Alizarin	18, 131				
779	Alizarin orange	18, 131				
780	Alizarin red S	18				
782	Alizarin brown	46, 63, 65, 131, 184, 190, 208, X.	134,941	167,294	1.24	157,416
784	Alizarin SX	131				
785	Alizarin GI	18, 137				
789	Anthracene blue WR	65, 84, 102, 131, 135	54,505	117,198	2.15	44,150
800	Anthracene blue	84				
838	Indanthrene blue RS	63, 137				
840	Indanthrene blue 3G	63				

TABLE 12.—*Production and sales of dyes and other finished coal-tar products, 1923*—Continued

Schultz No.	Common name	Manufacturers' identification number according to list on p. 195	Sales			Production
			Quantity	Value	Average price per pound	
	ANTHRAQUINONE DYES—continued		*Pounds*			*Pounds*
842	Indanthrene blue GCD	63, 137				
843	Indanthrene blue GC	137				
849	Indanthrene yellow	63, 137				
858	Alizarin saphirol B	88, 102, 131	272,471	$952,216	$3.50	309,124
862	Alizarin blue black	36, 65				
865	Alizarin cyanine green	36				
867	Indanthrene brown B	137				
	Total anthraquinone dyes.		1,952,601	3,438,677	1.76	2,123,966
	INDIGO AND ITS DERIVATIVES					
874	Indigo, synthetic (20 per cent).	62, 63, 131	25,492,201	5,884,712	.23	28,347,259
876	Indigo, white	46				
877	Indigo extract	7, 14, 63, 113, 131, X, X.	328,440	190,493	.58	330,810
880	Indigo RB	62				
881	Ciba blue 2B, 2BD	62				
882	Ciba blue G	62				
883	Indigo 6B	62				
	ANILINE BLACK GROUP					
923	Ursol	82, 167, X				
	FOOD DYES					
7	Naphthol yellow S	X				
23	Tartrazine	7, 27, 131, 198, X	53,801	188,608	3.51	58,117
83	Ponceau 3R	7, 131, X	17,694	96,068	5.43	16,098
144	Orange I	7, 27, 131, X	38,739	116,593	3.01	
168	Amaranth	7, 27, 107, 131, 198, X.	89,821	279,847	3.12	82,450
502	Guinea green B	131, 198				
505	Light green SF (yellowish)	131, 198				
515	Methyl violet	131				
592	Erythrosine	7, 131, X				
877	Indigo disulfonic acid	7, 131, X				6,498
	Yellow AB	7, 66, 91, 131, 175	7,168	18,852	2.63	6,523
	Yellow OB	7, 66, 91, 131, 175	9,108	24,682	2.71	7,586
	Total food dyes		228,686	860,077	3.76	230,343
	PHOTOCHEMICAL DYES					
	Orthochrome T	68				
	Pinacyanole	68				
	All other dyes	63, 147				
	Bacteriological, biological stains and indicators, and research chemicals.	41, 54, 68, 86, 99, 111, 131, 154, 172, 179, X.				
	Total dyes		86,567,446	47,223,161	.55	93,667,524

DYES NOT CLASSIFIED BY SCHULTZ NUMBER

Manufacturers were requested to report separately, in terms of their familiar pre-war designations, the production of dyes not classified by Schultz. The following table is a list of such dyes,

together with certain new dyes of American development for which there are no foreign equivalents:

Name of dye	Manufacturers' identification number according to list on page 195
Acid anthracene brown A, B, RH	88
Acid anthracene orange GR	80
Acid anthracene yellow GR	80
Acid chrome brown R	80
Acid black BA	6
Acid brown	X
Acid claret B	167
Acid naphthol blue black	39
Acid navy blue	140
Acid red OTH	137
Acid yellow HM	91
Alizarin black	208
Alizarin black GS paste	65
Alizarin blue IS	208
Alizarin brown 3R	167
Alizarin brown 5R	208
Alizarin green	X
Alizarin serge blue GS	65
Alizarin yellow 4G	7
Anthracene chrome black DNN	36
Anthranol chrome brown FB	133
Anthranol chrome green 3G	133
Anthranol chrome yellow DF extra	133
Anthranol chrome yellow SS	133
Anthrene blue GX	137
Anthrene jade green	137
Artificial silk black G	63
Atlantamine blue	12
Atlantamine green	12
Atlantamine red	12
Atlantamine yellow	12
Atlantole wood blue	12
Azo dark green	137
Azo eosine 2B	137
Azo fast violet 2R	131
Azo violet BS, 2B	6
Azo wool blue G, R	80
Benzo black LM	133
Benzo chrome brown G, R, 2R	7
Benzo chrome dark brown	7
Benzo fast black L, LM [1]	6, 63, 80
Benzo fast orange S	63
Benzo fast pink 2B	80
Benzo fast scarlet 4BA	63
Benzo rhoduline red B	63
Brilliant crocein FL	63
Bromo fluorescein	56, 135
Chloramine fast orange GR, GG, G3G	80
Chrome black	27, 46
Chrome black special	25
Chrome black A, T, BC, RX	X
Chrome green	6
Chrome green B	39, 70
Chrome green G	39
Chrome green SW	25, X
Chrome green SE, SW	25
Chrome red SW	X
Chrome yellow	6, 27, 137
Chrome yellow SS	88
Cindiazo blue B	39
Copper blue 2RX	6
Cotton brown R	6
Developed black 2BN, G	137
Diamine bordeaux B	63, 131
Diamine catechine	63
Diamine catechine 3G	131
Diamond green	80
Diamond red BHA	88
Dianol dark blue B	63
Diazo bordeaux 7B	63
Diazo fast red 5BL	63
Diazo fast red 7BL	63
Diazo indigo blue M	63
Diazo seal brown	X
Direct black GX	39
Direct blue 3RX	39
Direct blue 4R	39
Direct brown R	140
Direct brown GR, G2R, G3R	39
Direct dark brown B	80
Direct dark green	6
Direct fast blue B, R	39
Direct fast light blue FF	39
Direct fast orange R	39, 137
Direct fast orange RCL, 2R	39
Direct fast yellow 6GL extra	80
Direct fast yellow 2R, 2RCL	39
Direct navy R	140
Direct salmon red	X
Direct violet B conc. extra	X
Direct violet R conc	X
Dyelene chromate brown EBN	64
Empire coralline	X
Empire fast violet AA	X
Fast acid violet ERR extra	63
Fast chrome brown R	137
Furol DB	X
Helio bordeaux BL	63
Hydron pink FF	63
Indanthrene black BCS	137
Indanthrene blue BCS, 20 per cent paste	63
Indomine navy blue 2BM	133
Jet black APX	63
Marine blue SW	25
Midland vat cadet blue	62
Midland vat blue MB	62
Naphthanil red for printing	63
Navy blue T	27
Nerol black 2B	137
Oil brown I-2494	91
Oil brown	X
Oil brown R	7, 45
Oil brown H-8808	91
Oil orange	X
Oil orange Y-293	91
Oil red	19, X
Oil red C, S	203
Oil scarlet T	203
Oil yellow PHW, OB	91
Oil soluble yellow	203
Oxamine copper blue RRX	63
Oxydiamiogen OB	131
Pacco direct fast gray BL	X
Palachrome maroon	X
Palaside brown B	X
Paranol direct orange 9L	133
Permanent red R	190
Pluto orange G	88
Pontachrome brown R, SW	63
Pontachrome yellow SW	63
Pontamine diazo black H	63
Rosanthrene A, R	63
Rosanthrene orange	63
Scarlet 2RG	167
Silk black 4BF	39
Solamine blue FF	63, 137
Sudan orange	203
Sudan AT, AX, T	32
Sulphon acid black N2	80
Victoria fast violet 2R	88
Wool black B	137
Wool blue black	39
Wool blue G	36
Wool fast violet 2R	80
Zambesi black A	6
Zambesi black D	131
Zambesi black PC	39
Zambesi black V, VX [2]	39, 63, 131, 137

[1] Sales of Benzo fast black LM and L are 102,872 pounds, valued at $192,452.

[2] Sales of Zambezi black V and VX are 361,326 pounds valued at $470,320 and the production was 452,352 pounds.

Production and sales of dyes and other coal-tar products, 1923

Common name	Manufacturers' identification number according to list on page 195	Sales			Production
		Quantity	Value	Unit value	
COLOR LAKES					
		Pounds			*Pounds*
Black lakes	6, 37, 46, 50, 67, 92, 167, 168, 203, X.	565,097	$61,271	$0.11	587,344
Blue lakes	11, 22, 28, 37, 46, 59, 63, 67, 73, 90, 92, 100, 109, 112, 119, 162, 167, 168, 169, 170, 177, 188, 189, 190, X, X, X, X, X, X.	766,492	377,572	.49	770,751
Brown lakes	28, 37, 46, 59, 73, 100, 112, 168, 169, 177, 188, 189, 203, X.	222,950	20,502	.09	214,012
Eosine lakes	11, 22, 28, 59, 67, 73, 92, 100, 119, 162, 167, 168, 169, 170, 177, 188, 189, 190, 203, X, X, X, X, X, X, X, X.	486,864	335,093	.69	529,962
Green lakes	11, 22, 28, 37, 59, 63, 67, 73, 85, 90, 92, 100, 109, 119, 162, 167, 168, 169, 170, 177, 189, X, X, X, X, X, X, X.	626,403	181,481	.29	666,180
Lithol red lakes	11, 22, 28, 37, 46, 59, 63, 73, 90, 92, 100, 105, 112, 119, 162, 167, 168, 169, 170, 177, 188, 189, 190, 203, X, X, X, X, X, X.	706,479	495,101	.70	741,556
Maroon lakes	11, 22, 28, 37, 59, 63, 67, 92, 100, 105, 115, 116, 119, 123, 162, 167, 168, 169, 170, 177, 188, 189, 190, 199, 203, X, X, X, X.	1,229,610	392,308	.32	1,266,216
Orange lakes	11, 22, 28, 37, 59, 63, 67, 73, 92, 100, 109, 112, 119, 162, 167, 168, 169, 170, 177, 188, 189, 203, X, X, X, X, X, X, X, X.	585,292	150,548	.26	602,331
Para red lakes	11, 22, 28, 46, 50, 59, 63, 67, 92, 100, 105, 112, 115, 116, 119, 167, 168, 170, 177, 188, 189, 190, 199, 203, X, X, X, X, X.	3,196,651	1,018,090	.32	3,379,767
Red lakes	11, 22, 28, 37, 46, 50, 59, 63, 67, 73, 90, 92, 100, 105, 109, 112, 116, 119, 123, 162, 167, 168, 169, 170, 177, 188, 189, 190, 199, 203, X, X, X, X, X, X, X.	1,644,597	992,224	.60	1,689,027
Scarlet lakes	11, 22, 28, 37, 59, 63, 67, 73, 90, 92, 100, 105, 115, 116, 119, 123, 162, 167, 168, 169, 170, 177, 188, 190, 199, X, X, X, X, X, X, X.	1,047,206	393,442	.38	1,076,419
Violet lakes	11, 22, 28, 37, 46, 59, 63, 67, 73, 90, 92, 100, 109, 119, 162, 167, 168, 169, 170, 177, 188, 189, 190, 203, X, X, X, X, X, X.	387,176	378,876	.98	388,001

Production and sales of dyes and other coal-tar products—Continued

Common name	Manufacturers' identification number according to list on page 195	Sales			Production
		Quantity	Value	Unit value	
COLOR LAKES—continued					
Yellow lakes	11, 28, 37, 59, 63, 73, 92, 100, 109, 119, 167, 168, 169, 170, 177, 189, 203, X, X, X, X, X, X.	*Pounds* 1,162,542	$328,224	$0.28	*Pounds* 1,167,549
Total color lakes		12,627,359	5,124,732	.41	13,079,115
PHOTOGRAPHIC CHEMICALS					
Diaminophenol hydrochloride.	202				
Hydroquinol	124, 208, X	214,099	217,706	1.02	230,079
Methyl p-aminophenol sulfate (Metol).	68, X				
p-Hydroxyphenylglycine	68				
Total photographic chemicals.		321,083	443,697	1.38	343,289
MEDICINALS					
Acetanilide	122, 124, 136, 153	520,390	156,111	.30	564,498
Acetphenetidin	X				
Acriflavine (3:6-diamino-10-methyl acridine chloride).	1, 131				
Acriflavine, neutral	131				
Ammonium salicylate	93				
Anesthesiu. (*See* Benzocaine.)					
Apothesine (hydrochloride of diethylaminopropyl-cinnamate).	X				
Arsphenamine	1, 60, 108, 120, 126, 153, 174.	576	173,381	301.01	616
Aspirin (acetylsalicylic acid)	17, 62, 124, 128	1,337,998	1,088,977	.81	1,525,795
Atophan. (*See* Cincophen.)					
Benzocaine or Anesthesin (Ethyl p-amino benzoate.)	1, 126, 166	2,014	32,219	16.00	2,243
Benzyl benzoate. (*See* Perfumes.)					
Benzyl succinate	166, 175				
Bismuth betanaphthol	124, 136, 153	1,039	3,403	3.28	
Bismuth tribromophenol	75, 124, 136				
Butyn (p-amino benzoyl-gamma di normal butyl amino propanol sulfate).	1				
Chloramine T (sodium p-toluene sulfochloramide.	108, X				
Cincophen (phenyl cinchoninic acid) (Atophan).	1, 5, 27	31,911	299,010	9.37	32,710
Creosote benzoate	166				
Creosote carbonate	63, 142				
Dibromohydroxy mercury fluorescein, sodium salt of.	99				
Dichloramine T (p-toluene sulfone dichloramide).	108, 128				
Dihydroxy-dihydroxy mercury benzophenone sodium sulfonate.	99				
Formidine (methylene disalicylic acid derivative).	X				
Guaiacol carbonate	63				
Guaiacol crystals	63, 137				
Guaiacol liquid	63, 122, 142	5,710	12,591	2.21	5,793
Lithium benzoate	122				
Luminal (phenylethyl barbituric acid and sodium salt.	17				
Magnesium salicylate	93				
Methyl salicylate. (*See* Flavors.)					
Methylhydroxymethylester of salicylic acid.	17				
Monoglycol ester of salicylic acid.	17				
b-Naphthol benzoate	75				

Production and sales of dyes and other coal-tar products—Continued

Common name	Manufacturers' identification number according to list on page 195	Sales			Production
		Quantity	Value	Unit value	
MEDICINALS—continued		*Pounds*			*Pounds*
Neoarsphenamine	1, 60, 108, 126, 153, 174.	3,035	$1,029,121	$339.08	3,365
Neocinchophen. (*See* Tolysin.)					
Novaspirin (Methylenecitrylsalicylic acid).	17				
Peralga (l-diethylbarbarturic-2-amidopyrene).	5				
Phenacaine (ethenyl-p-diethoxy-diphenylamidine hydrochloride.	126				
Phenolphthalein	150, X				
Phenolsulfonates (calcium, sodium, zinc, etc.).	1, 118, 124, 153	196,173	61,914	.32	208,902
Phenolsulfonephthalein	86				
Phenylthiocarbamide	X				
Procaine (p-amino benzoyl-diethyl aminoethanol).	1, 126				
Proflavine (3:6 diamino acridine sulfate).	1, 131				
Proposote (creosote derivative).	X				
Resorcinol monoacetate	68				
Salicaine (salicyl alcohol)	27				
Salicylates, miscellaneous	153				
Salol (phenyl salicylate)	93, 124, 128	89,206	71,467	.80	98,597
Salophen (Acetylparaminophenol salicylate).	17				
Scarlet red	131				
Silver arsphenamine	126				
Sodium salicylate	62, 93, 124, 128, X	410,840	165,759	.40	416,382
Strontium salicylate	93				
Sulfoarsphenamine	120, 126, 153, 174	119	65,676	550.97	164
Tolysin- neocinchophen (p-methylphenyl-cinchoninic ethyl ester).	1–27				
Trypan blue	131				
Total medicinals		2,995,448	4,720,253	1.58	3,273,085
FLAVORS					
Coumarin (synthetic)	62, 75, 103, 128, X, X.	104,200	389,799	3.74	114,682
Ethyl benzoate	44, 75, 79, 141, 178, 191, 194, X.	1,041	1,611	1.55	980
Ethyl cinnamate	75, 79, 103, 178, 194				
Ethyl salicylate	75, 79, 178, 191, 194, X.				
Methyl cinnamate	75, 79, 103, 178, X, X.	815	3,725	4.57	796
Methyl salicylate	62, 79, 93, 103, 124, 178, X, X.	940,795	544,426	.58	967,505
Saccharin	93, X, X	363,048	661,913	1.82	340,944
Vanillin (*see* Part IV)	X				
Total flavors		1,442,387	1,780,313	1.23	1,458,024
PERFUME MATERIALS					
Acetophenone	75, 79, 103, 178, 192	238	855	3.59	277
Amyl benzoate	79				
Amyl salicylate	75, 79, 93, 103, 129, 178, 192, X.	11,562	16,569	1.43	9,217
Aubepine (Anisic aldehyde)	75, 78, 103, 178, 192	2,742	9,566	3.49	3,045
Benzophenone	75				
Benzyl acetate	75, 79, 103, 129, 178, 192, X.	21,179	27,635	1.31	21,937
Benzyl alcohol	103, 129, 178, 192, X	4,101	4,976	1.21	12,080
Benzyl benzoate	75, 79, 103, 124, 129, 178, 192.	26,372	37,545	1.42	29,185
Benzyl butyrate	79, 103				
Benzyl cinnamate	75, 79, 103, 178, 192				
Benzyl formate	178, X				
Benzyl propionate	79, 178, X				
Benzyl salicylate	178				
Benzylidine acetone	129, 178				

Production and sales of dyes and other coal-tar products—Continued

Common name	Manufacturers' identification number according to list on page 195	Sales			Production
		Quantity	Value	Unit value	
PERFUME MATERIALS—con.		*Pounds*			*Pounds*
Benzylphenyl acetate	178				
Bromstyrol	75, 79, 103, 178, 192	148	$718	$4.85	154
Butyl salicylate	79				
Cinnamic acid	79, 103, 178, 192				1,595
Cinnamic alcohol	178				
Cinnamic aldehyde	75, 78, 103, 178, 192	1,536	5,000	3.26	1,422
p-Cresyl acetate	75, 129				
p-Cresylphenyl acetate	75				
Dibenzyl ketone	75				
Diethyl phthalate	20, 75, 79, 103, 129, 178, 191, 192, X, X.	1,170,939	592,039	.51	1,250,280
Dimethyl acetophenone	178				
Dimethyl anthranilate	75, 178				
Dimethylbenzyl carbinol	75				
Dimethyl hydroquinone	75				
Dimethyl resorcinol	178				
Diphenylmethane	79, 178, 192				393
Diphenyloxide	178, X				
Ethyl fumarate	191				
Ethylphenyl acetate	178				
Ethylphenyl ether	79				
Hydratropic aldehyde	178				
Indol	75				
Isobutyl anthranilate	75				
Isobutyl indol	75				
Isobutylphenyl acetate	75, 129				
Isobutyl salicylate	178				
Methyl acetophenone	178				
Methyl anisate	178				
Methyl anthranilate	20, 62, 75, 103, 178, 186, 192.	1,564	5,247	3.36	2,554
Methyl benzoate	44, 75, 79, 141, 178, X.	172	254	1.48	24
p-Methylbenzyl acetate	75				
p-Methylbenzyl anthranilate	75				
Methyl p-cresol	178				
Methyl p-cresyl ether	79				
Methyl guaiacol	178				
Methylphenyl acetate	75, 79, 103, 129, 178, 192, X.	1,014	5,120	5.05	1,285
Methylphenyl ether	79				
Methylphenyl glycidate	75				
Methyl-p-tolyl ketone	75				
b-Naphthyl anthranilate	75				
Nerolin (b-naphthol ethyl ether).	75, 79, 178				
Nonyl anthranilate	75				
Phenylacetic acid	79				
Phenylacetic aldehyde	75, 103, 178, 192	453	4,615	10.19	457
Phenylethyl acetate	75, 103, 178, 194				
Phenylethyl alcohol	62, 75, 103, 178, 192, X.	799	5,167	6.47	1,238
Phenylethyl benzoate	178				
Phenylethyl formate	178				
Phenylethyl phenyl acetate	178				
Phenylethyl propionate	178				
Phenylglycol acetate	75				
Phenylpropyl alcohol	194				
Phenylvinylethylenemethyl ketone.	178				
Santalylphenyl acetate	75				
Skatol (methyl indol)	75, 178				
Sodium cinnamate	79				
Tetrahydroparamethyl quinoline.	75				
Yara yara (b-naphthol methyl ether).	79, 178				
All other perfumes	X				
Total perfumes		1,275,432	789,431	.62	1,365,449
Synthetic tanning materials	107, 207, X	10,068,431	5,816,590	.58	9,763,685
Synthetic phenolic resins	16, X				

Employees and Rates of Pay

The number of employees receiving specified rates of pay on December 18, 1923, or on the nearest representative date for which this information could be obtained, as reported by 181 of the 206 firms manufacturing coal-tar products in 1923, is contained in Table 13. The 25 firms not reporting either conducted a business in which coal-tar products were not the primary articles of manufacture or they did not have separately organized departments dealing therewith.

According to the Bureau of the Census, the number of firms engaged in the manufacture of coal-tar colors and other products in 1914 was 7, with 528 employees, divided as follows: Salaried employees, 130; wage earners (average number), 398. In 1923 there were 181 firms reporting 14,841 employees. This represents a decrease of 1,418 from 1922, which in turn is an increase of 2,967 over 1921.

The chemists and technically trained men in 1923 constituted 12.7 per cent of all employees, as compared with 10.8 per cent in 1922. Of the 1,882 men of this class in 1923, 28.27 per cent received $50 or more but under $75 per week, 23.32 per cent received $75 per week and over, 9.83 per cent received $45 or more but under $50 per week. Of those without technical training, 21.99 per cent received $30 but under $35 per week, 19.97 per cent received $25 but under $30, 16.39 per cent received $35 but under $40, 15.58 per cent received $20 but under $25. In general, the wages of 1923 for chemists and technically trained men showed a small decrease from those of 1922, while for all men without technical training there was a large increase during the same period. Table 13 compares specified rates of pay of technically trained men with those of men not having such training. Among the technically trained men there was an increase of 0.51 per cent in the pay of the group receiving $75 per week and over and a small decrease in the groups receiving $35 to $40, $40 to $45, $45 to $50, and $50 to $75. Of men without technical training there was an average increase of about 25 per cent in the weekly wages of the three classes receiving $25 to $30, $30 to $35, and $35 to $40 per week.

As previously stated, the dye and coal-tar chemical industry has probably a larger proportion of technically trained men than will be found in any other manufacturing industry in the United States.

Table 13.—*Employees and rates of pay, dye and coal-tar chemical industry, 1923*

Wages per week	Number of employees at each specified wage engaged in manufacturing operations			Percentage receiving each specified wage		Percentage receiving each specified wage or more	
	Chemists and technically trained men	Men without technical training	All employees	Chemists and technically trained men	Men without technical training	Chemists and technically trained men	Men without technical training
Under $10	2	74	76	0.11	0.57	100.00	100.00
$10 but under $15	16	348	364	0.85	2.69	99.89	99.43
$15 but under $20	37	773	810	1.97	5.96	99.04	96.74
$20 but under $25	74	2,018	2,092	3.93	15.58	97.07	90.78
$25 but under $30	110	2,588	2,698	5.84	19.97	93.14	75.20
$30 but under $35	173	2,850	3,023	9.19	21.99	87.30	55.23
$35 but under $40	178	2,123	2,301	9.46	16.39	78.11	33.24
$40 but under $45	136	1,108	1,244	7.23	8.55	68.65	16.85
$45 but under $50	185	643	828	9.83	4.96	61.42	8.30
$50 but under $75	532	414	946	28.27	3.19	51.59	3.34
$75 and over	439	20	459	23.32	0.15	23.32	0.15
Total	1,882	12,959	14,841	100.00	100.00		

TABLE 13.—*Employees and rates of pay, dye and coal-tar chemical industry, 1923*—Continued

Wages per week	Percentage receiving each specified wage					
	Chemists and technically trained men			Men without technical training		
	1923	1922	Increased percentage	1923	1922	Increased percentage
Under $10	100.00	100.00		100.00	100.00	
$10 but under $15	99.89	99.83	0.06	99.43	99.33	0.10
$15 but under $20	99.04	99.09	[1] .05	96.74	95.92	.82
$20 but under $25	97.07	97.10	[1] .03	90.78	75.89	14.89
$25 but under $30	93.14	92.94	.20	75.20	46.73	28.47
$30 but under $35	87.30	84.22	3.08	55.23	24.60	30.63
$35 but under $40	78.11	78.41	[1] .30	33.24	11.62	21.62
$40 but under $45	68.65	71.86	[1] 3.21	16.85	5.61	11.24
$45 but under $50	61.42	62.01	[1] .59	8.30	2.29	6.01
$50 but under $75	51.59	52.74	[1] 1.15	3.34	.96	2.38
$75 and over	23.32	22.81	.51	0.15	.06	.09

[1] Decrease.

RESEARCH WORK

Of the 206 firms engaged in 1923 in the manufacture of dyes and other coal-tar chemicals, 65 had separately organized research laboratories for the solution of technical problems and for the development or discovery of new products. The total cost of the research work carried on in these laboratories, together with that done in laboratories not separately organized for research, was $2,085,901. This figure is about the same as the amount ($2,172,508), expended in 1922 for this purpose. For the first time the Tariff Commission's census of 1923 has obtained not only the total cost of the research work carried on by the companies, but the net cost of that work chargeable to coal-tar products alone, amounting in 1923 to $1,900,281. The cited figures are doubtless an understatement of the real cost of experimental work, since they do not include, in all cases, the cost of research forming a part of manufacturing operations and not charged against research on the books of the companies.

The value of the finished coal-tar products produced in 1923 was about $65,000,000, not including crudes or intermediates. The foregoing figures give some indication of the large expenditure for research work considered necessary if the industry is to be self-contained and kept on a stable, efficient basis of operation. The coal-tar chemical industry must not only keep in view, as in the past, the development of products already known but must always be alert to the discovery of new products if it is to maintain a competitive position in the world's markets.

PART III

DYES IMPORTED FOR CONSUMPTION IN THE UNITED STATES, 1923

PART III

DYES IMPORTED FOR CONSUMPTION IN THE UNITED STATES, 1923

INTRODUCTORY

Since 1919 the United States Tariff Commission has compiled a detailed census of dye imports similar to that published by the Department of Commerce under the title "Artificial Dyestuffs used in the United States (fiscal year 1913 and 1914)," commonly known as the "Norton import census."

The commission first compiled such statistics for use in the administration of section 501, title 5, of the tariff act of September 8, 1916, which made the continuance of specific duties on coal-tar products, after September 8, 1921, dependent upon the production in the United States of as much as 60 per cent in value of the consumption of these products. As the information was found to be of direct value to manufacturers, consumers, and importers, as well as to the commission itself, in considering the tariff aspects of the coal-tar chemical industry, the annual census of imports has been continued.

Through cooperation with the Treasury Department the invoices covering dye importations through the various ports of the United States, with the exception of New York, have been sent to the commission for tabulation. In the year 1923, the monthly import statistics for the port of New York were compiled and published under a cooperative arrangement between the respective Chemical Divisions of the Department of Commerce and the Tariff Commission. In obtaining the final 1923 figures shown in this report, the monthly data previously available for the port of New York were rechecked and the statistics for the warehouse withdrawals completed for that year. Data were also obtained for imports through ports other than New York.

In tabulating the statistics the commission has followed in the main the "Schultz Farbstoff Tabellen," which are based upon the chemical composition of the dye. Certain types were also identified according to the "Colour Index" issued by the British Society of Dyers and Colourists, the Norton census, and other sources of information in the files of the Tariff Commission. Dyes identified by Norton as "a, b, and c" classes under a given Schultz number are listed under that number (without subdivision) except in a few instances in which they had been incorrectly designated. Dyes included under these "a, b, and c" classes are not always chemically identical with the original Schultz types. Such dyes as could not be identified by Schultz numbers are classified by the ordinary method of application, as follows; Acid, basic, direct, lake and spirit-soluble,

mordant and chrome, sulphur, and vat.[1] In many cases the classification of a dye by its method of application is arbitrary, as certain colors may be applied by either of two methods. A few dyes could not be classified either by the Schultz tables or by the method of application, and are therefore listed under the heading "Unclassified and unidentified dyes."

The rate of exchange used in converting foreign invoice values to United States currency was either the rate given on the invoice or, in comparatively few cases, the exchange value published by the Treasury Department for the month in which consular certification occurred.

Summary of Imports of Dyes in 1923

The total imports of coal-tar dyes during the year 1923 were 3,098,193 pounds, valued at $3,151,363, as compared with 3,982,631 pounds, valued at $5,243,257, for 1922.

Of the total imports in 1923, 47 per cent came from Germany, 28 per cent from Switzerland, 12 per cent from Italy, 6 per cent from France, 4 per cent from England, and 3 per cent from other countries.

Table 16 shows the quantity and the value (when publishable) of individual dyes imported in 1923. Table 14 is a summary of dyes imported from 1920 to 1923, inclusive, classified according to their method of application. Table 15 gives the quantity of each of the leading dyes imported in 1923, compared with corresponding imports for the years 1922, 1921, and 1914.

Swiss dyes.—The coal-tar dyes imported into this country from Europe fall largely into two groups, (1) dyes shipped directly from foreign factories, chiefly German and Swiss products, and (2) reparation dyes delivered by Germany in payment to the Allies and subsequently resold and shipped to the United States and other countries. In addition, there is a small percentage of dye imports originating with jobbers in the different foreign countries. Swiss dyes constitute 28 per cent, or 867,494 pounds, of total imports during 1923.

The prominent position maintained in the United States by Swiss dyes calls for a brief review of Switzerland's export trade. In 1913 the total quantity of Swiss dyes exported was 19,458,902 pounds, valued at $5,549,752; in 1920, the year of maximum export, 23,739,794 pounds, valued at $35,411,115, were exported.

Prior to the war the value of Swiss exports of dyes was slightly more than 10 per cent of the total value of Germany's dye exports. The proportion of Swiss exports to Germany at that time is significant, averaging approximately one-fifth of the total. Since the war, however, exports of Swiss dyes to Germany have been small.

From a broad economic viewpoint the Swiss dye industry is not self-contained or economically independent, on account of lack of coal and coke and their products, as well as other raw materials. Prior to the war many of its essential raw materials were imported from Germany. Since the war the situation has been materially changed, raw materials having become available from Great Britain, France, the United States, Czechoslovakia, and, more recently, again from Germany. Dye producers in Switzerland to-day enjoy an open competitive market wherein to purchase their raw materials.

[1] In nearly every case vat dyes have been reduced to a single strength.

In 1922 domestic imports of dyes were larger than in 1923, totaling for the former year 3,982,631 pounds, with an invoice value of $5,243,257. Of these, Swiss dyes constitute 39 per cent by quantity and 41 per cent by value. Most of the remainder were of German manufacture. In 1923 Swiss dyes, amounting to about one-half of the above quantity, represented 28 per cent of the total imports. Notwithstanding this decrease, the Swiss dye manufacturers secured a much greater share of the domestic import trade than would have been anticipated from the size of the Swiss industry, as compared with that of Germany. The recent increases reported in the selling prices of German dyes should favor increased exports of Swiss dyes. The reduction in the ad valorem duty on September 22, 1924, from 60 to 45 per cent will also tend to increase domestic imports of the higher-cost special types, such as are manufactured by the Swiss industry.

The prominence of Swiss dyes in the domestic market is not entirely a recent development, as the United States received about one-fifth of the total Swiss exports in 1914.

During the period of licensed control of dye imports under the Trading With the Enemy Act and up to the passage of the Dye and Chemical Control Act on May 27, 1921, licenses were refused for the importation of competitive types of enemy origin, but were granted for competitive types of nonenemy origin. This resulted in an extensive use of Swiss dyes in many of the textile mills of this country. Buyers consequently became well acquainted with Swiss products, and their use continued to a considerable extent even after the German dyes were placed on equal terms with respect to import facilities.

The Swiss have an excellent variety of dyes, consisting mainly of those of relatively high cost and special type, for which the demand is comparatively small. Indigo, however, is an important bulk color produced in Switzerland. An efficient manufacturing and distributing organization and the advantage of long experience favor the development of the Swiss industry.

An examination by class of application of the 66 leading dyes imported into the United States in 1923 shows that 23 of them were wholly or largely of Swiss manufacture. These include both competitive and noncompetitive products, as regards American manufacturers. The leading Swiss dyes imported in 1923 are as follows:

Acid:
- Xylene light yellow.
- Erioglaucine.
- Eriocyanine.
- Polar red.
- Polar yellow.

Mordant and chrome:
- Gallamine blue.
- Alizarin light blue B.
- Omega chrome brown.
- Erio chrome flavine A.

Direct:
- Trisulphon browns.
- Diazamine blue.
- Diphenyl brown BN.
- Chlorantine fast brown.
- Chlorantine fast orange.

Vat:
- Ciba violet B.
- Ciba scarlet.
- Ciba bordeaux B.

Basic:
- Phosphine.
- Rhodamine B.
- Rhodamine 6G.

Sulphur:
- Eclipse brown.
- Thional brown G.
- Pyrogene blue.
- Thional yellow.

Dyes imported from Italy.—In addition to the imports of dyes originating in plants of foreign manufacturers, a significant portion of domestic imports was made up of German reparation dyes resold by the countries receiving them and purchased by American importers. In 1923, 12 per cent, by quantity, of total domestic imports of dyes came from Italy, and examination of the individual imports shows that they include the faster and special types, apparently of German origin. They furthermore include many types, such as the anthraquinone vat dyes, which are not produced in Italy. It may be assumed, therefore, that these dyes were delivered to Italy in payment for reparation and later resold to consumers in the United States and other countries. Official Italian statistics of imports for 1922 show that 1,634,270 pounds of German reparation dyes were received in that year and 2,156,760 pounds in the first nine months of 1923.

From the 50 per cent stocks of dyes[2] on hand in the German plants as of August 15, 1919, (totaling 10,353,057 kilos, or 22,824,349 pounds), subject to the Reparation Commission's option, 5,200 tons were withdrawn for immediate delivery. Of these Italy received 700 tons, the United States and Great Britain each 1,500 tons, France 1,000 tons, and Belgium 500 tons. The remainder of the stock was distributed on the basis of the pre-war consumption, taking into account new conditions and home production. In this way Italy received 7 per cent of the Indanthrene blue GCD compared with the United States 55 per cent, and 13 per cent of the other vat dyes, as against 39 per cent for the United States. The total dye deliveries from the stocks on hand to the allied and associated Governments were 9,889,650 kilos (21,802,722 pounds).

During the period of United States participation the option for the delivery of 25 per cent of the German daily production gave no GCD blue to Italy and only 9 per cent of the other vat dyes, while the United States received 60 per cent of GCD blue and 42 per cent of other vats.

After the cessation of deliveries to the United States, the percentages accorded to Italy, France, and Belgium showed a conspicuous increase of GCD blue; Italy received 25 per cent, and of other vat dyes Italy and France each received 20 per cent, Belgium 10 per cent, and Great Britain 50 per cent.

According to the report of the Reparation Commission, Italy had received up to December 31, 1923, 6,274,601 kilos (13,832,985 pounds) of all dyes out of a total delivery by Germany of 25,583,390 kilos (56,401,142 pounds). Italy ranked second to Great Britain, the latter receiving 7,664,993 kilos (16,898,244 pounds) of all dyes. These reparation figures are of interest in any consideration of the possible imports of reparation dyes from Italy and France in 1924, especially in view of the renewed deliveries of the I. G. to the different allied countries.

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[2] "Report on the Works of the Reparation Commission from 1920-1922, printed and published by His Majesty's Stationery Offices."

IMPORT STATISTICS.

TABLE 14.—*Summary of dyes imported for consumption, classified by method of application, 1920–1923.*

Class	1923		1922	
	Pounds	Per cent of total	Pounds	Per cent of total
Acid	544,048	17.56	601,395	15.10
Vat:				
(*a*) Indigo			505	.01
(*b*) Vat (other than indigo)	1,207,554	38.98	1,548,519	38.89
Total	1,207,554	38.98	1,549,024	38.90
Mordant and chrome:				
(*a*) Alizarin	27,716	.89	27,086	.68
(*b*) Mordant and chrome	425,699	13.74	689,704	17.32
Total	453,415	14.63	716,790	18.00
Direct	527,014	17.01	671,621	16.86
Sulphur	114,023	3.68	194,883	4.89
Basic	210,896	6.81	155,084	3.89
Spirit-soluble and color-lake	23,213	.75	76,853	1.93
Unidentified, unclassified special	18,030	.58	16,981	.43
Total	3,098,193	100.00	3,982,631	100.00

Class	1921		1920	
	Pounds	Per cent of total	Pounds	Per cent of total
Acid	1,455,823	34.24	733,405	21.55
Vat:				
(*a*) Indigo	70,975	1.66	171,101	5.04
(*b*) Vat (other than indigo)	1,045,370	24.59	761,363	22.37
Total	1,116,345	26.25	932,464	27.41
Mordant and chrome:				
(*a*) Alizarin	136,283	3.58	73,252	2.16
(*b*) Mordant and chrome	559,678	12.78	636,230	18.71
Total	695,961	16.36	709,482	20.87
Direct	537,664	12.64	571,581	16.80
Sulphur	220,938	5.20	229,140	6.73
Basic	163,527	3.84	192,163	5.64
Spirit-soluble and color-lake	43,553	1.02	17,527	.51
Unindentified, unclassified special	19,100	.45	16,820	.49
Total	4,252,911	100.00	3,402,582	100.00

TABLE 15.—*Dyes of each class according to method of application, imported in largest quantity during the calendar year 1923, compared with imports in 1922, 1921, and fiscal year 1914*

Schultz No.	Class and name of dye	1923	1922	1921	1914
	ACID DYES	*Pounds*	*Pounds*	*Pounds*	*Pounds*
543	Patent blue	66,279	49,136	42,708	196,228
	Alizarin rubinol 3G, 5G, GW, R	48,826	26,457	(1)	10,917
22	Xylene light yellow	46,886	12,937	60,422	23,074
506	Erioglaucine	38,254	25,852	16,004	66,526
220	Palatine black	33,500	11,436	14,850	299,274
546	Cyanol	19,979	20,658	14,271	40,015
531	Eriocyanine	19,202	14,808	16,808	25,091
523	Fast green	17,190	52,498	22,619	14,347
265	Sulphocyanine black	15,543	14,858	615	69,590
	Polar red 3B, G, R, RS	15,031	14,926	2,579	2,821
	Polar yellow, 2G, 5G	13,453	2,998		782
564	Naphthalene green	13,328	19,298	23,926	22,144
545	Patent blue A	11,872	3,436	16,170	63,744
503	Neptune green	8,825	1,661	7,462	40,868
	Brilliant milling blue	8,540	872	2,175	9,966
	VAT DYES				
849	Indanthrene yellow (single strength)	87,946	15,507	49,609	12,683
761	Indanthrene golden orange R (single strength)	79,717	78,145	56,390	50,496
842	Indanthrene blue GCD (single strength)	70,546	16,802	201,835	478,980
760	Indanthrene golden orange G (single strength)	67,265	73,305	33,423	20,092
901	Ciba violet B (single strength)	64,517	131,661	21,987	20,836
	Hydron pink FB, FF (single strength)	55,428	20,250		
869	Algol brown B (single strength)	55,081	16,778	6,640	1,596
	Helindone pink B, R, RN (single strength)	47,771	40,668		
765	Indanthrene green B (single strength)	40,420	[2] 57,344	[3] 6,932	[3] 72,251
838	Indanthrene blue RS (single strength)	38,235	39,999	28,908	187,379
907	Ciba scarlet (single strength)	37,524	33,246	10,695	22,265
919	Ciba bordeaux B (single strength)	35,714	33,621	4,625	899
840	Indanthrene blue 3G (single strength)	31,748	24,992	19,715	6,120
759	Anthraflavone G (single strength)	27,721	20,594	10,594	7,143
819	Algol red FF, R (single strength)	25,228	14,825	14,489	2,322
	MORDANT AND CHROME DYES				
862	Alizarin blue black	70,917	22,277	43,277	54,706
637	Gallamine blue	29,244	29,237	15,179	2,756
778	Alizarin (synthetic)	27,716	27,086	[4] 136,283	202,392
858	Alizarin saphirol B	26,615	46,596	28,606	77,148
780	Alizarin red	25,017	25,872	15,565	81,929
854	Alizarin viridine	17,217	25,910	9,499	
865	Alizarin direct green G	16,241	11,669	36,534	2,000
782	Alizarin brown	14,531	4,596	20,700	114,586
	Acid alizarin gray G	13,526	7,555	2,818	
785	Alizarin GL, RG	12,528	6,500	18,266	49,021
856	Alizarin astrol	11,224	8,155	24,657	
	Omega chrome brown G, PB	11,511	8,570	5,486	
	Eriochrome flavine A	10,713	12,293	110	
774	Alizarin black	10,521	7,343	26,524	200,743
779	Alizarin orange	8,444	15,523	5,854	14,239
	DIRECT DYES				
273	Diaminogene blue	88,778	22,420	19,182	8,308
274	Diaminogene B	32,903	8,527	7,864	313,629
449	Trisulphon brown B	26,980	45,697	38,558	16,781
358	Diphenyl red	21,160	33,945	4,036	14,305
	Diamine fast orange EG, ER, R	17,793	8,719	6,261	17,387
348	Diphenyl brown BN	17,534	2,598		13,471
456	Benzo fast blue	17,036	6,997	3,768	100,495
457	Trisulphon brown GG	16,150	37,648	22,872	7,562
392	Tolnylene orange	14,382	36,920	523	67,032
	Chlorantine fast brown 3GL, RL	13,558	7,715	4,589	
	Zambesi black D, V	13,000	3,000	1,752	629,359
207	Diphenyl fast brown GNC	10,126	9,797	969	992
319	Diamine scarlet	9,950	14,137	12,399	41,175
	Diazo pure blue B, 3G, 3GL	9,026	14,067	6,892	6,370
	SULPHUR DYES				
	Thionol brown	28,802	48,750	20,632	
	Cross dye green B	26,242	27,834	51,074	100
	Eclipse brown	10,000	35,991	21,248	4,393
747	Thional brown G	9,228			110
726	Pyrogene blue	8,929	24,251	11,718	10,934
	Thional yellow	7,306		17,704	

[1] Included in Schultz No. 856.
[2] Figures for Indanthrene black included.
[3] Figures incomplete
[4] Figures from Department of Commerce.

TABLE 15.—*Dyes of each class according to method of application, imported in largest quantity during the calendar year 1923, compared with imports in 1922, 1921, and fiscal year 1914*—Continued

Schultz No.	Class and name of dye	1923	1922	1921	1914
	BASIC DYES	*Pounds*	*Pounds*	*Pounds*	*Pounds*
606	Phosphine	42,176	51,711	21,325	168,225
571	Rhodamine 6G	31,242	13,545	10,069	37,515
573	Rhodamine B	29,083	5,077	10,890	59,354
618	Thioflavine T	20,283	6,765	7,297	35,224
608	Euchrysine	9,483	3,476	872	15,403
603	Acridine orange	9,349	711	1,613	2,336
663	New methylene blue	6,343	2,060	4,329	30,392
661	Thionine blue	6,129	2,746	421	18,618
500	Setopaline	5,853	2,824	----------	923

KEY TO ABBREVIATIONS USED IN TABLE 16

1. THE SIX LEADING GERMAN COMPANIES

A ------- Actien-Gesellschaft für Anilin-Fabrikation, Berlin. Founded 1873.
B ------- Badische Anilin-und-Soda-Fabrik, Ludwigshafen-on-the-Rhine. Founded 1865.
By ------ Farbenfabriken, vormals Friedr. Bayer & Co., Leverkusen-on-the-Rhine. Founded 1862.
C ------- Leopold Cassella & Co., Frankfort-on-the-Main. Founded 1870.
K ------- Kalle & Co., A. G., Biebrich on the Rhine. Founded 1870.
M ------- Farbwerke, vormals Meister Lucius & Brüning, Höchst-on-the-Main. Founded 1862.

2. THE SMALLER GERMAN COMPANIES

BK------ Leipziger Anilinfabrik Beyer & Kegel, Fürstenberg, near Leipzig. Founded 1882.
CG------ Chemikalienwerk Griesheim G. m. b. H., Griesheim-on-the-Main. Founded 1881.
CJ ------ Carl Jäger G. m. b. H., Anilinfarbenfabrik, Düsseldorf. Founded 1823.
GrE ----- Chemische Fabrik Griesheim-Electron, Offenbach-on-the-Main. Founded 1842.
L ------- Farbwerk Mühlheim, vormals A. Leonhardt & Co., Mühlheim-on-the-Main. Founded 1879.
tM------ Chemische Fabriken, formals Weiler ter Meer, Uerdingen-on-the-Rhine. Founded 1877.
WD ----- Wülfing, Dahl & Co., A. G., Barmen. Founded 1842.
A–S Co--- Arzberger & Schöpff & Co., Eisenach.

3. DUTCH, BELGIAN, AND FRENCH COMPANIES

FA ------ Farbwerk Ammersfoort, Ammersfoort, Netherlands. Founded 1888.
NF------ Niederländische Farben-und-Chemikalienfabrik Delft, Delft, Netherlands. Founded 1897.
LG------ Lazard Godchaux, of Brussels. (These products are probably compounded largely from the dyes made by A. Wiescher & Co., of Haeren, Belgium.)
P ------- Société Anonyme des Matières colorantes et produits chimiques St. Denis (formerly A. Poirrier), St. Denis, near Paris, France. Founded 1830.

4. SWISS COMPANIES, ALL AT BASEL

DH------ Farbwerke vormals L. Durand, Huguenin & Co. Founded 1871.
G ------- Anilinfarben-und-Extract-Fabriken, vormals Joh. Rud. Geigy. Founded 1764.
I-------- Gesellschaft für chemische Industrie. Founded 1885.
S-------- Chemische Fabrik, vormals Sandoz & Co. Founded 1887.

5. ENGLISH COMPANIES

Bro_____ Brotherton and Co. (Ltd.), City Chambers, Leeds.
B. A. C___ British Alizarine Co. (Ltd.), Manchester.
B. D_____ British Dyestuffs Corporation (Ltd.), London.
Cl. Co___ The Clayton Aniline Co. (Ltd.), Clayton, Manchester.
C. V_____ The Colne Vale Dye and Chemical Co. (Ltd.), Milnsbridge, Huddersfield.
Hol_____ L. B. Holliday and Co. (Ltd.), Huddersfield.
Scot_____ Scottish Dyes (Ltd.), Grangemouth.

TABLE 16.—*Dyes imported into the United States, 1923*

Schultz No.	Name of dye	Manufacturer	Imports	
			Quantity	Invoice value
	Total		*Pounds* 3,098,193	$3,151,363
6	Martius yellow		400	
	Aniline yellow	B		
9	Direct yellow		2,102	
	Sun yellow G	S		
11	Chloramine orange		55	
	Chloramine orange G	By		
14	Diphenyl chrysoine		4,409	
	Diphenyl chrysoine GC	G		
19	Fast light yellow		6,211	8,510
	Fast light yellow	WD		
	Fast light yellow 2G	By		
	Fast light yellow 2G	WD		
	Fast light yellow 3G	By		
	Fast light yellow 3G	WD		
	Fast light yellow R	WD		
21	Pigment chrome yellow		100	
	Pigment chrome yellow L paste	M		
22	Xylene light yellow		46,886	37,860
	Xylene light yellow 2G conc. 75 per cent	S		
	Xylene light yellow 2G conc. 100 per cent	S		
	Xylene light yellow R conc	S		
25	Dianil yellow 3G	M	100	
28	Hansa yellow G—			
	Hansa yellow G paste	M	4,081	
	Hansa yellow G pdr	M	1,900	
34	Chrysoidine R		55	
	Chrysoidine RL	B		
38	Orange G		254	
	Orange 2G	C		
	Orange 2G	WD		
48	Alizarin yellow G		1,589	429
	Alizarin yellow 2G	M		
	Alizarin yellow 2G	I		
	Alizarin yellow 5G	I		
	Alizarin yellow GD	S		
56	Autol red		994	
	Nitrosamine red paste	B		
58	Alizarin yellow R		75	
	Alizarin yellow R paste	I		
	Ultra orange R	S		
61	Victoria violet		350	
	Azo wool blue SE	C		
	Victoria violet 4BS conc	S		
63	Azo acid blue		210	
	Azo acid blue B conc	S		
65	Azo coralline		4	
	Azo coralline L	WD		
73	Helio fast red		551	
	Sitara fast red RL	tM		
74	Tannin orange R		400	
	Tannin orange R pdr	C		
81	Brilliant cochineal		101	
	Palatine scarlet A	B		
84	Azo chromine		55	
	Azo chromine NR paste	G		
88	Acid anthracene brown		7,810	7,723
	Acid anthracene brown PG	By		
	Acid anthracene brown R	By		
	Acid anthracene brown RH	By		
93	Sudan R		25	
	Pigment purple A pdr	M		

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

Schultz No.	Name of dye	Manufacturer	Imports	
			Quantity	Invoice value
			Pounds	
100	Eosamine B	A	7,501	
117	Erica 2GN	A	260	
118	Geranine		447	
	Geranine G	By		
	Brilliant geranine B	By		
119	Diamine rose		400	
	Diamine rose GD	C		
121	Erica B		3,298	$5,866
	Cotton pink B extra	Q		
	Cotton pink BN	B		
	Erica B extra	A		
122	Erica G		345	
	Cotton pink GN	B		
124	Diazine green		10	
	Janus green B	M		
125	Diazine black		80	
	Black JD	B		
	Janus black I	M		
126	Indoine blue R		10	
	Naphthindone BB	C		
129	Chromazone red		1,323	
	Chromazone red, new conc	G		
140	Curcumeine		5,991	5,843
	Chromocitronine R	DH		
	Chromocitronine 3R	DH		
	Chromocitronine V	DH		
	Jasmine, highly conc	G		
141	Azo yellow		100	
	Indian yellow FF	C		
152	Permanent red 4B		2,240	
	Permanent red 4B extra pdr	A		
154	Palatine chrome brown		1,459	1,419
	Palatine chrome brown GGX	B		
	Palatine chrome brown RX	B		
	Palatine chrome brown W	B		
	Palatine chrome brown WNRTX	B		
158	Chrome brown RR		1,054	
	Chrome brown R	G		
	Chrome brown RVV	G		
159	Acid alizarin black		3,920	
	Acid alizarin black R	M		
160	Naphthylamine brown	B	6	
161	Fast red		170	
	Fast red AV	B		
	Fast red AVX	B		
168	Amaranth		500	
	Amaranth B	C		
	Amaranth B conc	C		
175	Acid ponceau		220	
	Acid ponceau E	G		
177	Mordant yellow		700	588
	Milling yellow GA	A		
	Milling yellow 3G	A		
	Milling yellow O	C		
180	Eriochrome blue black		2,205	
	Eriochrome blue black G	G		
182	Brilliant sulphon red		7,414	7,438
	Brilliant sulphon red B	S		
	Brilliant sulphon red 5B	S		
	Fast sulphon violet 5BS	S		
184	Eriochrome black A		4,409	
	Eriochrome black E	G		
193	Stanley red	Cl Co	300	
198	Thiazol yellow		25	
	Thiazol yellow 3G	By		
206	Diphenyl catechine G		750	
	Diphenyl catechine G supra	G		
207	Diphenyl fast brown G		10,126	
	Diphenyl fast brown GNC	G		
217	Agalma black 10B		150	
	Naphthylamine black 4B	By		
220	Palatine black		33,500	18,425
	Wool black 6B	A		
	Wool black GRF	A		
	Wool jet black 3B	A		
421	Anthracene acid brown G	C	453	

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

Schultz No.	Name of dye	Manufacturer	Imports	
			Quantity	Invoice value
			Pounds	
222	Janus yellow		760	
	Janus yellow G	M		
	Yellow IG	M		
	Yellow JG	M		
236	Wool red B		115	
	Fast bordeaux B	BK		
240	Janus red B		700	$1,292
	Janus red B	M		
	Red IB	M		
	Red JB	M		
250	Milling orange	WD	551	
256	Sulphon black 3B		200	
	Azo cyanine GR	K		
257	Sulphon cyanine		333	
	Cloth fast blue R	I		
260	Eriochrome verdon S	G	2,205	
265	Sulphonyanine black		15,543	8,111
	Acid milling black	G		
	Acid milling black B 50 per cent	G		
	Acid milling black B 100 per cent	G		
266	Naphthylamine black		798	
	Naphthylamine black 6B	By		
273	Diaminogene blue		88,778	93,814
	Diaminogene blue NA	C		
	Diaminogene blue NBB	C		
	Diazamine blue NA	CN		
	Diazamine blue BR	S		
	Diazamine blue RR	S		
	Naphthogene blue RR	A		
274	Diaminogene B		32,903	26,917
	Black extra	C		
	Diaminogene extra	C		
	Diaminogene black extra	C		
	Diazo indigo blue BR	By		
	Diazo indigo blue 2RL	By		
	Zambesi pure blue 4BG	A		
276	Diamond green		99	
	Diamond green B	By		
277	Anthracene acid black		119	
	Anthracene acid black ST	C		
	Acid chrome black STC	By		
279	Benzo fast scarlet		5,196	7,078
	Benzo fast scarlet 5BS	By		
	Benzo fast scarlet 8BS	By		
	Benzo fast scarlet GS	By		
	Direct fast scarlet SE	I		
283	Bismark brown		2,429	1,225
	Bismark brown	WD		
	Excelsior brown	WD		
	Leather brown A	C		
	Vesuvine extra	B		
	Vesuvine 3R	M		
288	Palatine chrome black		179	
	Acid alizarin black SE pdr	M		
293	Milling red		100	
	Milling red G	C		
294	Fast mordant yellow		11	
	Fast mordant yellow G pdr	B		
296	Cotton yellow		3,329	3,456
	Benzo fast yellow RL	By		
	Cotton yellow	B		
	Cotton yellow GI	B		
	Cotton yellow GX	B		
	Diamine fast yellow 3G	C		
297	Benzo fast pink 2BL	By	121	
303	Paper yellow		1,501	
	Brilliant yellow	By		
	Brilliant yellow conc	S		
306	Pyramine orange 3G	B	4,500	
308	Diazo black OT	By	501	
313	Congo rubine	A	100	
319	Diamine scarlet		9,950	9,910
	Chloramine red 3B	S		
	Diamine brilliant bordeaux R	C		
	Diamine scarlet B	C		
	Diamine scarlet 3B	C		
	Triazol red 3B	GrE		
322	Trisulphon violet B	S	500	

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

Schultz No.	Name of dye	Manufacturer	Imports	
			Quantity	Invoice value
			Pounds	
325	Columbia blue R	A	10	
326	Oxydiamine violet		, 633	
	Benzo violet O	By		
	Naphthamine violet BE	K		
330	Zambesi brown		50	
	Zambesi brown 4R	A		
332	Benzo fast red		1,042	$1,335
	Benzo fast red 8BL	By		
333	Diamine black		5	
	Oxamine black BHN extra	B		
338	Naphthamine blue		1,981	
	Naphthamine blue JEF	K		
339	Brilliant orange		3,821	2,656
	Diamine orange B	C		
340	Benzo orange R		50	
	Benzo fast orange WS	By		
342	Chrysamine		5,002	
	Chrysamine K	S		
	Chrysamine KS	S		
343	Diamine fast red		200	
	Diamine fast red 8BL	C		
346	Oxamine red		900	
	Oxamine red X	B		
	Oxamine red 3BX	B		
348	Diphenyl brown		17,534	
	Diphenyl brown BBNC	G		
	Diphenyl brown GS	G		
349	Diamine brown B	C	451	
354	Direct gray R paste	G	2,172	
358	Diphenyl red		21,160	17,614
	Aceto purpurine 8B	A		
	Chloramine red 8BS	By		
	Toluylene red	GrE		
	Toluylene red OO	GrE		
360	Pyramine orange R		6,895	
	Ignamine (Pyramine) orange R	B		
364	Diazo brilliant black		782	
	Diazo brilliant black B	By		
366	Delta purpurine		441	
	Delta purpurine 5B	By		
370	Brilliant congo		330	
	Brilliant congo R	By		
373	Congo orange		2,020	
	Congo orange R	A		
	Congo orange R	By		
386	Benzo blue		900	
	Chloramine blue BXR conc	S		
387	Columbia blue G	A	25	
392	Toluylene orange		14,382	13,101
	Direct fast orange K	I		
	Pyrazol orange G conc	S		
	Toluylene fast orange GL	By		
405	Benzopurpurine 10B	S	100	
411	Benzoazurine 3G	By	22	
424	Chicago blue 6B		7,431	
	Brilliant benzo blue 6B	By		
	Chloramine sky blue FF conc	S		
426	Benzo pure blue conc	By	11	
435	Janus brown		50	
	Janus brown B	M		
436	Columbia black		50	
	Patent dianil black FF conc	M		
448	Diamine bronze		800	
	Diamine bronze G	C		
449	Trisulphon brown		26,980	39,210
	Diphenyl brown TB conc	G		
	Trisulphon brown B	S		
	Trisulphon brown B conc	S		
456	Benzo fast blue		17,036	31,338
	Benzo fast blue 2GL	By		
	Benzo fast blue 4GL	By		
	Benzo light blue 2GL	By		
	Benzo light blue 4GL	By		
457	Trisulphon brown GG		16,150	19,495
	Trisulphon brown GG	S		
	Trisulphon brown GG conc. 50 per cent	S		
	Trisulphon brown GG conc. 70 per cent	S		
472	Chloramine blue HW		100	
	Chloramine blue HW	S		

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

Schultz No.	Name of dye	Manufacturer	Imports	
			Quantity	Invoice value
			Pounds	
475	Oxamine green G		250	
	Naphthamine green AN	K		
476	Benzamine brown 3GO		100	
	Dianil chrome brown G	M		
485	Benzo brown D3G	By	6	
493	Auramine		3,944	
	Auramine N conc	S		
	Auramine OO	G		
494	Auramine G		3,637	
	Auramine G	G		
	Auramine G	I		
496	Setoglaucine		3,498	$7,152
	Setoglaucine 753	G		
	Setoglaucine 753, 55 per cent	G		
	Setoglaucine 753, 100 per cent	G		
497	Victoria green	B	5	
498	Turquoise blue BB, G	By	4	
500	Setopaline		5,853	
	Setopaline conc. 707	G		
501	Brilliant glacier blue	I	110	
503	Neptune green		8,825	10,932
	Brilliant acid green 6B	By		
	Brilliant milling green B	C		
	Erioviridine B supra	G		
	Guinea fast green B	A		
	Night green A	tM		
	Patent green AGL	M		
505	Light green (yellowish)		468	473
	Acid green GG extra	By		
	Light green SF yellowish	B		
	Light green SF yellowish XX	B		
506	Erioglaucine		38,254	74,110
	Brilliant acid blue EG	By		
	Erioglaucine	G		
	Erioglaucine A	G		
	Erioglaucine AB	G		
	Erioglaucine AP	G		
	Erioglaucine EP	G		
	Erioglaucine supra conc	G		
507	Xylene blue VS		6,104	
	Xylene blue VS conc	S		
512	Magenta		148	
	Diamond magenta I, small crystals	B		
	Magenta, small crystals	M		
514	Red violet		220	
	Violet 4RN	I		
515	Methyl violet		690	1,003
	Methyl violet crystals	S		
	Methyl violet NFB	B		
	Methyl violet 300 XE	P		
516	Crystal violet		3,738	6,258
	Crystal violet crystals	tM		
	Crystal violet extra conc	K		
	Crystal violet extra	B		
	Crystal violet pdr	WD		
	Crystal violet O	M		
	Crystal violet 5BO	S		
518	Ethyl purple		3,852	
	Ethyl violet	B		
	Ethyl violet 6B	GrE		
522	Victoria blue 4R		1,350	
	Victoria blue 4R	I		
	Victoria blue 4R highly conc	B		
523	Fast green		17,190	18,910
	Fast green bluish	By		
	Fast green extra bluish	By		
	Fast green extra bluish conc	By		
524	Acid magenta		577	
	Acid fuchsine S conc	A		
	Acid magenta	C		
527	Acid violet 4BN		6,305	11,065
	Acid violet 4BNS conc	S		
	Acid violet 6BNOO	By		
	Acid violet 7BN	By		
528	Fast acid violet 10B		5,862	11,940
	Fast acid violet 10 B	By		
	Kiton fast violet 10 B	I		
	Kiton fast violet 10 B conc	I		

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

Schultz No.	Name of dye	Manufacturer	Imports	
			Quantity	Invoice value
			Pounds	
530	Acid violet		197	
	Acid violet 3BNO	B		
	Acid violet 6BNG	G		
	Acid violet C 1OB	B		
	Formyl violet S 4B	C		
	Acid violet 4 BS	WD		
	Acid violet 1OB	C		
531	Eriocyanine		19, 202	
	Eriocyanine A	G		
	Eriocyanine AC	G		
532	Alkali violet		142	$420
	Alkali violet CA	C		
	Alkali violet 4BNOO	B		
	Alkali violet 6BOO	B		
534	Acid violet 7B		25	
	Acid violet 7B conc	B		
535	Methyl alkali blue		195	
	Methyl alkali blue	M		
	Methyl alkali blue pdr	GrE		
536	Alkali blue		100	
	Alkali blue 3R conc	tM		
537	Methyl blue for silk		7, 058	20, 523
	Methyl Lyons blue	G		
	Methyl silk blue new	G		
	Pure blue 2G	tM		
539	Soluble blue		1, 165	2, 392
	Cotton blue No. 2 conc	M		
	Silk blue BSIC	GrE		
	Soluble blue T	B		
	Water blue	A		
541	Brilliant dianil blue 6G		440	
	Brilliant cotton blue 6B	K		
	Direct brilliant blue 8B	I		
543	Patent blue		66, 279	50, 586
	Brilliant acid blue V	By		
	Carmine blue V	I		
	Neptune blue BGX	B		
	Patent blue V	A		
	Patent blue V	M		
	Patent marine blue LE	M		
	Tetra cyanol V	C		
544	Cyanine B		440	
	Cyanine B	M		
545	Patent blue A		11, 872	10, 646
	Brilliant acid blue A	By		
	Brilliant acid blue F	By		
	Brilliant acid blue FF	By		
	Neptune blue BXX	B		
	Patent blue A	A		
	Patent blue A	M		
	Tetracyanol A	C		
546	Cyanol		19, 979	23, 576
	Cyanol extra	C		
	Cyanol extra	Q		
	Cyanol extra A	Q		
	Cyanol FF	C		
	Glaucol FF	L		
548	Acid violet 6BN		957	4, 836
	Acid violet 6BNOO	B		
	Acid violet 6BS	WD		
	Acid violet GENG	G		
550	Chrome bordeaux		55	
	Chrome bordeaux B	DH		
553	Eriochrome cyanine		999	
	Eriochrome cyanine RC	G		
554	Chrome azurol		1, 601	
	Chrome azurol S conc	G		
	Chrome azurol SXT	G		
555	Aurine		560	
	Aurine 100 per cent	Q		
557	Chrome violet		550	
	Chrome violet CG	DH		
558	Victoria blue R		4	
	Cornflower blue B	WD		

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

Schultz No.	Name of dye	Manufacturer	Imports	
			Quantity	Invoice value
			Pounds	
559	Victoria blue B		1,722	$3,322
	Victoria blue B	Q		
	Victoria blue B extra conc	Q		
	Victoria blue B highly conc	B		
	Victoria blue base	B		
	Victoria pure blue BO	B		
560	Night blue		28	
	Night blue	B		
	Night blue greenish D	G		
562	Fast acid blue		2,103	2,966
	Acid blue RBF	I		
	Brilliant wool blue FFR extra	By		
	Brilliant wool blue G	G		
	Fast acid blue B	By		
	Wool blue N	By		
564	Naphthalene green		13,328	20,967
	Erio green BB supra	G		
	Kiton fast green VX conc	I		
	Naphthalene green conc	M		
	Naphthalene green V	M		
	Xylene fast green B conc	S		
565	Acid blue B		500	
	Wool blue 2B	A		
	Wool blue 5B	A		
566	Wool green S		105	
	Cyanol fast green G	C		
	Wool green S extra conc	B		
568	Pyronine G		55	
	Pyronine G	L		
569	Acridine red		55	
	Acridine red 3B	L		
571	Rhodamine 6G		31,242	97,991
	Rhodamine 6G extra	B		
	Rhodamine 6G extra	By		
	Rhodamine 6G extra	I		
	Rhodamine 6G extra	M		
	Rhodamine 6G conc	G		
	Rhodamine 6GD extra	M		
	Rhodamine 6GDN	BD		
	Rhodamine 6GDN extra	B		
	Rhodamine 6GDN extra	M		
	Rhodamine 6GH	I		
572	Rhodamine G		412	
	Rhodamine G extra	B		
	Rhodamine RRR	G		
573	Rhodamine B		29,083	50,058
	Rhodamine B conc	G		
	Rhodamine B extra	B		
	Rhodamine B extra	By		
	Rhodamine B extra	I		
	Rhodamine B extra conc	Q		
	Rosazeine B extra	M		
574	Rhodamine 3B		110	
	Rhodamine 3B extra	I		
579	Xylene red		941	
	Sulpho rhodamine B	M		
	Sulpho rosazeine BG	M		
580	Fast acid violet B		251	771
	Fast acid violet B	M		
	Fast acid violet R	M		
	Violamine B	M		
582	Fast acid violet A2R		232	
	Acid violet 4RNOO	B		
	Erio fast fuchsine BL conc	G		
584	Fast acid blue R	M	25	
587	Eosine		5	
	Eosine A conc	Q		
597	Rose bengale B		59	
	Rose bengale B	Q		
	Rose bengale B	M		
601	Coerulein S		50	
	Coerulein S pdr	Q		
602	Acridine yellow		440	
	Acridine golden yellow 2G	L		
603	Acridine orange		9,349	26,623
	Acridine orange DHE	DH		
	Acridine orange LP new	BD		
	Brilliant acridine orange A	DH		
	Rhoduline orange N	By		
	Rhodnline orange NO	By		

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

Schultz No.	Name of dye	Manufacturer	Imports	
			Quantity	Invoice value
			Pounds	
606	Phosphine		42,176	$70,475
	Acid phosphine R	B		
	Canelle AL	B		
	Coriphosphine OX extra	By		
	Leather phosphine G	G		
	Leather phosphine 2G	G		
	Patent phosphine G	G		
	Patent phosphine G	By		
	Patent phosphine G	I		
	Patent phosphine 2G	G		
	Patent phosphine R	I		
	Philadelphia yellow 2G	A		
	Phosphine O	M		
	Phosphine 3R	A		
	Phosphine 3R	GrE		
607	Rheonine		565	
	Runic (Rheonine) AL conc	B		
	Runic (Rheonine) GD	B		
608	Euchrysine		9,483	15,537
	Euchrysine GRNTN	B		
	Euchrysine RRX	B		
	Euchrysine RRDX	B		
	Patent phosphine R	B		
	Patent phosphine 2R	B		
	Patent phosphine GRNTN	B		
	Patent phosphine RRDX	B		
609	Homophosphine		2,520	4,432
	Auracine G conc	By		
	Corioflavine GOOO	GrE		
	Flavophosphine G conc	M		
612	Quinoline yellow, spirit-soluble		1,320	2,104
	Quinoline yellow	By		
	Quinoline yellow	S		
	Quinoline yellow conc	S		
613	Quinoline yellow		7,168	10,071
	Quinoline yellow conc	By		
	Quinoline yellow conc	S		
	Quinoline yellow extra	B		
	Quinoline yellow KT extra conc	By		
	Quinoline yellow N	By		
	Quinoline yellow O	M		
615	Thioflavine S		35	
	Direct yellow S	C		
617	Columbia yellow		1,652	1,307
	Chloramine yellow GG	By		
	Diamine fast yellow AGG	C		
	Diphenyl chlorine yellow FF supra	G		
618	Thioflavine T		20,283	37,527
	Basic yellow T	C		
	Basic yellow TCN	C		
	Methylene yellow H	M		
	Rhoduline yellow 6G	By		
	Rhoduline yellow 6GT	By		
	Tannoflavine T	S		
	Thioflavine T	C		
	Thioflavine TCN	C		
	Yellow T	C		
620	Capri blue		110	
	Capri blue GON conc	L		
622	Delphine blue B		2,001	
	Brilliant delphine blue B	S		
624	Modern violet N		440	
	Modern violet N pdr	DH		
625	Chrome heliotrope		110	
	Modern heliotrope	DH		
626	Gallocyanine		2,202	
	Brilliant chrome blue P	S		
	Gallocyanine paste	S		
627	Anthracyanine		3,082	8,001
	Anthracyanine S pdr	DH		
	Chromacetine blue S pdr	DH		
	Modern cyanine V pdr	DH		
	Modern royal blue pdr	DH		
631	Chromocyanine		432	
	Chromocyanine B paste	DH		
633	Indalizarin		330	
	Indalizarin J paste	DH		

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

Schultz No.	Name of dye	Manufacturer	Imports	
			Quantity	Invoice value
			Pounds	
635	Modern violet		990	$2,340
	Blue 1900 dbl. pdr	DH		
	Gallo violet DF	By		
	Modern violet pdr	DH		
636	Prune		330	
	Naphtha chrome violet 2R	I		
	Violet PDH pdr	DH		
637	Gallamine blue		29,244	
	Gallamine blue extra paste	G		
644	Ultra cyanine		200	
	Ultra cyanine RB	S		
645	Gallazine		712	
	Gallazine A paste conc	DH		
	Gallazine No. 90	DH		
649	Cotton blue		1,404	979
	Cotton blue R extra	B		
	Meldola's blue 3R paste	S		
	Meldola's blue 3R conc	S		
650	Cotton blue BB	B	5	
653	Nile blue		3,435	
	Danubia (Nile) blue BX	B		
	Danubia blue BBX	B		
658	Fast black		1,163	
	Gallophenine P	By		
	Gallophenine VS paste	By		
660	Methylene green		505	50
	Methylene green extra yellowish	M		
	Methylene green B conc	By		
	Methylene green IA	M		
661	Thionine blue		6,129	11,639
	Thionine blue G	I		
	Thionine blue GO	M		
	Thionine blue GO old	M		
663	New methylene blue		6,443	10,889
	Methylene blue NNX	B		
	New methylene blue N	C		
	New methylene blue NX	C		
	New methylene blue NSS	C		
667	Indochromine		201	
	Brilliant alizarin blue R	By		
672	Azo carmine		7,218	7,147
	Azo carmine GX	B		
	Azo carmine GX 97 per cent	B		
	Azo carmine GX standard strength	B		
673	Azo carmine B		2,209	2,131
	Azo carmine	B		
	Azo carmine BX	B		
	Azo carmine BXH	B		
	Rosinduline 2 B bluish	K		
679	Safranine		110	
	Safranine superfine dbl. yellowish	G		
681	New fast gray		3,144	1,872
	Malta gray B	P		
	Malta gray J	P		
	New fast gray	By		
685	Tannin heliotrope	C	50	
686	Iris violet extra	B	30	
687	Rosolane O, T, R		49	
	Methylene heliotrope extra strong	M		
	Rosolane O pdr	M		
688	Rosolane		125	
	Rosolane paste	P		
695	Paraphenylene violet		500	
	Diphene blue B	A		
699	Induline NN		155	
	Fast blue R	B		
	Induline NN	B		
700	Nigrosine (soluble in water)		3,079	1,752
	Nigrosine T	B		
	Nigrosine W extra	WD		
	Nigrosine WLG	B		
	Silver gray P	A		
705	Indamine 6R		3,500	
	Acid cyanine BF	A		
	Indocyanine B	A		
712	Sulphur yellow		10	
	Sulphur yellow G extra	B		

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

Schultz No.	Name of dye	Manufacturer	Imports	
			Quantity	Invoice value
			Pounds	
720	Sulphur black		500	
	Thiogene black MA highly conc	M		
724	Immedial black		940	
	Immedial direct blue B	C		
726	Pyrogene blue		8,929	
	Pyrogene direct blue RL	I		
733	Immedial indone		570	
	Immedial indogene GLC conc	C		
734	Pyrogene yellow		551	
	Pyrogene yellow M	I		
735	Pyrogene indigo		2,314	
	Pyrogene indigo	I		
	Pyrogene indigo conc	I		
746	Katigene green		4,283	
	Immedial green GG extra	C		
	Pyrogene green 3G conc	I		
747	Thional brown		9,228	
	Thional brown G	S		
748	Hydron blue (single strength)		280	$116
	Hydron blue G paste	C		
	Hydron blue G pdr	C		
	Hydron blue R paste	C		
	Hydron blue R pdr	C		
754	Kryogene violet		1,110	
	Kryogene violet 3 RX	B		
759	Anthraflavone G (single strength)		27,721	25,537
	Anthraflavone G paste	B		
	Anthraflavone GC paste	B		
	Anthraflavone GC paste, fine	B		
	Anthraflavone GC pdr	B		
	Anthra yellow G paste	B		
	Anthra yellow GC paste	B		
	Anthra yellow GC paste, fine	B		
	Anthra yellow GC pdr	B		
760	Indanthrene golden orange G (single strength)		67,265	63,342
	Duranthrene golden orange Y paste	BD		
	Helindone golden orange IG paste	M		
	Helindone golden orange IG dbl. paste	M		
	Indanthrene golden orange G paste	B		
	Indanthrene golden orange G dbl. paste	B		
	Indanthrene golden orange G pdr	B		
	Vat golden orange G dbl. paste	B		
761	Indanthrene golden orange R (single strength)		79,717	88,968
	Helindone golden orange IRRT paste	M		
	Helindone golden orange IRRT paste, fine	M		
	Helindone golden orange IRRT pdr	M		
	Indanthrene golden orange RRT paste	B		
	Indanthrene golden orange RRT paste, fine	B		
	Indanthrene golden orange RRT pdr	B		
	Indanthrene golden orange RRTS pdr	B		
	Vat orange RRT paste	B		
	Vat orange RRT paste	By		
762	Indanthrene scarlet GS pdr		566	
	Indanthrene scarlet GS pdr	B		
	Vat orange 4R pdr	B		
763	Indanthrene dark blue BO (single strength)		5,051	2,944
	Helindone dark blue IBOA paste	M		
	Indanthrene dark blue BO extra paste	B		
	Indanthrene dark blue BO pdr	B		
765	Indanthrene green B (single strength)		40,420	18,607
	Helindone black IBB pdr	M		
	Helindone blue green IB dbl. paste	M		
	Indanthrene black	B		
	Indanthrene black 2B extra paste	B		
	Indanthrene black 2B dbl. paste	B		
	Indanthrene blue green B dbl. paste	B		
	Vat blaek BB dbl. paste	B		
	Vat blue green B dbl. paste	B		
767	Indanthrene violet RR (single strength)		24,506	15,752
	Helindone violet IRR extra paste	M		
	Helindone violet IRR extra pdr	M		
	Helindone violet DIRR extra paste	M		
	Indanthrene violet RR extra paste	B		
	Indanthrene violet RR dbl. paste	B		
	Indanthrene violet RR pdr	B		
	Indanthrene violet RR extra pdr	B		
	Vat brilliant violet RR paste	B		
	Vat brilliant violet RR pdr	B		
	Vat brilliant violet RRP pdr	B		
768	Indanthrene violet B paste	B	53	

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

Schultz No.	Name of dye	Manufacturer	Imports	
			Quantity	Invoice value
			Pounds	
774	Alizarin black 25 per cent paste		10,521	$4,123
	Alizarin black S paste 25 per cent	B		
	Alizarin black S paste 25 per cent	M		
	Alizarin black S pdr	M		
	Alizarin black WR pdr	B		
	Alizarin black WX extra S paste 40 per cent	B		
778	Alizarin, synthetic—20 per cent paste		27,716	4,396
	Alizarin	A-S Co.		
	Alizarin pdr	A-S Co.		
	Alizarin VI extra pure 20 per cent	B		
	Alizarin red 1B extra paste 20 per cent	By		
	Alizarin red D1B extra paste 20 per cent	By		
779	Alizarin orange 20 per cent paste		8,444	3,628
	Alizarin orange 20 per cent	BAC		
	Alizarin orange AO 20 per cent	BAC		
	Alizarin orange A 20 per cent	B		
	Alizarin orange pdr. 80 per cent	M		
780	Alizarin red powder		25,017	23,633
	Alizarin carmine pdr	BAC		
	Alizarin red 1WS pdr	M		
	Alizarin red S pdr	B		
	Alizarin red S pdr	BAC		
	Alizarin red W pdr	By		
782	Alizarin brown		14,531	
	Anthracene brown R pdr	By		
	Anthracene brown RD paste	G		
784	Alizarin SX, GD paste		8,206	1,493
	Alizarin SX 20 per cent paste	B		
	Alizarin red SX extra paste	By		
	Alizarin red SX 20 per cent paste	BAC		
785	Alizarin RG, GI		12,528	2,746
	Alizarin SDG 20 per cent paste	M		
	Alizarin red XGP 20 per cent paste	By		
	Alizarin red YCA 20 per cent paste	BAC		
788	Alizarin cyanine		442	
	Alizarin cyanine NS pdr	By		
790	Acid alizarin blue BB		912	1,494
	Anthracene blue SWB pdr	B		
	Anthracene blue SWGG extra pdr	B		
	Anthracene blue SWR pdr	B		
792	Cibanone orange R (single strength)		5,060	
	Cibanone orange R pdr	I		
794	Cibanone black (single strength)		5,175	
	Cibanone black B paste 10 per cent	I		
	Cibanone black 2G pdr. 100 per cent	I		
795	Cibanone yellow R (single strength)		8,373	
	Cibanone yellow R paste 10 per cent	I		
	Cibanone yellow R pdr	I		
798	Alizarin maroon W		500	
	Alizarin maroon	B		
799	Alizarin cyanine G		2,607	
	Alizarin cyanine G pdr	By		
	Alizarin cyanine NSG pdr	By		
800	Anthracene blue		3,379	929
	Anthracene blue WG paste	B		
	Anthracene blue WBU paste	B		
	Anthracene blue WGU paste	B		
803	Alizarin blue WX, A		441	
	Alizarin blue B pdr	Q		
804	Alizarin blue S		[1] 7,948	6,502
	Alizarin blue S extra paste	By		
	Alizarin blue S pdr	By		
	Alizarin blue SB pdr	M		
807	Alizarin black S		1,876	
	Alizarin black S paste	M		
808	Alizarin green S paste		3,898	
	Alizarin green S paste	B		
	Alizarin green S paste	BAC		
810	Helindone yellow (single strength)		4	
	Vat yellow RK paste	B		
	Vat yellow RK pdr	B		
811	Algol yellow 3G (single strength)		1,471	
	Algol yellow 3G paste	By		
	Algol yellow 3G pdr	By		
813	Indanthrene copper R paste	B	494	

[1] 5,815 pounds of paste, 2,133 pounds of pdr.

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

Schultz No.	Name of dye	Manufacturer	Imports	
			Quantity	Invoice value
			Pounds	
814	Algol yellow WF (single strength)		792	
	Algol yellow WF pdr	By		
816	Algol red 5G (single strength)		793	$381
	Algol red 5G pdr	By		
	Algol red 5GK paste	By		
	Algol red 5GK pdr	By		
817	Algol yellow R (single strength)		3,517	1,070
	Algol yellow R pdr	By		
	Vat yellow GK paste	By		
	Vat yellow GK pdr	By		
818	Algol pink R (single strength)		1,636	
	Algol pink R paste	By		
	Algol pink R pdr	By		
819	Algol red FF, R (single strength)		25,228	12,809
	Algol brilliant red 2B paste	By		
	Algol brilliant red 2B pdr	By		
	Algol brilliant red 2B extra pdr	By		
	Algol red FF extra paste	By		
	Algol red FF pdr	By		
	Algol red R paste	By		
	Algol red R pdr	By		
820	Algol brilliant violet R (single strength)		15,381	12,763
	Algol brilliant violet R paste	By		
	Algol brilliant violet R pdr	By		
	Duranthrene brilliant violet R paste	BD		
	Duranthrene brilliant violet R pdr	BD		
	Vat brilliant violet RK paste	By		
	Vat brilliant violet RK pdr	By		
821	Algol brilliant violet 2B (single strength)		5,591	4,496
	Algol brilliant violet 2B pdr	By		
	Indanthrene brilliant violet 2BK paste	By		
	Indanthrene brilliant violet 2BK pdr	By		
822	Algol brilliant orange FR (single strength)		4,684	3,989
	Algol brilliant orange FR paste	By		
	Algol brilliant orange FR pdr	By		
	Indanthrene orange RRK pdr	Q		
824	Algol orange R (single strength)		4,222	1,777
	Algol orange R paste	By		
	Algol orange R pdr	By		
	Indanthrene orange 6RTK pdr	By		
825	Algol red B (single strength)*		160	
	Algol red B pdr	By		
827	Indanthrene claret B extra (single strength)		13,306	13,361
	Anthra bordeaux R paste	B		
	Anthra claret R paste fine	B		
	Anthra bordeaux R pdr	B		
	Indanthrene bordeaux R extra paste	B		
828	Indanthrene claret B (single strength)		7,180	
	Indanthrene bordeaux B pdr	B		
	Vat heliotrope R dbl. paste	B		
830	Indanthrene red R (single strength)		1,317	
	Indanthrene red R paste	B		
831	Indanthrene red BN (single strength)		16,825	16,590
	Caledon red BN paste	Scot.		
	Duranthrene red BN paste	BD		
	Helindone red BIDN paste	M		
	Indanthrene red BN pdr	B		
	Indanthrene red BN extra paste	B		
	Indanthrene red BN extra pdr	B		
	Indanthrene red RK paste	B		
	Indanthrene red RK paste fine	B		
	Indanthrene red RKP pdr	B		
832	Indanthrene violet RN (single strength)		20,435	26,381
	Helindone violet IBN extra paste	M		
	Indanthrene violet BN paste	B		
	Indanthrene violet BN extra paste	B		
	Indanthrene violet BN paste fine	B		
	Indanthrene violet BN pdr	B		
833	Algol olive R (single strength)		1,050	583
	Algol olive R paste	By		
	Algol olive R pdr	By		
	Vat olive R paste	By		
834	Algol gray (single strength)		1,557	
	Algol gray 2B paste	By		
	Vat gray K pdr	By		
836	Helindone brown 3GN paste	M	110	

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

Schultz No.	Name of dye	Manufacturer	Imports	
			Quantity	Invoice value
			Pounds	
837	Indanthrene blue R powder	B	176	
838	Indanthrene blue RS (single strength)		38,235	$15,270
	Indanthrene blue RS paste	B		
	Indanthrene blue RS pdr	B		
	Indanthrene blue RS triple pdr	B		
	Indanthrene blue RSP dbl. paste	B		
	Indanthrene blue RSP triple pdr	B		
840	Indanthrene blue 3G (single strength)		31,748	19,644
	Indanthrene blue 3G paste	B		
	Indanthrene blue 3G pdr	B		
	Indanthrene blue 3G dbl. paste	B		
	Indanthrene blue 3G paste fine	B		
841	Indanthrene blue GGS (single strength)		2,200	
	Indanthrene blue GGSP dbl. paste	B		
	Indanthrene blue GGSNP quintuple pdr	B		
842	Indanthrene blue GCD (single strength)		70,546	42,166
	Helindone blue IGCD dbl. paste	M		
	Indanthrene blue GCD paste	B		
	Indanthrene blue GCD dbl. paste	B		
	Indanthrene blue GCD dbl. paste fine	B		
	Indanthrene blue GCD pdr	B		
844	Algol blue 3G (single strength)		5,516	4,032
	Algol blue 3G paste	By		
	Algol blue 3G pdr	By		
	Indanthrene blue 5G paste	B		
	Indanthrene blue 5G pdr	B		
847	Algol green B paste	By	201	
848	Indanthrene gray (single strength)		50	
	Indanthrene gray B dbl. paste	B		
849	Indanthrene yellow (single strength)		87,946	28,551
	Helindone yellow 1G dbl. paste	M		
	Helindone yellow DIG dbl. paste	M		
	Indanthrene yellow G paste	B		
	Indanthrene yellow G dbl. paste	B		
	Indanthrene yellow G pdr	B		
	Indanthrene yellow GP pdr	B		
850	Indanthrene blue WB powder	B	2,434	
851	Alizarin direct blue B	M	240	
852	Alizarin irisol D, R		2,987	7,298
	Alizarin blue JR pdr	By		
	Alizarin direct violet R pdr	M		
	Alizarin irisol R pdr	By		
853	Anthraquinone violet powder		1,610	2,611
	Anthraquinone violet	B		
	Anthraquinone violet, standard strength	B		
	Anthraquinone violet pdr	B		
854	Alizarin viridine		17,217	
	Alizarin viridine FF paste	By		
855	Alizarin pure blue		9,132	21,710
	Alizarin pure blue B pdr	By		
	Alizarin sky blue B pdr	By		
	Alizarin sky blue B 65 per cent pdr	By		
856	Alizarin astrol		11,224	16,017
	Alizarin astrol B	By		
	Alizarin astrol B pdr	By		
	Alizarin blue AS pdr	By		
858	Alizarin saphirol B		26,615	58,162
	Alizarin blue SAP pdr	By		
	Alizarin light blue B	S		
	Alizarin light blue B conc	S		
	Alizarin saphirol B pdr	By		
	Alizarin saphirol SE pdr	By		
	Alizarin saphirol SAE pdr	By		
	Alizarin saphirol WSA pdr	By		
	Alizarin saphirol SAWSA pdr	By		
	Helio fast blue BL pdr	By		
	Helio fast blue SL conc	By		
859	Cyananthrol R		2,941	14,652
	Alizarin direct blue RXO	B		
	Cyananthrol R	B		
	Cyananthrol RXO	B		
860	Cyananthrol G		4,618	10,044
	Alizarin direct blue BGAOO	B		
	Cyananthrol BGA	B		
	Cyananthrol BGAO	B		
	Cyananthrol BGAOO	B		
861	Anthraquinone blue SR		1,250	
	Anthraquinone blue SR extra pdr	B		

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

Schultz No.	Name of dye	Manufacturer	Imports	
			Quantity	Invoice value
			Pounds	
862	Alizarin blue black		70,917	$49,153
	Alizarin blue black B pdr	By		
	Alizarin blue black B pdr	M		
	Alirarin blue black 3B pdr	By		
	Alizarin blue black 3B pdr	M		
	Alizarin blue black BT pdr	B		
863	Anthraquinone blue green		179	
	Anthraquinone blue green BXO pdr	B		
864	Anthraquinone green GX		1,050	
	Anthraquinone green GXNO pdr	B		
865	Alizarin direct green G		16,241	28,764
	Alizarin brilliant green G	C		
	Alizarin cyanine green G extra pdr	By		
	Alizarin cyanine green 3G pdr	By		
	Alizarin cyanine green E pdr	By		
	Alizarin cyanine green EF pdr	I		
	Alizarin direct green G pdr	M		
867	Indanthrene brown (single strength)		12,799	2,541
	Duranthrene brown B paste	BD		
	Anthra brown B dbl. paste	B		
	Indanthrene brown B dbl. paste	B		
868	Cibanone brown (single strength)		2,007	
	Cibanone brown B pdr	I		
869	Algol brown B (single strength)		55,081	54,242
	Algol brown R paste	By		
	Algol brown R pdr	By		
	Indanthrene brown R paste	By		
	Indanthrene brown R pdr	By		
870	Algol corinth R (single strength)		1,592	1,444
	Algol corinth R pdr	By		
	Indanthrene corinth RK paste	By		
	Indanthrene corinth RK pdr	By		
873	Helindone brown AN (single strength)		836	869
	Helindone brown AN paste	M		
	Indanthrene brown GR paste	B		
	Indanthrene brown GR pdr	B		
	Indanthrene red brown R extra paste	B		
	Indanthrene red brown R pdr	B		
876	Indigo, white		110	
	Indigosol DH	DH		
880	Indigo RB (single strength)		690	348
	Helindone blue BB paste	M		
	Indigo MLB/2B pdr	M		
	Indigo RB dbl. paste	B		
881	Ciba blue 2BD paste	I	6,417	
882	Ciba blue G (single strength)		11	
	Indigo MLB/5B pdr	M		
883	Indigo KG (single strength)		4,855	
	Durindone blue 6B pdr	BD		
	Indigo MLB/6B pdr	M		
885	Brilliant indigo BD (single strength)		14,835	
	Brilliant indigo B paste	B		
	Brilliant indigo B paste	By		
886	Brilliant indigo G paste	B	2,565	
887	Brilliant indigo 4G (single strength)		2,917	2,794
	Brilliant indigo 4G paste	B		
	Brilliant indigo 4G pdr	B		
	Brilliant indigo BASF/4G paste	B		
890	Ciba yellow G paste 10 per cent	I	2,204	
892	Helindone green G (single strength)		2,202	
	Helindone green G paste	M		
	Helindone green G pdr	M		
893	Alizarin indigo G paste 10 per cent		17,289	
	Alizarin indigo G paste	By		
	Alizarin indigo G pdr	By		
894	Alizarin indigo B paste		1,763	
	Alizarin indigo green B paste	By		
895	Alizarin indigo 3R paste	By	1,362	
896	Helindone blue 3GN (single strength)		7,360	
	Helindone blue 3GN pdr	M		
897	Ciba heliotrope B paste	I	110	
899	Ciba gray paste		882	
	Ciba gray G paste 20 per cent	I		

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

Schultz No.	Name of dye	Manufacturer	Imports	
			Quantity	Invoice value
			Pounds	
901	Ciba violet B (single strength)		64,517	$29,122
	Ciba violet B paste 10 per cent	I		
	Ciba violet B paste 20 per cent	I		
	Ciba violet B pdr	I		
	Ciba violet R paste 20 per cent	I		
	Ciba violet R pdr	I		
902	Helindone brown 2R (single strength)		1,570	
	Helindone brown 2R paste	M	(745)	
	Thioindigo brown R pdr	K	(825)	
904	Helindone brown G (single strength)		1,741	
	Helindone brown G paste	M	(661)	
	Thioindigo brown G pdr	K	(1,080)	
906	Ciba red G paste	I	551	
907	Ciba scarlet (single strength)		37,524	37,436
	Ciba scarlet G extra paste	I	(22,145)	
	Ciba scarlet G pdr	I		
	Helindone fast scarlet C paste	M	(7,678)	
	Thioindigo scarlet 2G paste	K	(7,701)	
	Thioindigo scarlet 2G pdr	K		
908	Ciba red R paste 20 per cent	I	7,388	
910	Helindone pink (single strength)		10,378	8,052
	Helindone pink AN paste	M	(8,666)	
	Helindone pink Bn paste	M		
	Thioindigo pink AN paste	K	(1,712)	
	Thioindigo pink BN extra paste	K		
911	Ciba orange G paste 10 per cent	I	330	
912	Thioindigo red B (single strength)		8,860	8,943
	Ciba pink B paste	I		
	Ciba pink BG paste	I		
	Ciba pink BG pdr	I		
	Durindone red B paste	BD		
913	Helindone orange R (single strength)		22,571	19,652
	Helindone orange R paste 10 per cent	M	(16,791)	
	Helindone orange R pdr	M		
	Thioindigo orange R pdr	K	(5,780)	
	Thioindigo orange RY paste 20 per cent	K		
	Thioindigo yellow 3GN paste 20 per cent	K		
915	Helindone fast scarlet R (single strength)		7,666	
	Helindone fast scarlet R paste	M		
	Helindone fast scarlet R pdr	M		
917	Helindone red B paste	M	50	
918	Helindone red 3B (single strength)		21,916	15,579
	Durindone red 3B paste	BD		
	Helindone red 3B paste 20 per cent	M		
	Helindone red 3B pdr	M		
	Thioindigo red 3B paste	K		
	Thioindigo red 3B pdr	K		
	Vat red violet RH paste 20 per cent	B		
	Vat red violet RH pdr	B		
919	Ciba bordeaux B (single strength)		35,714	
	Ciba bordeaux B paste 10 per cent	I		
	Ciba bordeaux B pdr	I		
920	Helindone violet (single strength)		2,255	
	Helindone violet R pdr	M		
921	Helindone gray BB (single strength)		6	
	Vat gray 6B paste	B		
	Vat gray 6B pdr	B		
923	Ursol		14,071	16,894
	Fur black DB, DG	A		
	Fur blue black A, SA	A		
	Fur blue gray	A		
	Fur brown NZ, NZD, P, PR, PY, 2R, 4R, SK, SKG, SP, SO.	A		
	Fur gray AL, ALA, B, G, R	A		
	Fur gray brown SLA	A		
	Fur olive DA, 3G	A		
	Fur red brown 6R	A		
	Fur yellow 2G, 4G	A		
	Fur yellow brown A, 4GL	A		
	Fur dye DF, 2G, SB, SC	A		
	Nako DR, 3GA, PS, RH	M		
	Nako black DD, D2B, O	M		
	Nako yellow SEL	M		
	Ursol D lumps	A		
	Ursol SG	A		

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

UNIDENTIFIED ACID DYES

Name of dye	Manufacturer	Imports	
		Quantity	Invoice value
		Pounds	
Acid black SR	I	220	
Acid milling red R conc	G	110	
Acid milling yellow G conc	S	2,202	
Acid pure blue R supra	G	5,201	
Acid rhodamine		3,568	$4,478
Acid rhodamine BG	B		
Acid rhodamine G	B		
Acid rhodamine 3R	G		
Acid rhodamine R	Q		
Acid rhodamine RG	Q		
Acid red violet	Q	11	
Acid silver gray	Q	22	
Acid violet 7B purple	Q	22	
Alizarin direct violet ER pdr	B	355	
Alizarin emeraldole G pdr	By	126	
Alizarin emeraldole green G	Q	30	
Alizarin rubinol		48,826	110,212
Alizarin rubinol 3G pdr	By		
Alizarin rubinol 5G pdr	By		
Alizarin rubinol GW pdr	By		
Alizarin rubinol R pdr	By		
Alizarin uranole		550	925
Alizarin uranole 2B	By		
Alizarin uranole R	By		
Alphanol brown		20	
Alphanol brown B	C		
Alphanol brown R	C		
Anthosine		965	
Onis (Anthosine) 3B	B		
Onis (Anthosine) 5B	B		
Anthracyanine brown GL	By	105	
Anthrarubine B pdr	K	110	
Azo blue B conc	S	201	
Azo orseille BB	C	202	
Azo rhodine 2G conc., 2GN conc	S	700	
Azo wool violet 7R	C	1,000	
Brilliant milling blue B	C	8,540	7,574
Brilliant milling red R	C	1,100	
Brilliant naphthol blue R	C	220	
Brilliant pure yellow 6G extra	By	396	
Cashmere black TN	By	55	
Cloth fast black		330	503
Cloth fast black BN	I		
Cloth fast black 2BN	I		
Cloth fast black 4BN	I		
Cloth fast red GR conc	I	661	
Eosine BG	GrE	100	
Erio blue AB	G	7,804	
Erio fast cyanine		2,315	5,931
Erio fast cyanine S	G		
Erio fast cyanine S conc	G		
Erio fast cyanine SE	G		
Erio fast violet		275	
Erio fast violet BMS conc	G		
Erio fast violet RMS conc	G		
Erythrosine TB pdr	DH	55	
Fast acid blue A pdr	GrE	4,480	
Fast acid green 8B pdr	GrE	1,792	
Fast acid marine blue		800	
Fast acid marine blue HBBX	B		
Fast acid marine blue HBTA	B		
Fast acid red RH	BD	500	
Fast light red BL	By	899	
Fast sulphon green 2G conc	S	110	
Guinea brown		250	188
Guinea brown GL	A		
Guinea brown 2GL	A		
Guinea brown R	A		
Guinea brown RD	A		
Guinea brown 2R	A		
Guinea brown 2RD	A		
Guinea fast red		8,325	7,129
Guinea fast red BL	A		
Guinea fast red 2BL	A		
Guinea fast red 2R	A		
Guinea rubine 4R	A	10	

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

UNIDENTIFIED ACID DYES—Continued

Name of dye	Manufacturer	Imports	
		Quantity	Invoice value
		Pounds	
Havana brown		40	
Havana brown 5G	B		
Havana brown S	C		
Ink blue		744	$1,179
Ink blue BITN	GrE		
Ink blue BJTNO	GrE		
Ink blue BJTBNOO	GrE		
Kiton fast green A conc	I	992	
Kiton fast red 4BL	I	2,454	
Kiton pure blue AFL	I	441	
Kiton yellow G	I	331	
Milling brown		235	
Milling brown 3G	A		
Milling brown R	A		
Naphthalene blue black	Q	45	
Neolan black 2G	I	110	
Neolan blue		991	
Neolan blue B	I		
Neolan blue 2G	I		
Neolan green B	I	220	
Neolan gray B new	I	110	
Neolan navy blue		66	
Neolan navy blue 2G	I		
Neolan navy blue R	I		
Neolan pink		661	
Neolan pink B	I		
Neolan pink G	I		
Neolan red R	I	110	
Oxamine acid brown		2,700	
Minaxo acid brown G	B		
Oxamine acid brown G	B		
Palatine light yellow		3,961	
Palatine light yellow RX	B		
Pilatus light yellow RX	B		
Polar maroon VC	G	2,205	
Polar orange R conc	G	6,908	
Polar red		15,031	14,900
Polar red 3B conc	G		
Polar red G conc	G		
Polar red R conc	G		
Polar red RS conc	G		
Polar yellow		13,453	
Polar yellow 2G conc	G		
Polar yellow 5G conc	G		
Radio brown B	C	200	
Radio red G	C	100	
Radio yellow R	C	20	
Scarlet 2R	S	500	
Silk blue BIC	A	500	
Special blue G	B	125	
Sulphon acid brown 2R	By	33	
Sulphon orange G	By	20	
Sulphon yellow 5G conc	By	11	
Supramine black BR	By	1,030	
Supramine brown R	By	656	
Supramine red		745	817
Supramine red B	By		
Supramine red 2G	By		
Spruce red B	B		
Supramine yellow		1,106	1,687
Supramine yellow G	By		
Supramine yellow R	By		
Spruce yellow R	B		
Wool black N for printing	I	441	
Wool fast blue		2,154	2,390
Wool fast blue BL	B		
Wool fast blue BL	By		
Wool fast blue GL	By		
Wool fast orange G	B	50	
Wool fast red BL	By	134	
Wool fast yellow 3G	B	660	
Wool printing black CUI	I	441	
Wool red G	B	50	
Wool violet RC	G	55	
Xylene fast blue AE conc	S	110	
Xylene milling red B conc	S	110	

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

UNIDENTIFIED VAT DYES

Name of dye	Manufacturer	Imports	
		Quantity	Invoice value
		Pounds	
Algol brilliant pink (single strength)		3,452	$3,995
Algol brilliant pink FB paste	By		
Algol brilliant pink FF paste	By		
Vat brilliant pink FF paste	By		
Algol brilliant red B (single strength)		936	
Algol brilliant red B pdr	By		
Algol brown G (single strength)		18,074	16,556
Algol brown G paste	By		
Algol brown G pdr	By		
Vat brown G paste	By		
Vat brown G pdr	By		
Alizarin indigo brown R paste	By	10	
Alizarin indigo 5R paste	By	399	
Ciba printing black 20 per cent paste		220	
Ciba printing black B	I		
Ciba printing black G	I		
Cibanone brown R paste	I	1,984	
Grelanone yellow G paste	GrE	560	
Helindone black		528	
Helindone black paste	M		
Helindone black T	M		
Helindone bordeaux B extra paste	M	220	
Helindone brown JG paste	M	300	
Helindone fast scarlet	M	992	
Helindone fast scarlet G paste	M		
Helindone fast scarlet GG paste	M		
Helindone golden orange DJG (single strength)		881	
Helindone golden orange DJG paste	M		
Helindone golden orange DJG pdr	M		
Helindone pink		47,771	44,643
Helindone pink B extra paste	M		
Helindone pink R extra paste	M		
Helindone pink RN extra paste	M		
Helindone violet 2R paste	M	209	
Helindone yellow		150	
Helindone yellow AGC paste	M		
Helindone yellow DAGC paste	M		
Hydron bordeaux (single paste)		1,208	
Hydron bordeaux B dbl. paste	C		
Hydron bordeaux R dbl. paste	C		
Hydron brown (single strength)		4,065	3,439
Hydron brown CG	C		
Hydron brown G paste	C		
Hydron brown OG pdr	C		
Hydron brown R paste	C		
Hydron dark blue (single strength)		80	32
Hydron dark blue G paste	C		
Hydron dark blue G pdr	C		
Hydron dark blue GG paste	C		
Hydron dark blue GG pdr	C		
Hydron green		689	
Hydron green B paste	C		
Hydron green G paste	C		
Hydron navy blue (single strength)		52	40
Hydron navy blue C paste	C		
Hydron navy blue C pdr	C		
Hydron navy blue G paste	C		
Hydron olive		503	
Hydron olive GN paste	C		
Hydron olive R paste	C		
Hydron orange		3,521	3,916
Hydron orange FB paste	C		
Hydron orange R paste	C		
Hydron orange RE paste	C		
Hydron pink (single strength)		55,428	62,364
Hydron pink FB paste	C		
Hydron pink FF paste	C		
Hydron pink FF pdr	C		
Hydron scarlet (single strength)		17,354	19,012
Hydron scarlet 2B paste	C		
Hydron scarlet 2B pdr	C		
Hydron scarlet 3B paste	C		
Hydron violet (single strength)		1,232	1,138
Hydron violet B paste	C		
Hydron violet R paste	C		
Hydron violet R pdr	C		

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

UNIDENTIFIED VAT DYES—Continued

Name of dye	Manufacturer	Imports	
		Quantity	Invoice value
		Pounds	
Hydron wool brown D, G	C	10	
Hydron wool olive B	C	5	
Hydron wool red BB	C	5	
Hydron wool yellow G	C	5	
Hydron yellow NF paste	C	700	
Indanthrene blue BCD (single strength)		800	
Indanthrene blue BCD dbl. paste fine	B		
Indanthrene blue BCS (single strength)		12,240	
Indanthrene blue BCS pdr	B		
Indanthrene blue RC (single strength)		3,336	
Indanthrene blue RC paste	B		
Indanthrene blue RC pdr	B		
Indanthrene blue RO paste	B	988	
Indanthrene blue RZ (single strength)		5,430	$1,448
Indanthrene blue RZ dbl. paste	B		
Indanthrene blue RZ pdr	B		
Indanthrene blue REZ pdr	B		
Indanthrene blue 3GT paste	By	10	
Indanthrene brilliant red 2B paste	By	1,001	
Indanthrene brown 3R paste	Q	716	
Indanthrene golden orange 3R (single strength)		1,974	1,873
Helindone golden orange 13R paste	M		
Indanthrene golden orange 3R paste	B		
Indanthrene orange 3R paste	B		
Indanthrene gray 3B (single strength)		200	
Indanthrene gray 3B dbl. paste	B		
Indanthrene pink (single strength)		13,348	12,232
Anthra pink B extra paste	B		
Anthra pink R extra paste	B		
Indanthrene pink B dbl. paste	B		
Indanthrene red violet (single strength)		3,682	3,313
Indanthrene red violet RRN paste	B		
Vat red violet RRK paste	B		
Vat red violet RRK paste fine	B		
Thioindigo pink RN		6,487	5,510
Thioindigo pink RN paste	K		
Thioindigo pink RN extra paste	K		
Thioindigo rose RN extra paste	K		
Thioindigo violet 2R (single strength)		4,280	
Thioindigo violet 2R paste	K		
Thioindigo violet 2R pdr	K		
Vat orange R paste	GrE	336	
Vat violet BR paste	GrE	112	
Vat yellow 3RT (single strength)		6	
Vat yellow 3RT pdr	B		

UNIDENTIFIED MORDANT AND CHROME DYES

Acid alizarin gray G	M	13,526	$22,818
Acid chrome blue		12	
Acid chrome blue BH	By		
Acid chrome blue 2R	By		
Alizarin bordeaux 2G paste	By	155	
Alizarin cyclamine R paste	By	797	
Alizarin fast black SP paste	By	418	
Alizarin fast gray 2BL pdr	By	5,257	12,914
Alizarin geranole B pdr	By	991	
Alizarin light green EF pdr	GrE	2,240	
Alliance fast brown 5G	BD	25	
Anthracene chromate brown EB	C	8,420	10,217
Anthracene chrome blue R	C	50	
Brilliant chrome blue		440	
Brilliant chrome blue 2B	DH		
Brilliant chrome blue S	DH		
Chromanol black RVI	DH	110	
Chromanol blue NR pdr	DH	881	
Chrome azurine	DH	396	
Chrome azurine G	DH		
Chrome azurine P	DH		
Chrome fast cyanine GN	I	110	
Chrome fast green B	S	220	
Chrome fast phosphine R	DH	55	

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

UNIDENTIFIED MORDANT AND CHROME DYES—Continued

Name of dye	Manufacturer	Imports	
		Quantity	Invoice value
		Pounds	
Chrome fast printing red		200	
Chrome fast printing red BD paste	By		
Chrome fast printing red GD paste	By		
Chrome printing azurine G pdr	I	5	
Chrome printing bordeaux B pdr	I	5	
Chrome printing brown 5G pdr	I	5	
Chrome printing green B pdr	I	5	
Chrome printing orange		10	
Chrome printing orange G pdr	I		
Chrome printing orange 2R pdr	I		
Chrome printing red		555	$1,267
Chrome printing red B pdr	DH		
Chrome printing red B pdr	I		
Chrome printing red RY	DH		
Chrome printing red Y	DH		
Chrome printing violet N	I	661	
Chrome violet		340	1,053
Chrome violet CBD	DH		
Chrome violet C3BD	DH		
Chrome violet YM pdr	M		
Chromochlorine G pdr	DH	110	
Chromorhodine		2,917	9,256
Chromorhodine BN pdr	DH		
Chromorhodine BR pdr	DH		
Chromorhodine 6GN extra pdr	DH		
Chromoxane brilliant blue G	By	2,505	3,012
Chromoxane violet R	By	99	
Cloth yellow R pdr	GrE	100	
Eriochrome black DF conc	G	220	
Eriochrome brilliant green G supra	G	110	
Eriochrome flavine A conc	G	10,713	
Eriochrome green		771	
Eriochrome green L	G		
Eriochrome green O	G		
Eriochrome red	G	3,085	
Lanasol blue B	I	881	
Lanasol brown 2R	I	1,102	
Metachrome black AG	A	5	
Metachrome blue black 2BX	A	7,000	
Metachrome brilliant blue BL	A	5	
Metachrome brown 6G	A	5	
Metachrome green 3G	A	5	
Metachrome olive		2,505	1,404
Metachrome olive B	A		
Metachrome olive D	A		
Metachrome olive 2G	A		
Metachrome olive brown		5,800	
Metachrome olive brown G	Bro		
Metachrome olive brown G	A		
Metachrome violet		470	
Metachrome violet B	A		
Metachrome violet 2R	A		
Modern green N pdr	DH	220	
Modern gray RCN	DH	220	
Modern olive 1N pdr	DH	165	
Monochrome brown EF	By	500	
Naphthochrome blue BN	I	110	
Naphthochrome cyanine R	I	110	
Naphthochrome green G	I	110	
Naphthochrome violet 4B	I	110	
Nitrosine pdr	DH	55	
Omega chrome brown		11,511	
Omega chrome brown G conc	S		
Omega chrome brown PB conc	S		
Oxychrome blue black BG pdr	GrE	1,344	
Printing violet BD paste	I	132	
Ultra brown R	S	55	
Ultra cyanol B conc	S	600	

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

UNIDENTIFIED DIRECT DYES

Name of dye	Manufacturer	Imports	
		Quantity	Invoice value
		Pounds	
Benzo bordeaux 6B	By	220	
Benzo chrome blue black B	By	110	
Benzo chrome brown		327	$362
Benzo chrome brown B	By		
Benzo chrome brown 5G	By		
Benzo chrome brown R	By		
Benzo copper blue 2B	By	110	
Benzo dark brown extra	By	551	
Benzo fast black		4,539	3,014
Benzo fast black	Q		
Benzo fast black L	By		
Benzo fast black NL	Q		
Benzo fast blue FFL	By	220	
Benzo fast bordeaux		2,202	2,623
Benzo fast bordeaux 6BL	By		
Benzo light bordeaux 6BL	By		
Benzo fast brown		5,903	6,601
Benzo fast brown 3GL	By		
Benzo fast brown RL	By		
Benzo light brown 3GL	By		
Benzo fast eosine BL	By	153	
Benzo fast gray BL		2,854	
Benzo fast gray BL	By		
Benzo light gray BL	By		
Benzo fast heliotrope		3,289	5,278
Benzo fast heliotrope BL	By		
Benzo fast heliotrope 4BL	By		
Benzo fast heliotrope 5RH	By		
Benzo fast orange		1,537	2,135
Benzo fast orange 2R	By		
Benzo fast orange 2RL	By		
Benzo light orange 2RL	By		
Benzo fast orange S	By	1,421	
Benzo fast rubine		132	
Benzo fast rubine BL	By		
Benzo light rubine BL	By		
Benzo fast scarlet 5BL, 2GL	By	22	
Benzo fast violet BL	By	564	
Benzo red 12B	By	3,722	3,051
Benzo rhoduline red		1,862	1,020
Benzo rhoduline red B	By		
Benzo rhoduline red 3B	By		
Benzo scarlet BC	By	110	
Brilliant benzo fast violet 2RL	By	218	
Brilliant benzo fast yellow GL	By	11	
Brilliant benzo green B	By	10	
Brilliant benzo violet B, 2BH, 2BR	By	3,179	3,905
Brilliant congo blue 5R	A	5	
Brilliant congo violet R	A	5	
Brilliant cotton blue R conc	K	200	
Brilliant fast blue B, 2G	By	176	
Brilliant sky blue		8,458	10,687
Brilliant sky blue 8G extra	By		
Brilliant sky blue 2RM	By		
Brilliant sky blue 2RN	By		
Carbazol yellow W pdr	B	11	
Chicago red 111	G	1,550	
Chloramine brown 2R conc	S	500	
Chloramine light blue BS	S	200	
Chloramine light violet R conc	S	200	
Chloramine sky blue RF conc	S	55	
Chloramine violet FFB	Q	100	
Chlorantine black Y	I	4,409	
Chlorantine brown Y	I	2,205	
Chlorantine fast brown		13,558	16,234
Chlorantine fast brown 3GL	I		
Chlorantine fast brown 3GL conc	I		
Chlorantine fast brown RL	I		
Chlorantine fast gray B	I	991	
Chlorantine fast orange TRL	I	8,708	
Chlorantine fast violet 2RL	I	1,102	
Chlorantine fast yellow 4GL	I	2,205	
Chlorazol fast black		325	
Chlorazol fast black N	BD		
Chlorazol fast black No. 1	BD		
Chlorazol fast brown RK	BD	1,100	

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

UNIDENTIFIED DIRECT DYES—Continued

Name of dye	Manufacturer	Imports	
		Quantity	Invoice value
		Pounds	
Chlorazol violet R	BD	2,000	
Chromanil black		700	
Chromanil black BF	A		
Chromanil black FF	A		
Chromopurpurine JJ pdr	DH	220	
Cotton pink RN	B	130	
Developing blue		1,600	$1,190
Developing blue B	A		
Developing blue 2R	A		
Developing blue 4R	A		
Diamine azo fast green G	C	52	
Diamine brilliant scarlet S	C	2,508	
Diamine brilliant violet B	C	3,000	
Diamine catechine		6,643	6,326
Diamine catechine B	C		
Diamine catechine G	C		
Diamine catechine GR dbl. strength	I		
Diamine fast blue		3,808	5,696
Diamine fast blue FFB	C		
Diamine fast blue FFG	C		
Diamine fast blue F3G	C		
Solamine blue FF	A		
Diamine fast bordeaux		4,066	5,117
Diamine fast bordeaux	C		
Diamine fast bordeaux 6BS	C		
Diamine fast brown		2,789	2,772
Diamine fast brown G	C		
Diamine fast brown GB	C		
Diamine fast brown G2B	C		
Diamine fast brown 3G	C		
Diamine fast brown R	C		
Diamine fast gray		2,268	
Diamine fast gray BN	C		
Diamine fast gray NBN	C		
Diamine fast orange		17,793	15,443
Diamine fast orange EG	C		
Diamine fast orange ER	C		
Diamine fast orange R	C		
Diamine fast pink		800	1,128
Diamine fast pink B	C		
Diamine fast pink C	C		
Diamine fast pink G	C		
Diamine fast red violet FR	C	270	
Diamine fast scarlet		155	
Diamine fast scarlet 6BS	C		
Diamine fast scarlet GS	C		
Diamine fast violet		663	
Diamine fast violet FFBN	C		
Diamine fast violet FFRN	C		
Diamine fast yellow 4G	C	50	
Diamine nitrazol green GF	C	518	
Diamine orange		425	
Diamine orange F	C		
Diamine orange G	C		
Diaminogene sky blue		2,261	2,172
Diaminogene sky blue 3B	C		
Diaminogene sky blue N	C		
Sky blue N	C		
Dianil fast blue		210	
Dianil fast blue GL	M		
Dianil fast blue RL	M		
Dianil fast gray RL	M	25	
Dianil fast orange RR	M	100	
Dianil fast scarlet		225	271
Dianil fast scarlet 8BS	M		
Dianil fast scarlet 4BSN	M		
Dialil fast scarlet GS	M		
Dianil fast violet BL	M	220	
Dianil light red 8BL	M	600	
Diazamine black N extra	CN	2,205	
Diazanil black V	M	1,170	
Diazanil blue 2R	M	100	
Diazanil pink B	M	750	

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

UNIDENTIFIED DIRECT DYES—Continued

Name of dye	Manufacturer	Imports	
		Quantity	Invoice value
		Pounds	
Diazanil scarlet		2,552	$5,319
Diazanil scarlet 3BA	M		
Diazanil scarlet 4BA	M		
Diazanil scarlet 6BA	M		
Diazo blue NA	L	2,205	
Diazo bordeaux 7B	By	7	
Diazo brilliant blue 2BL	By	10	
Diazo brilliant green		325	
Diazo brilliant green BL	By		
Diazo brilliant green 3G	By		
Diazo brilliant scarlet		7,032	8,768
Diazo brilliant scarlet B extra	By		
Diazo brilliant scarlet 2BL extra	By		
Diazo brilliant scarlet 5BL extra	By		
Diazo brilliant scarlet 3B extra	By		
Diazo brilliant scarlet 3BA extra	By		
Diazo brilliant scarlet 6B extra	By		
Diazo brilliant scarlet G extra	By		
Diazo brown		502	406
Diazo brown G	By		
Diazo brown 3G	By		
Diazo brown 3RB	By		
Diazo brilliant orange GR, 5G	By	322	
Diazo dark blue 3B	By	284	
Diazo fast blue		1,983	2,843
Diazo fast blue BR	I		
Diazo fast blue 4RW	I		
Diazo fast blue 6GW	I		
Diazo fast bordeaux BL	By	442	
Diazo fast green		26	
Diazo fast green BL	By		
Diazo fast green BL	A		
Diazo fast red 5BL, 7BL	By	8	
Diazo fast violet		961	
Diazo fast violet BL	By		
Diazo fast violet 3RL	By		
Diazo fast yellow		553	
Diazo fast yellow G	By		
Diazo fast yellow 2G	By		
Diazo geranine B extra	By	738	
Diazo indigo blue 4GL extra	By	2,482	4,326
Diazo light green 2RL	By	11	
Diazo olive G	By	50	
Diazo pure blue		9,026	3,927
Diazo sky blue B	By		
Diazo sky blue 3G	By		
Diazo sky blue 3GL	By		
Diazo rubine B	By	2,930	3,798
Diazo violet R	By	137	
Diazo yellow R	By	199	
Diazogene red B	CJ	850	
Diazol pink NR	P	2,204	
Diazophenyl black V	G	5,407	
Diphenyl fast bordeaux G conc	G	110	
Direct black RMW	C	50	
Direct brown 5G	I	2,205	
Fast cotton blue		510	724
Fast cotton blue FF	A		
Fast cotton blue FFG	A		
Fast cotton blue 4GL	A		
Fast cotton gray VL	A	305	
Formal fast black G conc	G	110	
Ionamine		20	
Ionamine B	BD		
Ionamine H	BD		
Naphthamine fast black KS	K	250	
Naphthamine green AG extra	K	250	
Naphthamine light blue 4B	K	100	
Naphthamine light brown 2G	K	500	
Naphthamine light green G	K	1,000	
Naphthamine light red R	K	500	
Naphthamine light violet 2B	K	500	
Naphthamine pink 2B conc	K	110	
Naphthogene blue B	By	249	

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

UNIDENTIFIED DIRECT DYES—Continued

Name of dye	Manufacturer	Imports	
		Quantity	Invoice value
		Pounds	
Nitranil brown		330	
Nitranil brown B	I		
Nitranil brown R	I		
Nitranil brown S	I		
Nitranil green B	I	110	
Oxamine black		80	
Oxamine black BBN	B		
Oxamine black BBNX	B		
Oxamine fast blue		2,702	$2,657
Oxamine fast blue 6B	B		
Oxamine fast blue RR	B		
Oxamine fast blue RRX	B		
Oxamine fast pink BX	B	130	
Oxamine light red ESB	B	200	
Oxydiaminogene	C	50	
Para blue 2BX	By	10	
Paranil black 2B	A	5	
Parasulphon brown		1,200	
Parasulphon brown B	S		
Parasulphon brown V	S		
Pluto brown 2G	By	209	
Plutoform black		50	
Plutoform BL	By		
Plutoform black 3GL	By		
Pyrazol orange		400	
Pyrazol orange R conc	S		
Pyrazol orange RR conc	S		
Rosanthrene orange R conc	I	1,604	
Rosanthrene pink	I	661	
Toluylene fast brown 2R	By	11	
Triazol light blue 4GL	GrE	280	
Triazol pure blue 6B	GrE	2,240	
Zambesi black		13,000	5,705
Zambesi black D	A		
Zambesi black D 60 per cent	A		
Zambesi black V	A		
Zambesi black V 77 per cent	A		

UNIDENTIFIED SULPHUR DYES

Cross dye green B	BD	26,242	
Eclipse brown BK	G	10,000	
Immedial violet C	C	850	
Katigene yellow brown GR extra	By	10	
Pyrogene brown DTB new	I	1,102	
Pyrogene cutch brown 2R extra	I	2,205	
Pyrogene indigo blue	S	220	
Pyrogene violet brown X	I	5,070	
Sulphide (thiogene) violet V	M	300	
Sulphur brilliant blue CLB	A	800	
Thiogene new blue 2RL	M	81	
Thional yellow GG	S	7,306	
Thionol black XXN conc	BD	100	
Thionol brown		28,802	
Thionol brown O	BD		
Thionol brown R	BD		
Thionol purple B conc	BD	2,500	

TABLE 16.—*Dyes imported into the United States, 1923*—Continued

UNIDENTIFIED BASIC DYES

Name of dye	Manufacturer	Imports	
		Quantity	Invoice value
		Pounds	
Acridine scarlet J	DH	77	
Brilliant acridine orange		770	
Brilliant acridine orange 3R	DH		
Brilliant acridine orange 5R	DH		
Brilliant cresyl blue 2BS conc	L	110	
Brilliant rhodamine red B	By	24	
Corvoline BT conc	B	100	
Dahlia violet	Q	11	
Flavophosphine GO	M	765	
Indoine A extra pure	G	110	
Leather black TBO	C	50	
Leather brown 5GX	B	5	
Methylene blue 3G	B	105	
New ethyl blue BS	M	11	
Phosphine brown L	G	110	
Phosphine orange	G	110	
Rhodamine 4G		552	$1,548
Rhodamine 4GD	Q		
Rhodamine 4GD extra	M		
Rhodamine 4GDN extra	Q		
Rhoduline blue		77	
Rhoduline blue GO	By		
Rhoduline blue 3GO	By		
Rhoduline sky blue 3G	By	55	

UNIDENTIFIED SPIRIT-SOLUBLE AND COLOR-LAKE DYES

Alizarin green C (soluble in oil)	By	198	
Azonine G, RR, S	C	30	$28
Brilliant lake blue G extra	By	127	
Hansa green G pdr	M	25	
Hansa yellow 5G lumps	M	300	
Helio bordeaux BL paste	By	2,455	
Helio fast violet AL	By	31	
Helio red RM, RMT pdr	By	769	
Japan black		779	681
Japan black extra	B		
Japan black MBG	B		
Japan black MGB	B		
Oil blue Z	K	10	
Oil brown AN	K	10	
Oil green ALB, ALG	K	20	
Paper fast bordeaux B	By	3,015	
Pigment black extra pdr	B	100	
Printing red	A-S Co	110	
Stone (lithol) fast orange R pdr	B	2,610	
Stone (lithol) fast yellow		650	952
Stone fast yellow 2G extra pdr	B		
Stone fast yellow 5G lumps	B		
Stone fast yellow GN lumps	B		
Stone fast yellow GR lumps	B		
Tero (typophor) black FB	B	5	
Tero (typophor) brown FR	B	7	
Tero (typophor) carmine FB	B	12	
Tero (typophor) red FG	B	25	
Tero (typophor) yellow FR	B	205	
Yellow II	B	38	
Zapon blue R	B	5	
Zapon violet R	B	5	

UNIDENTIFIED, UNCLASSIFIED DYES

All other aniline dyes		3,151	$3,455
Beaver reddish brown	Q	22	
Pinatype complement red D	M	11	
Red violet HR	P	220	
Sumazine blue	SMS [2]	500	
Thio violet 5R pdr	DH	55	

[2] The Sugar Manufacturers' Supply Co., Ltd., Great Britain.

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PART IV

CENSUS OF SYNTHETIC ORGANIC CHEMICALS OTHER THAN THOSE OF COAL-TAR ORIGIN, 1923

Part IV

CENSUS OF SYNTHETIC ORGANIC CHEMICALS OTHER THAN THOSE OF COAL-TAR ORIGIN, 1923

Introductory

The United States Tariff Commission has compiled a census of the production of synthetic organic chemicals for the year 1923. A similar census, made for the first time in 1921, has been repeated each year. The quantity of production and the amount and value of the sales have been given in all cases where the figures could be published without disclosing the operations of the individual producer.

The products included in this census are synthetic organic compounds derived from sources other than coal tar. Aliphatic compounds derived from natural sources by isolation, distillation, extraction, hydrolysis, or purification, as for example, alkaloids, constituents of essential oils, sugars, and acids, such as stearic and tartaric, are not included, nor are cyanides, cyanamides, or carbides of metals or inorganic radicals. Statistics for products obtainable from other sources have been excluded in most cases.

As the Bureau of the Census collects data for the more important non-coal-tar organic compounds, the Tariff Commission has not attempted to collect statistics on such, except in a few instances where the importance of the industry or other conditions appeared to warrant this departure.

The production in 1923 of synthetic organic chemicals other than those derived from coal tar was 90,597,712 pounds, compared with 79,202,155 pounds in 1922. Sales in 1923 amounted to 67,727,067 pounds, valued at $13,875,521. This total includes the production of research chemicals, sales of which amounted to 437 pounds, valued at $7,930, or $1.81 per pound.

Developments in the Industry

Previous to the World War the United States produced a few synthetic organic chemicals other than those of coal-tar origin. Among these were acetone, chloroform, ether, acetic acid, formaldehyde, acetaldehyde, amyl acetate, and vanillin. Although few in number, the chemicals of this group required large scale production.

Shortly after the outbreak of the war the manufacturers of finished perfumes, flavors, pharmaceuticals, and other products, who had been dependent upon imports of fine chemicals from Germany, were confronted with a serious situation. The American manufacturers who then undertook to supply these products have since developed an industry not only of considerable size but the source of most of the synthetic organic chemicals consumed in the United States.

Synthetic aromatic chemicals.—The synthetic aromatic chemical industry is a source of supply of raw materials for the flavor and perfume industries. The past year (1923) was probably one of the

most successful that American manufacturers of these products have enjoyed. Progress has been made in overcoming the former prejudice against synthetic aromatic chemicals, and the most important factor in this result has been the successful and systematic development of quality products. American manufacturers of these products have not neglected that essential unit of their business, namely, the research laboratory, and the industry has consequently been placed upon a stable and scientific basis. Workers in the field of perfumes and flavors know it to be one of the most extensive and difficult branches of organic chemistry and, although much important work has been accomplished, further developments may be expected.

Heliotropin, ionone, isoeugenol, rhodinol, terpineol and vanillin show conspicuous increases in production. Several of the esters used in perfumery, as well as nerol, an alcohol similar to geraniol, were reported in 1923, but not in 1922. Among the products showing a decrease in production are linalyl acetate and citronellol.

Esters.—Several of the esters show a large increase in production. The production of amyl acetate in 1923 reached 3,207,022 pounds and of ethyl acetate (85 per cent), 25,887,720 pounds, as compared with 16,114,458 pounds in 1922. Ethyl chloride shows an increase in production, and butyl acetate a decrease.

Chloroform and carbon tetrachloride.—The production of chloroform and carbon tetrachloride was greatly increased in 1923, the output of chloroform in that year amounting to 1,585,250 pounds, and that of carbon tetrachloride to 13,513,644 pounds.

Pharmaceuticals.—Manufacturers of synthetic medicinals have increased production in chloral hydrate, glycerophosphoric acid and salts, iodoform, and formaldehyde. Formaldehyde is used as a disinfectant and antiseptic, and in the manufacture of hexamethylenetetramine. The latter, which serves not only in medicine but in greater amounts as an accelerator in the vulcanization of rubber and in the manufacture of synthetic resins, shows a decrease in production for 1923.

Some medicinals of special interest, reported in 1923 but not in the previous year, are alphozone (succinic dioxide) and dibromin (dibromomalonylureide).

Acetylene derivatives.—Aldol and paracetaldehyde each show an increased production for the year 1923; on the other hand, the production of acetaldehyde shows a decrease. These products are imported from Canada, where during the war a large plant was erected at Shawinigan Falls to produce acetic acid and acetone fron acetylene. The production of aldehyde-ammonia, used as an accelerator in the vulcanization of rubber, shows a decrease in production for the year 1923. Acetylene derivatives reported in 1923 but not in 1922 include acetylene tetrabromide and acetylene tetrachloride.

Ethylene and propylene derivatives.—Ethylene shows a considerable increase in production for 1923, being used as an anesthetic in place of ether or nitrous oxide. Several derivatives of ethylene and propylene were made in commercial quantities in 1923. Probably the most important of these is ethylene chlorohydrin, which shows a large increase in production. These derivatives are manufactured by at least two companies. The process used is based upon the recovery of ethylene and propylene from the waste gases of petroleum-cracking and from other hydrocarbon gases. Other products from

these sources are diethyl sulphate, used as an ethylating agent, particularly in dye manufacturing, and isopropyl alcohol, used in organic synthesis, particularly for the perfumery and flavoring industries.

Gallic and pyrogallic acids are important products of this group. Gallic acid is a white crystalline substance made from nutgalls, used in the manufacture of dyes, pyrogallic acid, ink, and in medicine. Pyrogallic acid is one of the oldest of photographic developers. Both of these products showed an increased production in 1923.

Dihydroxytartaric acid.—A large increase in the manufacture of this product is noted for 1923. It finds application in the manufacture of a dye known as tartrazine.

Furfural, first reported in commercial quantities in 1922, shows a large increase in production in 1923. This synthetic is made from corncobs, a waste material available in practically unlimited quantities. Furfural may have valuable uses in the synthetic resin and varnish industry.

Lactic acid, used in the leather, textile, and dye industries, shows a decreased production for 1923. The manufacture of this product by a controlled fermentation process is an American development.

Oxalic acid, one of the most important chemicals of this group of synthetics, showed a decrease in production in 1923.

Tetraethyl lead is one of the synthetics reported for the first time in 1923. It is finding use as an anti-knock compound in gasoline engines.

Statistics of Production and Imports

TABLE 17.—*Production and sales of synthetic organic chemicals, 1923*

(Not derived from coal tar)

[The numbers in the second column refer to the numbered alphabetical list of manufacturers printed on page 195. An X indicates that the manufacturer did not consent to the publication of his name in connection with the particular product. A blank in the third and fourth columns indicates that these sales can not be published without revealing information in regard to the sales of individual firms. A blank in the sixth column indicates that the production can not be published without revealing information in regard to the output of individual firms. The details thus withheld are, however, included in the totals]

Name	Manufacturer's identification number according to list on p. 195	Sales			Total production
		Quantity	Value	Average price per pound	
Total		*Pounds* 67,727,067	$13,875,521	$0.20	*Pounds* 90,597,712
Acetaldehyde	29, 75, 118, 149, X	1,003	614	.61	
Acetamide	54, 68				
Acetin (mono)	191				
Acetylene tetrabromide	62				
Acetylene tetrachloride	29				
Aldehyde ammonia	149				
Aldol (b-hydroxybutyraldehyde)	29				
Alloxan (mesoxalyl urea)	179				
Allyl alcohol	144				
Allyl isothiocyanate	33				
Alphozone (succinic dioxide)	X				
Aminopropionic acid	197				
Amyl acetate and sec. amyl acetate	10, 63, 72, 75, 117, 127, 129, 141, 191, 193, X, X.	1,858,176	1,017,627	.55	3,207,022
Amyl alcohol and sec. amyl alcohol	X, X, X				
Amyl isovalerate	191				
Amyl oenanthate	75				

TABLE 17.—*Production and sales of synthetic organic chemicals, 1923*—Continued

Name	Manufacturer's identification number according to list on p. 195	Sales			Total production
		Quantity	Value	Average price per pound	
		Pounds			*Pounds*
Anethol	75, 79, X	573	$636	$1.11	305
Anisic acid	79				
Aubepine (anisaldehyde)	24, 75				
Barbital (veronal) (diethylbarbituric acid).	1, 17, X	9,116	176,960	19.41	
Barbital sodium	17				
Borneol	69, 137				
Brometone (tribromotertiarybutyl alcohol).	X				
Bromodiethylacetylcarbamide	17				
Bromocamphor	62, 118				
Bromoform	62				
Butanol (n-butyl alcohol)	29, 43				
sec.-Butyl alcohol	X				
Butyl acetate (n, and sec.)	10, 63, 75, 79, 117, 127, 141, 191, 193, X.	351,041	151,673	.43	1,816,086
n-Butyl bromide	68				
Butyl butyrate	79				
n-Butyl iodide	68				
Butyl propionate	79				
Butyraldehyde	29, 43				
n-Butyric acid	72, 79, 141				23,569
Butylxanthic disulphide	X				
d-Camphoric acid	118				
n-Caproic acid	75, 141				
Carbon tetrachloride	62, 139, 200, X	11,607,361	874,281	.08	13,513,644
Chaulmoogric ester	17				
Chloroacetyl chloride	62				
Chloral hydrate	124, X				
Chloretone (trichlorotertiarybutyl alcohol).	X				
Chloroacetic acid (mono)	62, 63				
Chloroform	62, 139, 160, X	1,442,479	355,319	.25	1,585,250
Chlorodimethyl ether	17				
Chloro-theophylline	17				
Cinnamyl alcohol	75				
Cinnamyl ketone	75				
Cinnamyl valerate	75				
Citronellol	75, 103, 194				
Citronellyl acetate	75, 178, X				99
Crotonaldehyde	29				
Crotonic acid	29				
Cyanacetic acid, sodium salt	17				
Decyl alcohol	75				
Decyl aldehyde	75				
Dibromin (dibromomalonylureide)	X				
Dibromobehenate of calcium	17				
n-Dibutylamine	1				
Dichloroacetic acid	62				
Dichloroethylether	29				
Dichloromethane	62				
Dichloropentanol	17				
Diethylacetic acid	17				
Diethylamine	1, 205				
Diethylaminoethyl alcohol	205				
Diethylbromoacetyl bromide	17				
Diethyl malonate (malonic ester)	1, 17				
Diethyl sulfate	29				
Dihydrovanillone	75				
Dihydroxycitronnellic ketone	75				
Dihydroxytartaric acid	27, 88, 151, 205				100,029
Diiodohydroxypropane	17				
Dimethylamine	205				
Dimethylglyoxime	68, 111				
1:3-Dimethylxanthine	17				
1:3-Dimethylxanthine sodium acetate.	17				
Disodiummonoethylarsone	X				
Duodecyl alcohol	75				
Duodecyl aldehyde	75				
Erucic acid	17				
Ethyl acetate, 85 per cent	10, 63, 72, 75, 117, 127, 129, 191, 193, 194, X.	16,970,972	1,936,217	.11	25,887,720

TABLE 17.—*Production and sales of synthetic organic chemicals, 1923*—Continued

Name	Manufacturer's identification number according to list on p. 195	Sales			Total production
		Quantity	Value	Average price per pound	
		Pounds			*Pounds*
Ethyl acetoacetate	191				
Ethyl anisate	79				
Ethyl azelate	79				
Ethyl bromide	17, 62, 118, 194, 205			$0.39	124,842
Ethyl butyrate	24, 72, 75, 79, 141, 191, 194, X, X.	40,791	$51,581	1.27	40,477
Ethyl n-caproate	141				
Ethyl carbonate	75, 191				
Ethyl chloride	48, 62, 78, 83, 118, 160, 191, X, X.	219,594	68,505	.31	270,180
Ethyl chloroacetate	62, 191				
Ethyl citrate	194				
Ethyl xanthic acid, ethyl ester of	X				
Ethyl ether	48, 63, 118, 153, 174, 191.	4,666,832	554,203	.12	5,104,157
Ethyl formate	75, 79, 118, 141, 191, X.	2,016	1,220	.61	1,958
Ethyl glycolic acid ester of menthol	17				
Ethyl iodide	68, 118, 124, 153, 179.	226	1,234	5.46	261
Ethyl isovalerate	75, 141, 191				
Ethyl lactate	75, 191				
Ethyl laurate	75				
Ethyl malonate (mono)	1, 75				
Ethyl nitrite	118, 153, X	29,946	15,428	.52	35,140
Ethyl oenanthate	75, 79, 141, 194, X.	3,965	6,942	1.75	3,476
Ethyl oxalate	17, 75, 191, 194				
Ethyl pelargonate	24, 75, 79, 129				823
Ethyl propionate	72, 75, 194, X			1.81	1,869
Ethyl n-valerate	72, 75, 194, X				
Ethylene	191				
Ethylene bromide	62, 118				
Ethylene chlorohydrin	29, 62				
Ethylene diamine	29, X				
Ethylene dibromide	62				
Ethylene dichloride	29, 62				
Ethyleneglycol	29				
Ethylene oxide	29				
Formaldehyde	58, 93, 127, 142, 149, X.	18,854,535	2,474,506	.13	24,081,188
Formic acid, 85 per cent	196				
Furfural	156				
Gallic acid	68, 118, 208	161,399	88,342	.55	469,941
Geranyl acetate	75, 79, 129, 178, X				
Geranyl butyrate	75, 103, X	20	125	6.25	
Geranyl formate	75, 103, 178, X	22	129	5.86	
Geranyl propionate	75				
Geranylphenyl acetate	75				
Glycerol monochlorohydrin	68				
Glycerophosphoric acid and salts of	142, X				
Glycol diacetate	29				
Guaiacol acetate	75				
Guaiacolphenyl acetate	75				
Heliotropin	24, 75, 78, 192, X	12,914	24,572	1.90	11,696
Heptadecyl aldehyde	75				
Heptaldehyde	75, 79, X				
Heptaldehyde ammonia	X				
Heptoic acid	79				
n-Heptyl alcohol	75				
Heptylideneethylamine	X				
Heroin (diacetylmorphine)	118, 136, 153	1,000	118,433	118.43	
Hexachloroethane	29, 62				
Hexadecyl alcohol	75				
Hexadecyl aldehyde	75				
Hexadecyl ketone	75				
Hexamethylenetetramine	93, 142, 149, X	1,155,083	974,877	.84	1,381,073
Hexamethylenetetramineanhydromethylene citrate	17				
Hydroxycitronellal	186, X				
Iodobehenate of calcium	17				
Iodobehenate of iron basic	17				
Iodobehenic acid	17				
Iodoform	118, 124, 136, 153	12,179	63,758	5.24	13,231
Ionone	75, 103, 129, 192, 194, X	23,476	98,478	4.20	

TABLE 17.—*Production and sales of synthetic organic chemicals, 1923*—Continued

Name	Manufacturer's identification number according to list on p. 195	Sales			Total production
		Quantity	Value	Average price per pound	
		Pounds			*Pounds*
Isoamyl acetate	141				
Isoamyl butyrate	24, 75, 79, 141, 191, X, X.	9,362	$13,189	$1.41	9,733
Isoamyl formate	75, 79, 141, 191			1.20	84
Isoamyl nitrite	68				
Isoamyl n-valerate	72				
Isoamyl isovalerate	75, 79, 141, 191, X.	399	1,196	3.00	430
Isobutyl acetate	75, 79, 141, 191	83	274	3.30	111
Isobutyl alcohol	103				
Isobutyl butyrate	75, 141, 191	12	34	2.83	
Isobutyl formate	75, 191				
Isobutyl isobutyrate	79				
Isobutylpropionate	75				
Iso butyraldehyde	75				
Iso butyric acid	79, 141				
Isoeugenol	24, 75, 103, 192, 195, X.	2,063	9,502	4.61	
Isopropyl acetate	75				
Isopropyl alcohol (Isopropanol)	29, 144, X				
Isopropyl chloride	144				
Isopropyl oxalate	191				
Isovaleric acid	79, 141, 176				
Jasmone ketone	75				
Lactic acid	197				
Limonene alcohol	194				
Linalyl acetate	75, 103, 178, 192	453	3,570	7.88	238
Linalyl butyrate	75				
Linalyl formate	75, 178, 192				
Linalyl propionate	75				
Linalyl valerate	75				
Methaform (chlorobutanol)	X				
Methyl acetate	79, 127, 191				
Methylamine	205				
Methyl anisate	79				
Methyl bromide	62				
Methyl n-butyrate	75, 141, 191				
Methyl chloride	X				
Methyl eug nol	75, 178				
Methyl formate	191				
Methyl iodide	179				
Methyl isoeugenol	178				
Methylnonylacetic aldehyde	75				
Methyl oxalate	75, 191				
Methyl propionate	75				
p-Methyl quinoline	75				
Methyl sulfate	X				
Methyl xanthic acid, ethyl ester of	X				
Methylene citric acid	17				
Nerol	194				
Nonyl alcohol	75				
Nonyl aldehyde	75				
Octadecyl alcohol	75				
Octadecyl aldehyde	75				
Octadecyl ketone	75				
Octoic alcohol	178				
sec-Octyl acetate	75, 192				
n-Octyl alcohol and sec-octyl alcohol (capryl alcohol).	75, 179, 192				45
Octyl aldehyde	75, 103				
Octyl formate	178				
Oxalic acid	143, 196				
Paracetaldehyde	29, 110				
Pentachloroethane	29, 62				
Paraformaldehyde	93, 142, 149	117,506	57,670	.49	112,846
Piperonone (piperinic ketone)	75				
Piperonone vanillone	75				
Potassium ethyl xanthate	X				
Potassium methyl xanthate	X				
Propionaldehyde	75				
Propionic acid	72				
n-Propyl acetate	75				
n-Propyl alcohol	144				
n-Propyl n-butyrate	191				
n-Propyl isovalerate	191				
Propyl oenanthate	75				
n-Propyl propionate	75				

TABLE 17.—*Production and sales of synthetic organic chemicals, 1923*—Continued

Name	Manufacturer's identification number according to list on p. 195	Sales			Total production
		Quantity	Value	Average price per pound	
		Pounds			*Pounds*
Propylene chlorohydrin	29				
Propylenedichloride	29				
Propylene glycol	29				
Propylene oxide	29				
Pyrogallol (pyrogallic acid)	68, 118, 208	222,929	$218,066	$0.98	235,389
Pyruvic acid	27				
Rhodinol	75, 103, 129, 178, 186, 192, 194.	2,985	43,558	14.69	5,729
Rhodinyl acetate	75, 178				
Rhodinyl butyrate	75				
Rhodinyl formate	178				
Succinic anhydride	X				
Tannyl acetate (tannigen)	17				
Terpineol	137, 192, X, X	260,318	129,430	.50	322,337
Terpineoline	X				
Terpin hydrate	153, 195				
Terpinyl acetate	75, 79, 103, 129, 178, 192, X.	7,655	11,250	1.47	13,638
Terpinyl butyrate	75				
Tetrachloroethylene	62				
sym-Tetrachloroethane	62				
Tetradecyl alcohol	75				
Tetradecyl aldehyde	75				
Tetradecyl ketone	75				
Tetraethyl lead	63				
Tetramethyldiaminopentanol	17				
Triacetin	79, 129, 191				
Trichloroethylene	29, 62				
Triethyltrimethylenetriamine	X				
Trimethylene bromide	1				
n-Valeric acid	72				
Vanillic acid	75				
Vanillic alcohol	75				
Vanillin [1]	78, 79, 122, 195, X, X.				269,941
Vanillyl vanillate	75				
Zinc butyl xanthate	X				
All other synthetic organic chemicals	111				
Research chemicals	54, 68, 172	437	7,930	1.81	

[1] Includes vanillin reported by one firm under coal-tar flavor.

TABLE 18.—*Comparison of production of synthetic organic chemicals, 1922 and 1923*

Name	1923	1922
	Pounds	*Pounds*
Amyl acetate	3,207,022	1,692,074
Butyl acetate (n. and sec.)	1,816,086	2,467,506
Carbon tetrachloride	13,513,644	11,166,318
Citronellyl acetate	99	105
Ethyl acetate (85 per cent)	25,887,720	16,114,458
Ethyl bromide	124,842	155,162
Ethyl butyrate	40,477	22,958
Ethyl chloride	270,180	164,198
Ethyl ether	5,104,157	4,017,043
Ethyl formate	1,958	1,627
Ethyl iodide	261	238
Ethyl oenanthate	3,476	4,731
Ethyl pelargonate	823	971
Formaldehyde	24,081,188	23,958,152
Gallic acid	469,941	411,768
Heliotropin	11,696	6,794
Hexamethylenetetramine	1,381,073	2,015,161
Iodoform	13,231	11,811
Isoamyl butyrate	9,733	5,576
Isoamyl formate	84	155
Isobutyl acetate	111	510
Linalyl acetate	238	736
n-Octyl alcohol and sec. octyl alcohol	45	106
Pyrogallol	235,389	187,536
Rhodinol	5,729	777
Terpinyl acetate	13,638	13,802
Vanillin	269,941	221,046

TABLE 19.—*Imports and production of synthetic organic chemicals (except those of coal-tar origin), 1922, 1923*

Name	Imports, 1922		Production 1922	Imports, 1923		Production 1923
	Pounds	Value	Pounds	Pounds	Value	Pounds
Acetaldehyde	82,390	$13,192	71,537	163,913	$26,338	
Acetic or pyroligneous acid	18,706	1,318				
Containing by weight not more than 65 per cent acetic acid	43	19		37,052	4,758	
Containing more than 65 per cent acetic acid				664,034	79,553	
Formic acid	278,141	20,481		1,282,004	96,174	
Gallic acid	4,490	2,387	411,768	6,048	2,743	469,941
Glycerophosphoric, and salts and compounds	12,481	8,659		28,265	38,100	
Lactic acid	380,840	37,913				
Containing by weight 55 per cent or more of lactic acid	5,000	758		66,648	16,056	
Oxalic acid	1,290,075	106,486	3,978,807	2,621,302	206,100	
Pyrogallic acid	1	3	187,536	342	417	235,389
Methanol	[1] 27	43	[1] 6,808,911	[1] 15,786	12,573	[1] 8,593,727
Carbon tetrachloride	66,131	1,854	11,166,318	1,429	130	13,513,644
Chloroform	15	3		381	133	1,585,250
Chloral hydrate	1,354	1,186		6,135	1,819	
Cocaine, etc	[2] 7,518	18,572		[2] 100	238	
Ethers and esters:						
Containing not more than 10 per cent alcohol—						
Ethyl ether	906	158	[3] 4,017,043	[3] 103	75	5,104,157
Ethyl chloride	17,096	10,906	[3] 164,198	[3] 9,519	11,899	270,180
Amyl acetate	200	258	[3] 1,692,074	[3] 26,418	9,612	3,207,022
Amyl nitrite	6	17		56	114	
Ethyl acetate	200	276	[3] 16,114,458	[3] 27,202	11,664	25,887,720
Nitrous, spirits of	1,998	1,365				
Other, n. s. p. f.	4,374	1,781		11,448	6,458	
Containing more than 50 per cent alcohol	1,616	1,442		668	1,436	
Formaldehyde solution (not more than 40 per cent)	407	67	23,958,152			24,081,188
Formaldehyde solution (formalin)	300	50		166	67	
Hexamethylenetetramine	16,010	7,765	2,015,161	47,373	24,722	1,381,073
Urea	260,636	61,561		47,711	5,898	
Thymol	11,403	34,426		12,136	27,067	
Vanillin	[2] 3,514	1,448	221,046			269,941

[1] Gallons. [2] Ounces. [3] Alcohol content unknown.

PART V

INTERNATIONAL DYE TRADE

PART V

INTERNATIONAL DYE TRADE

INTRODUCTORY

In the census of 1922 the world's trade in synthetic dyes was the subject of discussion. This included a review of the conditions existing before the war, when Germany dominated the world trade, and a consideration of manufacturing developments during and since the war, as a result of which the United States, Great Britain, France, and Italy have established home dye industries producing a great part of the requirements of each country and which have to some extent developed an export trade in dyes. The dye industries of Great Britain, Switzerland, and France were considered in detail. Available statistical information from official sources on production, consumption, imports and exports of dyes by different nations was also included in Part V, International Dye Trade.

GENERAL DEVELOPMENTS DURING 1923

The occupation of the Ruhr.—The occupation of the Ruhr by the French during 1923 had a pronounced effect on the international dye trade through the partial elimination, for some months of that year, of active competition by German dye manufacturers. The total output of dyes in the German factories in January, 1923, was at the rate of 240,000,000 pounds per year or approximately 85 per cent of the output in 1913. The monthly production figures of the German dye plants declined from January to May, when they reached a minimum output for that year, being at the rate of about 35 per cent of the 1913 output. Then, from June until December, each month registered a gain in production, the rate in the latter month being equivalent to nearly 185,000,000 pounds per year. The total production of 1923 (144,859,572 pounds) was smaller by 47,946,992 pounds than the 1922 output, which had amounted to 192,806,564 pounds. This decrease represents a significant portion of the world's total annual consumption. The requirements of China, India, and other large nonmanufacturing consumers were in part met by the United States, Great Britain, France, and Switzerland, as is apparent from the official dye statistics of those countries. The exports of the United States increased in 1923 to 17,924,200 pounds, valued at $5,565,267, from a 1922 total of 8,344,187 pounds, with a value of $3,996,443. The exports of dyes similarly increased in the United Kingdom, totaling in 1923, 14,132,944 pounds, valued at $4,719,924, compared with 5,299,504 pounds, valued at $2,714,612, in 1922. The exports during 1923 of both the United Kingdom and the United States fell below those of 1920, a year of world-wide business activity, before German dyes had reappeared in the world's markets. Germany's monthly production figures for January and February, 1924, show an output at the rate of nearly 190,000,000

pounds per year. This expansion in production is obviously a factor in the world's large dye markets, such as the Far East countries, and will probably affect exports of dyes from the United States and Great Britain. The output of the early months of 1924 indicates that the effects of the Ruhr occupation, which extended from the early part of 1923 to the latter part of the year, have very largely disappeared.

Seizure of German dyes by French and Belgian authorities.—According to reports from France, 6,560 tons of dyes were seized in May, 1923, in the dye plants at Höchst, Ludwigshafen, and Biebrich. Of this total, 2,100 tons were sold in order to pay sums due the German Coal Syndicate by the German dye concerns from which the dyes were taken. It is understood that the remaining 4,460 tons were to be divided between France and Belgium. A portion of the first dye seizure was resold for exportation. Later seizures were reported to consist of pharmaceuticals and chemicals.

Indigo and alizarin red comprised a large portion of the seized stocks. The British Alizarin Company purchased alizarin in quantity in order to prevent the demoralization of price levels by the dumping of this dye on the market. The official import figures for the United Kingdom show a total of 1,445,024 pounds of alizarin, valued at $391,535, for the month of January, 1924. This amount exceeded by 503,216 pounds the total imports of alizarin during the entire year 1923.

Increased post-war capacity to produce dyes.—The combined capacity of the world's synthetic dye plants in 1924 is estimated to exceed 600,000,000 pounds per year, or nearly double the pre-war capacity. In arriving at this estimate the capacity of the seven leading dye-producing nations has been used. In addition, there is probably productive plant capacity in Austria, Czechoslovakia, Belgium, Holland, Sweden, Russia, and possibly other countries, but the aggregate of these minor producers will, it is believed, not seriously affect this estimate. The estimated capacity for the first seven countries given in the following table was obtained by adding 25 per cent to the maximum reported or estimated output.

The existing capacity to produce in excess of normal requirements can not fail to result in an era of severe competition in the world's markets, and will finally eliminate many of the plants now producing dyes.

TABLE 20.—*World's estimated annual capacity to produce dyes*

Country	Maximum reported or estimated output	Estimated annual capacity
	Pounds	*Pounds*
Germany [1]	280,000,000	350,000,000
United States [2]	94,000,000	117,500,000
Great Britain [3]	43,000,000	54,000,000
Switzerland [3]	24,000,000	30,000,000
France [4]	24,000,000	30,000,000
Italy [5]	10,000,000	12,500,000
Japan [6]	16,000,000	20,000,000
Total	491,000,000	614,000,000

[1] For the year 1913, exports totaled 239,598,133 pounds and home consumption is estimated at 40,000,000 pounds.

[2] For 1923. [3] For 1920. [4] For 1923. [5] For 1922. [6] For 1919

The following tables show exports from the principal dye-producing countries and imports into the chief dye-consuming countries:

TABLE 21.—*Exports of coal-tar dyes from chief producing countries, 1913, 1921–1923*

Exported from—	1913		1921	
	Pounds	Value	Pounds	Value
Germany	239,598,133	$51,689,400	[1] 48,304,991	[1] $15,935,585
United States				[4] 6,270,139
Great Britain	5,451,376	862,566	7,621,600	5,033,828
Switzerland	19,458,902	5,549,752	10,779,612	11,654,516
France	1,152,134	275,716	5,947,131	1,608,308
Italy	117,725	22,458	607,812	274,128

Exported from—	1922		1923	
	Pounds	Value	Pounds	Value
Germany	114,213,300	$79,826,618	73,974,473	[2] $41,580,742 [3] 17,125,528
United States	[5] 8,344,187	[5] 3,996,443	[5] 17,924,200	[5] 5,565,267
Great Britain	3,860,416	2,300,298	14,132,944	4,719,924
Switzerland	16,167,655	13,042,635	18,282,967	12,253,711
France	1,251,551	1,094,420	4,650,382	3,749,442
Italy	372,578	254,250	[6] 432,983	[6] 417,906

[1] May to December, 1921.
[2] 1923 basis.
[3] 1913 basis.
[4] Includes natural and coal-tar dyes, with exception of logwood extract.
[5] New classification for coal-tar colors adopted in 1922 was "Color Lakes" and "Other colors, dyes, and stains."
[6] First nine months.

TABLE 22.—*Imports of dyes into chief consuming countries, 1913, 1921–1923*

Imported into—	1913		1921	
	Pounds	Value	Pounds	Value
China	[1] 60,696,533	$11,673,779	46,939,187	$19,283,019
United States	[2] 45,950,895	7,537,870	4,252,911	5,156,779
Great Britain	41,203,008	9,207,684	6,686,288	5,930,054
Austria-Hungary	17,168,764	3,616,199	3,439,837	931,610
British India [3]	16,923,607	3,741,031	11,731,237	11,798,262
Italy	15,542,429	3,611,705	[4] 7,450,665	2,556,457
Japan	[5] 9,755,260	2,100,255	7,752,896	9,858,807
Germany	7,138,495	1,682,422	[6] 291,457	33,497
Russia	4,835,647	3,701,186		
France	4,706,601	1,416,316	2,531,320	1,539,907
Canada [3]	2,633,516	594,414	2,366,855	1,692,873
Turkey	2,631,703	641,321		
Sweden	2,376,166	699,737	984,028	851,265
Spain	[7] 2,303,709	1,021,368	3,178,365	1,264,929
Switzerland	2,201,292	431,197	1,084,337	668,843
Dutch East Indies	[8] 2,073,434	890,366	2,166,053	1,385,364
Czechoslovakia			10,854,128	6,901,737
Netherlands			2,666,518	1,937,097

[For footnotes see next page.]

TABLE 22.—*Imports of dyes into chief consuming countries, 1913, 1921–1923*—Continued

Imported into—	1922		1923	
	Pounds	Value	Pounds	Value
China	56,300,385	$17,788,624		
United States	3,982,631	5,243,257	3,098,193	$3,151,363
Great Britain	6,450,192	5,873,160	6,289,584	4,591,038
Austria-Hungary	2,760,380	817,737		
British India	14,119,822			
Italy	[9] 5,484,383	2,751,374		
Japan	12,526,817	9,025,223		
Germany	1,003,300	111,906	466,494	123,522
Russia				
France	3,279,786	2,778,480	3,022,505	2,986,200
Canada	3,290,349	2,287,159		
Turkey				
Sweden				
Spain	2,115,627	1,777,938		
Switzerland	1,290,793	672,769	1,980,171	974,518
Dutch East Indies	2,091,102		2,238,238	
Czechoslovakia	7,826,320	5,765,175	5,118,341	2,688,556
Netherlands	3,816,162	2,124,263		

[1] Exports to China, 1913, from France, Germany, and Switzerland amounted to 69,181,230 pounds, valued at $11,516,567. Chinese statistics show value but not quantity of aniline dyes, and include "unclassified dyes," which may contain other than coal-tar dyes.
[2] Fiscal year 1914—Quantity from Special Agents Series No. 121; value from Commerce and Navigation Reports.
[3] Years ended March 31, 1914, and 1922 and 1923.
[4] Figures include 3,496,275 pounds of reparation dyes for which no value is shown.
[5] Aniline only, in 1913.
[6] 1921 imports, May to December.
[7] 1914.
[8] Quantity of synthetic indigo not shown, 1913.
[9] Figures include 1,666,237 pounds of reparation dyes for which no value is shown.

GERMANY'S POSITION IN THE WORLD'S DYE TRADE

Of primary importance in a consideration of international dye trade is the pre-war supremacy of Germany and her recent efforts to regain her lost trade.

The chemical industry is one of the leading industries of Germany. Its vital place in the welfare of the country is fully appreciated and the severe loss of trade in dyes and chemicals as a result of the war can not be considered as permanent.

The organization and growth of the dye industry in Germany up to the outbreak of the war has been described in great detail in many technical publications. Accordingly, mention is made here only of the more important influences which have favored the expansion of the German industry, together with statistics of the exports of dyes from 1880 to 1913, demonstrating the remarkable rate of their growth.

The coal-tar dye industry was established in England and France several years before it was started in Germany. Professor Hoffman and other German chemists who had resided in England were thoroughly familiar with the initial work on these dyes carried out in the Royal College of Chemistry and in other English institutions. They returned to Germany, to find the significance and promise of the coal-tar dye and chemical industry fully appreciated. The value of research was, from the start, recognized by the German universities, the Government, and the industrial firms. This probably more than any other factor favored the rapid growth and development of the

industry. Other vital factors in the growth of this chemical branch were (1) the heavy capital investment; (2) the availability of raw material; (3) the concentration within a small area; (4) the fact that foreign patent laws in consuming countries, such as France, Great Britain, and the United States, were unfavorable to the establishment of domestic dye industries, but favorable to German ownership of patents; and (5) the intimate relationship between different concerns which resulted, in recent years, in the formation of a powerful trust.

PRE-WAR TRADE

Prior to the war German dye manufacturers succeeded in eliminating any serious foreign competition, using to that end such methods as price cutting, full-line forcing, and dumping.

In 1913, the total exports of dyes reached a maximum, 239,598,133 pounds; adding 40,000,000 pounds as the estimated home consumption, total production during that year approximated 280,000,000 pounds. As Germany then dominated the world's market an analysis of official dye-export figures throws much light on the world's dye trade at that time. Table 23 shows total exports of dyes from Germany in 1913 for the first 10 importing countries both by quantity and value.

TABLE 23.—*Exports of coal-tar dyes from Germany to leading countries, 1913*

Exported to—	Pounds	Exported to—	Value
China	65,743,387	China	$10,957,190
United States	44,030,272	United States	9,027,780
Great Britain	32,744,924	Great Britain	6,617,240
Austria-Hungary	16,933,533	Austria-Hungary	3,787,380
British India	15,008,916	Japan	3,453,900
Italy	10,908,360	British India	3,168,060
Japan	9,744,333	Italy	2,524,920
Belgium	5,531,341	Russia	1,929,420
Netherlands	5,072,785	France	1,524,480
France	5,055,148	Belgium	1,405,380

Table 24 shows exports by countries for the year 1913, giving value and quantity for the three following classes of synthetic dyes, "aniline and other coal-tar dyes, not elsewhere mentioned," "alizarin, alizarin dyes and anthracene dyes," and "synthetic indigo."

TABLE 24.—*Exports of coal-tar dyes from Germany, 1913*

	1913			1913	
	Pounds	Value		Pounds	Value
Alizarin, alizarin red, variegated colors from anthracene:			Alizarin, alizarin red, variegated colors from anthracene—Continued.		
Alsace-Lorraine			Sweden	127,867	$47,640
France	489,421	$190,560	Switzerland	661,380	95,280
Great Britain	5,857,622	976,620	Spain	50,706	23,820
Italy	416,669	119,100	British India, etc	5,866,441	905,160
Netherlands	716,495	119,100	Japan	205,028	95,280
Austria-Hungary	1,192,689	333,480	East Indies, etc	1,298,509	238,200
Austria			United States	5,855,418	1,310,100
Czechoslovakia			Total	24,338,784	5,145,120
Russia	725,313	428,760			

TABLE 24.—*Exports of coal-tar dyes from Germany, 1913*—Continued

	1913	
	Pounds	Value
Aniline and other coal-tar dyes not specifically mentioned:		
Belgium	5,531,341	$1,405,38
Bulgaria	384,393	71,460
Alsace-Lorraine		
France	3,853,641	1,024,260
Great Britain	24,285,874	5,259,500
Italy	9,032,246	2,167,620
Netherlands	3,009,279	666,960
Norway	595,242	142,920
Austria-Hungary	12,740,383	2,977,500
Austria		
Jugoslavia		
Czechoslovakia		
Hungary		
East Poland		
Portugal	921,523	238,200
Rumania	496,035	119,100
Denmark	806,884	142,920
Russia	2,420,651	833,700
South Russia		
Baltic States		
Finland	520,286	142,920
Sweden	1,986,345	476,400
Switzerland	1,728,406	500,220
Serbia	211,642	47,640
Spain	1,446,218	428,760
Turkey	963,410	214,380
British India, etc	8,428,185	1,953,240
China	18,653,121	4,536,994
Japan	7,729,328	2,000,880
Dutch East Indies	531,309	119,100
Argentina	350,531	119,100
Aniline and other coal-tar dyes not specifically mentioned—Continued.		
Brazil	1,382,284	$404,940
Canada	976,638	190,560
Chile	123,458	47,640
Mexico	1,197,098	285,840
United States	30,544,733	6,717,240
Other countries		
Total	141,729,325	33,835,604
Indigo:		
Alsace-Lorraine		
France	712,086	309,660
Great Britain	2,601,428	381,120
Italy	1,459,445	238,200
Netherlands	1,347,011	214,380
Austria-Hungary	3,000,461	476,400
Austria		
Czechoslovakia		
Hungary		
Russia	956,796	666,960
Spain	147,708	119,100
Egypt	976,638	214,380
British India, etc	714,290	309,660
China	47,090,256	6,396,964
Japan	1,809,977	1,357,740
East Indies, etc	2,103,188	357,300
United States	7,630,121	1,000,440
Dutch Indies		
Other countries		
Total [1]	73,530,014	12,685,444

[1] Officially published totals do not check with items shown.

EXPORTS SINCE THE WORLD WAR

The establishment of dye industries in the United States, Great Britain, France, and Italy, able to supply most of the home requirements and, in addition, to enter the export trade to some extent, has resulted in the loss of a large part of Germany's export trade in dyes, as shown in the following table:

TABLE 25.—*Exports of coal-tar dyes from Germany, 1913, 1920–1923*

Year	Pounds	Value
1913	239,598,133	$51,666,168
1920	61,140,171	53,002,407
1921 [1]	48,304,991	15,935,585
1922	115,974,900	80,781,892
1923	73,974,473	[2] 41,580,742 [3] 17,125,528

[1] May to December. [2] 1923 basis. [3] 1913 basis.

Of the leading consuming countries which are now dye producers, the United States ranks first (rating second by quantity of the world's consumers and first by value). The recovery of this market is of great importance to Germany, as the United States now possesses a dye industry ranking second to that of Germany and not only supplies more than 90 per cent of its domestic requirements, but has

exported significant amounts of indigo, sulphur black, and other dyes to Far East markets, a feature tending to prevent German domination in these markets. It is accordingly a logical move on the part of Germany to seek to regain the United States market, even at very great cost and over a prolonged period of effort.

EFFORTS TO REGAIN EXPORT TRADE

No doubt is possible as to the determination of the "I. G." to regain for Germany her former supremacy in the world's dye trade. Of the various methods open to her in the effort to accomplish this purpose, the following appear to be of leading importance:

(*a*) Affiliation with concerns in the new dye-producing countries to establish a foothold in them.

(*b*) The exercising of influence in competing countries, either directly or indirectly through consumers, to bring about tariff changes facilitating a freer entrance of dyes into those countries.

(*c*) By attacking the export trade of the United States, Great Britain, and France, to weaken the industry of those nations to the extent to which the export trade serves as a source of revenue and a balance of production, and thus to admit of more continuous operation at lower manufacturing costs.

(*d*) The use of propaganda directed against the new foreign industries and their products and favorable to the German organization and its dyes.

(*e*) Commercial warfare, by such well-known methods as price cutting, full-line forcing, and dumping.

Affiliations.—The new dye-producing nations, the United States, Great Britain, France, Italy, and Japan, have adopted tariff measures or import restrictions calculated to protect and stimulate the production of dyes in those countries. Germany has consequently not had free access to the markets of these countries, which before the war were dominated by German dyes.

One method open to Germany for establishing a foothold and sharing the profits is to enter into an affiliation with one or more of the large dye producers, and to obtain control by purchase of the major portion of the stock carrying voting rights. In the event of high protective measures being continued in those countries, Germany might find it advantageous to purchase outright an existing American plant, or to establish new plants in the United States, where their processes could be conducted and their trade secrets retained exclusively in the hands of German agents. A price-cutting campaign might be resorted to for the purpose of forcing some of the existing concerns out of business.

Italy.—The Germans have established themselves in Italy by affiliation. The Bianchi Co., one of the largest Italian producers, is reported to have an agreement with the Cassella Co. of Germany, under which the Germans agree to supply technical assistance and personnel, and the Italians in turn agree not to sell any products so produced outside of Italy or its colonies. The profits are divided on the basis of the relative German and Italian stock ownership. The effect of this affiliation is (1) to diminish the volume of Italian dyes in the export market; (2) to effect a sharing of profits in the Italian home market by the "I. G.," and (3) to enable the exercise of German influence in Italy.

France.—An arrangement between the French dye concern Materies Colorantes, and the "I. G." was reported in 1922. The Germans are understood to have agreed to furnish technical aid in return for the French undertaking to restrict exports to their colonies. The complications of the Ruhr occupation are reported to have unfavorably affected the operation of this agreement.

Great Britain.—Negotiations were conducted in 1923 between the British Dye Corporation and the "I. G.," but no working agreement had been reached to June, 1924.

The United States.—In 1923 and 1924 it was reported that endeavors were being made by German manufacturers to secure affiliations with certain firms in the United States. Up to June, 1924, however, no authoritative statement in regard to the conclusion of such agreements had been published.

Attack on the export trade of the United States, Great Britain, and France.—The export trade comprises nearly nine-tenths of Germany's dye business. In the case of the new dye-producing nations it has been a minor part of the total trade, as the home market demands made up the bulk of the business. Nevertheless, the dye export trade for the new industries in the United States and Great Britain constitutes an important balance for stabilizing production by offsetting the fluctuations of home consumption. Furthermore, as the output increases, the unit cost of production declines.

The destruction by Germany of the dye export trade of the United States, Great Britain, France, and Italy would be an important step in a program to weaken the new industries. The existence of competition in the Far East and in other dye markets prevents German domination and the arbitrary fixing of prices.

In 1921, Germany regained a large part of her trade in Far East markets, lost during the war. The occupation of the Ruhr in 1923 diminished the German export trade and stimulated that of the United States and other new dye-producing nations. In 1924, Germany returned with renewed energy to the Far East markets and began to regain her former supremacy in them.

Commercial warfare.—The well-known methods employed by the Germans prior to 1914 may be revived or extended at any time, the first being price cutting or destructive underselling. In the past, when a German firm encountered competition in a dye or other chemical product, it sold the goods at or below cost until the rival concerns were forced out of business. Such losses as may result from this price cutting designed to be, and usually are, made up by a higher selling price in countries where no competition is encountered or by a subsequent increase in price when competition has been eliminated. In this connection it should be borne in mind that the export-price levels of dyes in Germany since the war are far above those of pre-war years.

Full-line forcing has also been an effective weapon of commercial warfare. Germany produced certain products not duplicated elsewhere; the sale of these products can be and was made contingent upon the acceptance of a full line or by a refusal to sell any dyes whatever to consumers who attempted to divide their orders. Dumping,[1] and dishonest and deceptive labeling, are among measures which may be utilized.

[1] United States Tariff Commission report on Dyes and Related Coal-Tar Chemicals, 1918; see p. 26

EFFECT OF THE OCCUPATION OF THE RUHR.

In the month of January, 1923, just before the occupation of the Ruhr by the French, the production of dyes in German plants, based on the monthly reparation lists, totaled slightly over 20,000,000 pounds, or at the rate of 240,000,000 pounds per year—approximately 85 per cent of the pre-war production (1913). In the month of February, the total production receded to nearly 16,000,000 pounds and the output declined from that month until May, when it reached a minimum of 7,431,962 pounds, or 37 per cent of the January output. During the months of July, August, and September the output registered a slight increase; the average production being about 9,000,000 pounds per month. From October to December, however, the increase was more rapid, reaching an output of 15,390,586 pounds in December, or at the rate of nearly 185,000,000 pounds per year.

The effect of the occupation of the Ruhr was most pronounced in the Höchst and the Badische plants. These are two of the largest dye producers in the occupied zone. The equivalent quarterly output of the Höchst plant in January was 1,225,010 pounds, rapidly declining to 57,181 pounds in March, and during April and May production ceased. From June until November the average monthly production was about 15 per cent of the January figure. The November output showed a large increase, and the December production was over 70 per cent of the January figure. In the case of the Badische plant at Ludwigshafen, the January output was 5,304,426 pounds. After a slight drop in February an abrupt decline was registered, reaching in June the minimum of 131,385 pounds. Then, starting from an output of 419,641 pounds in July, the upward movement continued until it reached 5,506,835 pounds in December.

An examination of the monthly output figures of the other dye plants shows that the occupation had less effect on their output. The total monthly output of all plants in December had reached 76 per cent of the January figure, showing that the effect of the occupation had been overcome in the latter part of the year. The total output of 1923 was 75 per cent of the total 1922 production, and about 13 per cent of the production of the pre-war year 1913.

The production in January, 1924, was 14,153,841 pounds and that of February, 1924 increased to 15,750,430 pounds, equivalent to about 189,000,000 pounds per year.

STATISTICS OF EXPORTS AND IMPORTS.

The following tables show the development of Germany's trade in dyes since 1880:

TABLE 26.—*Development of the German export trade in coal-tar dyes, 1880–191 3*

Year	Aniline and other coal-tar dyes				Alizarin and Alizarin dyes			
	Quantity		Value		Quantity		Value	
	Tons	Pounds	1,000 marks	Dollars	Tons	Pounds	1,000 marks	Dollars
1880	2,140	4,717,844	31,307	7,457,327	5,888	12,980,685	20,607	4,908,587
1885	4,646	10,242,572	34,846	8,300,317	4,284	9,444,506	9,510	2,265,282
1890	7,280	16,049,488	37,854	9,016,823	7,905	17,427,363	12,649	3,012,992
1895	15,789	34,808,429	63,156	15,043,759	8,928	19,682,669	11,606	2,764,549
1900	23,781	52,427,593	77,289	18,410,240	8,591	18,939,719	11,167	2,659,979
1905	36,570	80,622,222	100,654	23,975,783	9,339	20,588,759	15,532	3,699,722
1910	49,997	110,223,386	125,790	29,963,178	9,220	20,326,412	21,279	5,068,658
1911	52,480	115,697,408	119,507	28,466,567	9,624	21,217,070	19,647	4,679,915
1912	59,696	131,605,802	133,764	31,862,585	11,589	25,549,109	23,639	5,630,810
1913	64,288	141,729,325	142,079	33,843,218	11,040	24,337,902	21,573	5,138,689

Year	Indigo			
	Quantity		Value	
	Tons	Pounds	1,000 marks	Dollars
1880				
1885				
1890				
1895				
1900	1,873	4,129,216	9,364	2,230,505
1905	11,165	24,614,359	25,721	6,126,742
1910	17,564	38,721,594	39,613	9,435,817
1911	21,618	47,659,043	41,830	9,963,906
1912	24,827	54,733,604	45,216	10,770,451
1913	33,353	73,530,024	53,323	12,701,539

[1] Ullmann Enzyklopädie der technischen Chemie, vol. 5, p. 299.

TABLE 27.—*Germany: Imports of coal-tar dyes, by groups, 1923*

	Pounds	Value (1913 basis)		Pounds	Value (1913 basis)
Aniline and other not specially mentioned coal-tar dyes, sulphur colors:			Alizarin (red) and alizarine colors (variegated) from anthracene	8,598	1,190
Czechoslovakia	183,864		Indigo, natural and synthetic	18,078	13,090
Other countries	255,954		Indigo carmine, color lakes and blues of indigo and indigo carmine		
Total	439,818	$109,242			

TABLE 28.—*Germany: Exports of coal-tar dyes, by countries, 1923*

Exported to—	Aniline and other not specially mentioned coal-tar dyes, sulphur colors	Alizarin; alizarine red	Alizarin dyes, variegated, from anthracene	Indigo, natural and artificial	Indigo, carmine color lakes, and new blue of indigo
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Belgium	37,699				
Bulgaria	513,892				
Denmark	598,990				
France	26,014				
Greece	242,506				
Great Britain	959,883		59,304		
Italy	2,699,974		65,918		
Netherlands	2,053,585		78,925	472,887	
Norway	333,336				
Austria	1,313,721			80,247	
Jugoslavia	445,109				
Czechoslovakia	3,195,127		13,669	162,038	17,857
Hungary	533,954			43,872	
East Poland	2,491,198				
West Poland	253,529				
Portugal	539,466				
Rumania	827,607				
North Russia	2,619,065				
South Russia	156,527				
Esthonia	187,611				
Latvia	532,190				
Lithuania	169,754				
Finland	566,582				
Sweden	1,586,430				
Switzerland	2,457,027				
Spain	1,014,336			16,755	
Turkey	253,749				
Egypt	123,237			69,445	28,659
British India	6,379,451	344,359	572,755	234,349	
China	16,916,116			6,146,645	
Japan	8,668,046		26,014	329,367	
Dutch Indies	496,917	46,076	96,561	147,047	
Argentina	537,702				
Brazil	964,513				
Canada	751,107				
Chile	192,462				
Colombia	98,546				
Mexico	623,461				
Uruguay	76,059				
United States	824,300		83,334		
Other countries	263,670	199,516	388,671	492,508	56,879
Total	63,700,815	589,951	1,385,151	8,195,160	103,395
Value, 1923 basis	$34,223,210	$258,230	$813,008	$6,199,900	$86,394
Value, 1913 basis	15,197,966	96,866	373,898	1,415,624	41,174

THE BRITISH DYE INDUSTRY

Great Britain's pre-war position.—As stated in the Census of 1922, the consumption of dyes in Great Britain prior to the war has been estimated at about 20,000 tons. In 1913 the total imports of coal-tar dyes were 41,203,008 pounds, with a value of $9,207,684. In 1907, as reported by the First Census of Production of the United Kingdom, the production was 139,000 hundredweight (15,568,000 pounds), valued at £373,000 ($1,855,204). It is estimated that the

British production of dyes before the war was somewhat over one-tenth of the consumption. In the manufacture of alizarin and sulphur black, British dye producers before the war held a notable position, as they entered into national conventions in regard to these products dominated by German influence. A limited variety of acid, direct, basic, sulphur, and some other of the simpler dyes were produced in that period. In 1913 the exports of dyes totaled 5,451,376 pounds, with a value of $862,566. The United States was the principal consumer, taking 33 per cent by weight and value, followed by Italy with 11.4 per cent by weight and 9.4 per cent by value, while Germany took 7.3 per cent by quantity and 11.5 per cent by value. Of the total British exports 27 per cent by weight and 23 per cent by value was shipped to British possessions. British India was the principal consumer among the dominions, taking in the fiscal year ended March, 1914, a total of 1,070,047 pounds, valued at $153,286, subdivided as follows: Alizarin dyes, 963,698 pounds, value $114,660; aniline dyes, 102,869 pounds, value $37,409; all other, 4,480 pounds, value $1,217.

Developments since the war.—Expansion in the dye industry of Great Britain from 1916 to 1920 resulted in the production of many colors in excess of the home requirements. In 1920, a year of world-wide business boom, before the reappearance of German dyes in the world markets, exports reached a total of 13,791,680 pounds, with a value of $9,385,429. This is 153 per cent greater by quantity and nearly 100 per cent greater by value than the 1913 export figures. Since 1920 exports have shown an annual decline, the total for 1921 being 7,621,600 pounds, valued at $5,033,828, and for 1922, 3,860,416 pounds, valued at $2,300,298. In 1923, however, as the result of the Ruhr occupation, exports rose sharply to 14,132,944 pounds, valued at $4,719,924.

The year 1920 was probably the year of maximum production. The production of the British Dyestuffs Corporation was reported at about 16,000 [2] tons. As this concern is stated to have produced about three-fourths of the total output, it would appear that the total production during that year was nearly 45,000,000 pounds. More recently, it has been reported that this concern produces about one-half of the total production. The total production of Great Britain [3] in 1922 is reported to have approximated 21,000,000 pounds, of which vat dyes exceeded 180,000 pounds and indigo 1,000,000 pounds. As the result of post-war developments in particular, the British dye industry (19 producers) is able to supply approximately eight-tenths of the home requirements, including an excellent variety of the vat dyes, with production fairly well balanced in the other classes.

Conditions in 1923.[4]—Although the continued trade depression in Great Britain has affected the demand for dyes, the year 1923 was a better year for the industry than 1922. In certain groups of dyes there was a decided improvement. The increased repair work by the railroads stimulated the consumption of paints and allied products and consequently increased the demand for color-lake dyes.

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[2] Report on Dyes and Dyestuffs, subcommittee appointed by the Standing Committee on Trusts, printed and published by His Majesty's stationery office, London, 1921.
[3] U. S. Department of Commerce, *Trade Information Bulletin No. 231.*
[4] *The Dyestuffs Industry in 1923*, Sir William Alexander, The Chemical Age, Dec. 29, 1923.

The high price of cotton, however, has been an adverse factor in the improvement of the cotton manufacturing industry, and normal conditions in the dye industry can not be looked for until the cotton trade is itself in a more active state. The political situation in Germany and the occupation of the Ruhr by the French seriously interfered with the export of British dyes. On the other hand, the reduction in the available supply of German dyes for the world's markets was reflected in an increased demand for dyes of British manufacture. The official figures of exports of coal-tar dyes in Great Britain show that in 1923 they totaled 14,132,944 pounds, with a value of $4,719,924, as against 1922 figures of 3,860,416 pounds, valued at $2,300,298.

British dye firms have devoted much attention to quality and standard of production. It has been stated that "the general level of quality of British makers' production is equal to that of the best continental manufacturers."

The more important gaps in the range of British-made dyes are being rapidly reduced, about a score of dyes not previously manufactured in Great Britain being placed on the market in 1923. Among Great Britain's contributions to the range of existing dyes are the Caledon Jade-greens of the Scottish Dyes, Limited, and the Cettutyl series of the British Dyestuffs Corporation, used for Celanese silk. Owing to the general business depression in Great Britain, with consequent intermittent production, the maximum reduction in the costs of producing coal-tar dyes is not yet attainable. The great importance of reduced production costs is fully realized by the dye makers. It is reported that the 1923 trading[5] profits of the British Dyestuffs Corporation amounted to £251,423, as compared with £102,657 for 1922. The debit balance of £700,699 was reduced to £449,276.

Anglo-German negotiations.—Negotiations for a working arrangement between the British Dyes Corporation and the I. G. were carried on during 1922 and 1923. Up to July, 1924, no agreement had been concluded. Details of the proposals were not officially announced until April 8, 1924, when Sir William Alexander, Chairman and Managing Director of the British Dyes Corporation, speaking at the fifth annual meeting of the concern, summarized the negotiations and the replies to some of the principal criticisms of the proposed arrangement. The statement of Sir William Alexander is, in part, as follows:

"I now pass to a subject which has caused discussion and criticism in many quarters recently—namely, the negotiations which have been proceeding for the conclusion of a working agreement between your corporation and the Association of German Dyestuffs Manufacturers, generally known as the Interessen Gemeinschaft, or I. G. At the ordinary general meeting held in 1922 I told you that informal negotiations between ourselves and the I. G. had been proceeding, and that whilst we would welcome an arrangement it must leave inviolate the principles upon which your undertaking was founded; namely, the establishment of a dye-making industry in this country adequate to our needs both in peace and in war.

"At that time the I. G. did not see their way clear to make or accept proposals consistent with this principle, chiefly, in my opinion,

[5] Chemical Trade Journal and Chemical Engineer, Apr. 4, 1924, p. 419.

because they were not convinced that this country was really determined to maintain the Dyestuffs (Import Regulations) Act, and also because at that time they had not sufficient proof that we could manufacture quality for quality as regularly and as well as themselves. At the end of last year negotiations were reopened, and it was found possible to agree on certain heads which, if incorporated in a document in legal form, might form the basis of a contract which your directors could recommend their shareholders to accept.

"During the extended negotiations modifications have been made from time to time in the form of the proposals, following suggestions which have been made to us and criticisms which have reached us from many directions.

"I would remind the shareholders that in a matter of such national and international importance as the conclusion of an agreement between your undertaking and the great German combine, the Government, under the articles of association, has the final and decisive voice. Until the Government has indicated at least its general approval of the lines on which we have proceeded, it is impossible to enter into details. In any event, the board would not venture to submit a scheme for the approval of shareholders which did not safeguard the interests of the undertaking both from a national and from a shareholders' point of view.

"Reply to Criticisms.—It is said that pressure would be exerted on the score of cost of production to concentrate production in Germany as far as possible, with diminution of the output of the corporation's factories. We are sure that with our natural resources in raw materials we should be able to manufacture with the assistance of the I. G. as cheaply and efficiently as they themselves, and the whole spirit of the negotiations is against any diminution in the output of the corporation's factories, and is even in favor of an increased production.

"We have taken our stand on the principles enunciated two years ago with regard to the objects for which the corporation was formed, namely, to "concentrate, extend, and expedite the manufacture of synthetic dyestuffs and colors in this country."

"There are those who think that acceptance of the contract would curtail or eliminate research from our activities, since it may be cheaper and easier to take the results of research ready-made from the I. G. I wish to declare categorically that there is not the slightest intention of diminishing the activities of our research department, and in the preamble to the agreement we propose to state that it is essential that research in organic chemistry and its application to industry must be continued and developed in this country. The establishment and development of the industry in this country is a fundamental condition of any arrangement. In the past the efforts of the research department have been mainly expended in improving existing processes, in cheapening costs, and in developing manufacturing recipes for dyestuffs already known to the I. G. Continuous pressure from consumers for lower prices and a wider range of dyestuffs has forced us in that direction, but with all further technical information readily forthcoming from the I. G. on dyestuffs which are already known, our research department should be free to enter upon entirely new fields of investigation. Our works chemists would have the freest access to German plants and methods.

"There was a fear that a contract might be concluded which would close the free access of dyestuff consumers in this country to German sources of supply with the advantages which that access confers in the way of technical assistance in dyeing problems, information regarding new developments, and in other ways. The proposals, as originally drafted, provided that the I. G. should retire so far as selling is concerned from the British market. To meet the views of users, the proposed arrangement has been modified to permit their obtaining German dyestuffs in any way they please, subject, of course, to any legislative restrictions.

"Anticipated benefits.—We believe that, if we are able to bring our negotiations to a satisfactory conclusion, they will result in an expansion of our range of dyestuffs to a point where the quality, quantity, variety, and price would guarantee the British consumer all the security he could reasonably ask for. We are also of opinion that not only would the arrangement secure a national industry for peacetime requirements, but would provide the nation with an equipped and trained personnel as a most valuable contribution to our defenses in time of peril. Increased output by securing a greater share of British and overseas requirements will mean more employment for workmen and chemists and a reasonable return on their investments to the shareholders who have invested capital, many from patriotic motives, in this young industry."

The general terms of the proposed agreement are understood to be as follows:[6]

1. The British Dyestuffs Corporation shall have a monopoly of the British market and a percentage share of foreign and colonial markets.

2. It shall be able to draw upon the I. G. for personnel and information as to manufacturing and technical processes on lines similar to those adopted between the I. G. and a corresponding French firm.

3. In return the I. G. shall receive one-half of the profits of the British Dyestuffs Corporation.

4. The British Dyestuffs Corporation shall offer users of dyes a guaranty that such dyes as it continues to import into this country shall not be sold at a higher price than is obtained abroad.

5. There will be no more reparation deliveries of dyestuffs.

Statistics of imports and exports.—The following tables show the trade of the United Kingdom in coal-tar dyes, 1922 and 1923:

TABLE 29.—*The United Kingdom: Imports of coal-tar dyes, 1922*

Imported from—	1922		Imported from—	1922	
	Pounds	Value		Pounds	Value
Alizarin:			Other coal-tar dyes—Con.		
Germany	1,274,224	$265,994	Netherlands	1,680	$1,634
Netherlands	1,120	2,205	Belgium	27,325	49,880
United States	----------	208	Switzerland	1,894,369	3,546,746
Total	1,275,344	268,407	United States	16,800	6,187
Synthetic indigo:			Other foreign countries	7,729	10,150
Germany	572,768	13,321	British possessions	25,648	18,565
Other coal-tar dyes:			Total	4,602,080	5,591,431
Germany	2,628,529	1,958,269			

[6] United States Department of Commerce, Chemical Division, *Trade Information Bulletin No. 231.*

TABLE 30.—*The United Kingdom: Exports of coal-tar dyes, 1922*

Exported to—	1922	
	Pounds	Value
Alizarin:		
Java	33,936	$10,536
France	47,264	27,068
United States	33,824	19,672
Brazil	448	877
Other foreign countries	6,160	939
Total to foreign countries	121,632	59,092
British India	698,208	184,272
Other British possessions	9,520	7,352
Total British possessions	707,728	191,624
Total	829,360	250,716
Indigo, synthetic:		
Spain	560	$159
China [1]	9,408	5,169
Other foreign countries	1,680	850
Total foreign countries	11,648	6,178
Australia	52,416	22,502
Other British possessions	448	266
Total British possessions	52,864	22,768
Total	64,512	28,946
Other sorts:		
Russia	560	979
Sweden	50,624	40,602
Norway	49,168	44,038
Denmark	32,368	15,336
Germany	13,328	10,956
Netherlands	208,208	133,378
Belgium	137,648	89,999
France	106,624	67,896
Switzerland	310,128	125,672
Portugal	18,032	9,832

Exported to—	1922	
	Pounds	Value
Other sorts—Continued.		
Spain	77,056	$39,264
Italy	22,064	7,002
China [2]	70,000	43,312
Japan [1]	3,696	4,960
United States	180,656	126,651
Brazil	83,552	31,917
Other foreign countries	50,400	33,910
Total foreign countries	1,414,112	825,704
Egypt	8,512	7,657
Union of South Africa	127,456	101,638
British India—		
Bombay (including Karachi)	261,408	$132,992
Madras	46,144	24,765
Bengal, Assam, Bihar, and Orissa	28,672	23,237
Burmah	3,696	3,481
Hongkong	9,072	11,444
Australia—		
Western Australia	2,912	3,118
South Australia (including northern territory)	17,136	9,818
Victoria	389,424	394,008
New South Wales	204,512	190,459
Queensland	27,552	12,595
Tasmania	224	323
New Zealand	125,664	99,476
Canada	255,920	146,730
Other British possessions	44,128	33,193
Total British possessions	1,552,432	1,194,934
Total	2,966,544	2,020,638

[1] Exclusive of Hongkong, Macao, and leased territories.
[2] Including Formosa and Japanese leased territories in China.

TABLE 31.—*The United Kingdom: Imports and exports of coal-tar dyes, 1922, 1923*

	1922		1923	
	Pounds	Value	Pounds	Value
Imports:				
Alizarin	1,275,344	$268,407	941,808	$332,809
Indigo, synthetic	572,768	13,321	926,688	60,573
Others	4,602,080	5,591,432	4,421,088	4,197,656
Exports	3,860,416	2,300,298	14,132,944	4,719,924

Exchange values: £, year, 1922=$4.42865; £, year, 1923=$4.5740.

THE SWISS DYE INDUSTRY

Prior to the war the Swiss dye industry, notwithstanding the absence of raw materials, ranked second to that of Germany, producing about 7 per cent of the total world's output, the value of dye exports in 1913 from Switzerland exceeding one-tenth of the total value of the products exported from Germany. The raw materials were formerly imported almost entirely from Germany. During and since the war these materials have been imported from Great Britain, the United States, France, Italy, Poland, and more recently from Germany.

The absence of German dyes from the world's markets during and immediately after the war resulted in a period of unprecedented prosperity for Swiss dye manufacturers. In 1920 the exports of Swiss dyes totaled 23,739,793 pounds, with a value of $35,411,115—over six times that of the pre-war year 1913.

The three leading dye producers of Switzerland located in Basel, namely, Die Gesellschaft für Chemische Industrie (known as "Ciba"), Die Chemische Fabrik, vormals Sandoz, and the J. R. Geigy Co., formed a union of interests ("Interessen Gemeinschaft") similar to that of the German dye producers. A significant development among the Swiss dye manufacturers is the establishment and operation of their branch plants in foreign countries. In the United States, the branch plants are the Cincinnati Chemical Works, at Norwood and St. Bernard, Ohio; in Great Britain, the Clayton Aniline Co. (Ltd.), at Clayton, near Manchester; in Italy, the Fabbrica Lombarda Colori D'Anilina and the Felli Co. (successors of Fisher and Hunold) are understood to be connected with the Swiss manufacturers; in France, the Swiss manufacturers are similarly reported to have branch plants. Prior to the war, the Society of the Chemical Industry of Basel had a branch plant at St. Fous, and the J. R. Geigy Co., of Basel, operated a branch at Maronne, near Rouen. Although the new dye-producing nations—Great Britain, the United States, France, and Italy—have adopted tariff and other protective measures which have resulted in a diminution of dye exports from Switzerland, the Swiss industry has been able, through the branch plants operated in those countries, to cater to their dye requirements to an extent beyond that indicated merely by the imports originating directly in Switzerland.

Statistics of imports and exports.—The following tables show the extent of Switzerland's trade in coal-tar dyes in 1923:

TABLE 32.—*Switzerland: Imports and exports of coal-tar dyes, 1923*

	Aniline and other coal-tar dyes		Indigo, indigo solution		Alizarin, synthetic	
	Pounds	Value	Pounds	Value	Pounds	Value
IMPORTS						
Germany	1,456,579	$792,834	22,046	$9,030	243,167	$40,093
Austria	882	903	441	181		
France	17,416	18,241	201,280	84,882	3,307	2,528
Italy	23,148	18,782				
Great Britain	9,700	4,696				
Other countries	2,205	2,348				
Total	1,509,930	837,804	223,767	94,093	246,474	42,621
EXPORTS						
Germany	49,824	38,829				
Austria	116,182	105,832	121,253	34,856		
France	1,925,498	1,936,574	6,393	6,502		
Italy	537,481	568,168	128,528	38,107		
Belgium	953,269	521,392	73,854	22,214		
Holland	258,820	234,780	90,830	23,117		
Great Britain	1,308,871	1,713,352				
Spain	104,498	167,416	13,669	16,796		
Portugal	108,246	85,604				
Denmark	176,368	175,543	7,937	10,114		
Norway	36,155	39,371				
Sweden	517,640	469,741				
Finland	94,798	77,658				
Poland	114,198	131,116				
Czechoslovakia	681,883	515,794				
Hungary	15,873	23,839				
Greece	15,432	13,364				

TABLE 32.—*Switzerland: Imports and exports of coal-tar dyes, 1923*—Contd.

	Aniline and other coal-tar dyes		Indigo, indigo solution		Alizarin, synthetic	
	Pounds	Value	Pounds	Value	Pounds	Value
EXPORTS—continued						
Bulgaria	29,983	$19,866				
Rumania	22,707	19,686	22,487	$5,599		
Russia	11,464	27,090				
Egypt	20,282	18,421	268,079	95,718		
Mesopotamia	2,646	3,973	8,157	6,682		
British India	219,578	155,677	33,510	14,448		
Dutch India	65,036	63,932	214,948	57,250		
China	100,971	82,895	7,085,364	1,806,903		
Japan	654,546	653,591	573,857	558,596		
Canada	189,816	161,456				
United States	837,968	1,063,734				
Mexico	93,696	93,190				
Brazil	150,133	210,941				
Uruguay	7,937	6,682				
Argentina	103,175	87,952				
Chile	18,739	19,144				
Algeria			4,409	3,070		
Other	23,148	26,006	62,831	21,130		
Total	9,566,861	9,532,609	8,716,106	2,721,102		

Converted from francs to dollars on the basis of 1 franc=$0.1806—the annual average for 1923.

THE FRENCH DYE INDUSTRY

In the commission's report in 1922[7] the French dye industry for the following periods was considered:

Dye production in France, immediately prior to the war.

Developments during and after the war, together with the production figures for the years 1919, 1920, 1921, and part of 1922.

Merger of Kuhlmann and Compagnie Nationale.—The merger of "Etablissements Kuhlmann" and the "Compagnie Nationale de Matières Colorantes et de Produits Chimiques" on December 27, 1923, is probably the most significant event of that year in the French chemical industry, involving as it did a consolidation of organic and inorganic chemical undertakings. The new firm is known as "Compagnie Nationale de Matières Colorantes et Manufactures de Produits Chimiques du Nord Rèunies."

The merger is expected to result in administrative and sales economy, reduction of overhead, the avoidance of duplication in manufacture, and the union of technical staffs. The new firm will produce a diversity of organic and inorganic products, affording added stability and security in times of crisis.

The financial advantages are conspicuous, as the Compagnie Nationale, while possessing an excellent technical staff, had not established itself on a solid financial basis. The Kuhlmann is in a strong financial position and has a century-long tradition of good administration. The nominal capital of the Etablissements Kuhlmann will be increased to 150,000,000 francs by an issue of 50,000,000 francs of new shares having a par value of 250 francs each. The shares of the Compagnie Nationale de Matières Colorantes will be exchanged share for share for the new Kuhlmann stock, dated as of

[7] U. S. Tariff Commission, *Census of Dyes and Other Synthetic Organic Chemicals*, p. 134.

January 1, 1924, and will receive an exchange settlement of 25 francs per share. This settlement will largely cover the tax applying to the operation of fusing the two companies.

The new concern produces a variety of products, including mineral acids, phosphate, nitrogen fertilizer, raw materials for the glass industry, ice plants, and the tanning industry; fungicides, dyes, pharmaceutical and other organic chemicals.

The Etablissements Kuhlmann manufactures mineral acids and has already produced certain intermediates at La Madeleine-lez-Lille plant. Intermediates will continue to be made at Oissel, with the exception of a few products consuming a large amount of acid to be drawn from La Madeleine plant. Dye manufacture will remain centralized in large works developed by the Compagnie Nationale at Villers-Saint-Paul.

The Compagnie Nationale de Matières Colorantes et de Produits Chimiques was formed in 1916 with the support of the Government and the cooperation of many French industrial and financial interests. It had originally a capital of 40,000,000 francs, increased in 1919 to 71,000,000 on its fusion with the Société de Produits Chimiques et Colorantes Francais. In 1921 the capital was increased to 100,000,000 francs. The rapid development of this concern enabled it to supply a large part of French dye requirements, attention being first given to the bulk colors and later to some of the specialties.

Statistics of production, imports, and exports.—The following table, taken from an advertisement of the Compagnie Nationale of France, shows for the years 1918–1922 its production of 20-per cent indigo paste and of other coal-tar colors.

	1918	1919	1920	1921	1922
Indigo paste, 20-per cent, pounds	33,415	1,119,381	6,537,521	5,812,428	3,039,041
Other dyes, pounds	16,627	695,364	3,440,931	2,667,204	5,986,624

TABLE 33.—*France: Dye production*[1] *(pounds), 1920–1923*

Year	Azo dyes	Indigo and sulphonated derivatives	Sulphur dyes	Diphenyl and triphenyl methane	Alizarin and other oxyketone	Indophenols, oxazines, and thiazines	Unspecified	Total
1920	4,975,782	6,571,913	3,452,404	141,094	19,841	19,841	374,782	15,555,657
1921	4,204,172	5,839,985	1,814,386	403,442	211,642	136,685	328,485	12,938,797
1922	7,881,445	3,075,417	3,769,866	1,234,576	731,927	191,800	897,272	17,782,303
1923	11,296,370	4,700,207	5,024,283	1,483,696	570,991	145,504	959,001	24,180,052

[1] L'Industrie Chimique, April, 1924. Does not include data for Swiss plant at St. Fous.

TABLE 34.—*France: Imports and exports of coal-tar dyes, 1922 and 1923*

IMPORTS

Class	1922				1923			
	Dry		Paste		Dry		Paste	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Nitroso	4,189	$2,458	441	$328	4,630	$4,188		
Nitro	2,646	2,704			1,984	1,093		
Pyrazolone	121,694	165,744	220	82	133,819	118,729		
Stilbene	58,201	50,223			41,887	34,296		
Monoazo	784,838	568,676	27,998	9,258	447,313	287,293	12,125	$6,374
Polyazo	1,165,352	916,961	20,062	4,015	517,199	438,558	2,425	2,064
Thiobenzenyl	34,612	40,064			22,707	31,868	441	364
Sulphur	172,841	133,382			118,607	84,677	9,039	2,125
Indophenol	550,930	241,530	91,270	35,803	304,896	390,908	104,719	92,810
Azines	86,200	92,253	14,991	3,277	76,720	46,375	5,291	1,275
Pyronines	35,935	82,585		82	24,030	55,176	661	304
Eosines	12,566	27,856	441	246	24,912	49,895	441	61
Diphenylmethane	406,087	603,169	220	574	425,047	456,343	441	243
Acridines	44,753	86,764			54,013	85,587		
Hydroquinones	57,320	83,241	68,343	27,938	130,512	188,109	75,838	33,749
Indigotines	19,841	22,695	7,275	5,080	6,834	6,616	1,323	1,093
Insoluble vat colors other than indigo	38,581	34,820	98,766	40,228	168,652	279,402	236,554	221,069
Cibanones	12,566	12,044	25,573	28,594	28,219	38,787	41,226	26,769
Total	3,609,152	3,167,169	355,600	155,505	2,531,981	2,597,900	490,524	388,300

EXPORTS

Class	1922				1923			
	Dry		Paste		Dry		Paste	
	Pounds	Value	Pounds	Valne	Pounds	Value	Pounds	Value
Nitroso	39,903	$19,581	9,480	$1,639	120,151	$47,164	2,425	$364
Nitro	441	328	441	164	18,078	8,984		
Pyrazolone	882	655	2,866	819	661	304		
Stilbene	220	164			19,400	8,377	220	61
Monoazo	4,850	1,884	1,323	328	34,392	10,805	882	243
Polyazo	1,102	492	220	82	326,060	128,016		
Thiobenzenyl					1,984	1,578		
Sulphur	12,787	3,359	1,323	246	8,157	1,700		
Indophenol	7,496	8,111			9,480	8,255	1,323	486
Azines	2,646	2,294	441	246	8,818	6,313		
Pyronines	48,060	122,567			658,294	1,346,690		
Eosines	882	1,475			18,960	29,075	1,984	668
Diphenylmethane	655,648	628,731	69,665	31,133	1,990,313	1,526,726	27,337	9,773
Acridines							220	
Hydroquinones	3,086	4,916	5,952	1,966	4,409	5,645	798,065	208,747
Indigotines	188,714	150,751	143,299	76,686	185,848	118,790	268,079	114,784
Insoluble vat colors other than indigo	18,078	26,381	31,746	9,422	141,756	164,801	2,425	607
Cibanones							661	486
Total	984,795	971,689	266,756	122,731	3,546,761	3,413,223	1,103,621	336,219

Exchange rate, 1922, 1,000 francs=$81.93.
Exchange rate, 1923, 1,000 francs=$60.70.

THE ITALIAN DYE INDUSTRY

Pre-war production.—Prior to the war the production of dyes in Italy was practically negligible, the country's requirements being mostly imported from Germany. On account of the lack of coal, Italy, like Switzerland, is very largely dependent upon imported raw materials although having a limited output of crudes, together with sulphur and salt and the advantage of electrolytic development for

the manufacture of chlorine and caustic soda. The sulphur dye named Italian Green was manufactured by Lepetit & Dollgus before the war, and some dyes, including sulphur black, were made from imported intermediates. The sulphur black was made in small quantities in 1908 by Rinalso Ghisotti, at Turro; this plant was later acquired by A. Bonneti, who produced aniline. The company which is now known as Societá Chimica Lombarda, A. E. Bianchi Company of Rho (Milan), began to manufacture sulphur black in 1913.

Post-war developments.—The Bianchi firm, on the outbreak of the war, began the manufacture of explosives and particularly of dinitrophenol; they increased their output of sulphur black and started the production of certain azo dyes. In 1923 the output of dyes by this firm was about 5 tons per day and they are to-day one of the larger producers. The concern has an agreement with the Cassella Works, of Frankfort, and imports some of its intermediates from Germany. In 1914, Dellapiane & Co. began the production of sulphur black and in 1915 produced other sulphur dyes. The plant was moved to Rho in 1916, and in 1918 was reorganized under the name Societa Italica Colori Artificiali (Italica). It now produces many azo dyes, including direct dyes for cotton and a number of basic dyes, together with a wide range of sulphur colors. All these dyes are said to be produced from intermediates manufactured at the plant. In 1916 this firm had only four chemists, but in 1923 had 28, and its daily output of dyes in the latter year was about 5,000 kilos (11,000 pounds).

The Botelli Company, of Madonna di Campagna (Turin), began the production of sulphur black during the war. In 1919 the firm amalgamated with the Fabrique de Produits Chimiques, the Rohner Company, of Isvizzera, and the new concern is now producing intermediates for azo dyes, chrome colors, etc. The Schiapparelli concern, of Turin, produces aniline oil and sulphur black, and the Ledogia firm at Garessio manufactures sulphur colors.

The plant of the Societá Italiana Prodotti Esplodente (known as "S. I. P. E."), more particularly designed for the manufacture of explosives, was later diverted to the manufacture of synthetic dyes. The company produces at its Cengio (Liguria) works large quantities of aniline oil and other intermediates and is reported to be connected with the Societá Italica Colori Artificiali.

During the war, the Industria Nazionali Colori de Anilina (known as "I. N. C. A.") produced dinitrophenol, and in 1916 acquired licenses for operating a number of patents owned by Levinstein's Limited, of Great Britain; in 1919 it began the production of sulphur dyes, direct cotton dyes, and acid dyes. In 1923 it produced 1,600 tons of sulphur black and 200 tons of other colors.

The Fabbriche Italiane Materie Coloranti Bonelli, organized during the war for the manufacture of munitions, especially dinitrophenol, erected in the immediate post-war period a large electrolytic alkali plant and began the production of dyes. At present it is one of the largest dye producers in Italy. Among other firms may be mentioned the Fabbrica Lombarda Colori Anilina ("I. P. C. A."), which, following a commercial agreement with the Swiss manufacturers, Sandoz & Co., began the production of sulphur black and a few direct cotton colors at its Bovisa (Milan) works.

The Industria Piedmontese Colori di Anilina produces sulphur blacks and direct cotton dyes, but does not manufacture intermediates.

Felli & Co. (successors of Fisher & Hunold) began, during the war, the production of aniline oil, dinitrophenol, betanaphthol, and sulphur black. They ceased operations after the war, but have since resumed activities with the help of the Ciba Co., of Switzerland.

Production,[8] *1918–1922.*—In 1918 the total Italian production of synthetic dyes was about 10,000 quintals (2,204,600 pounds), almost entirely sulphur dyes. In 1922 the production was about 50,000 quintals (11,023,000 pounds), of which about 39,000 quintals (8,597,940 pounds) were sulphur dyes.

According to Professor Poma,[9] in his paper of June, 1923, the present production in Italy of dyes is about 2,000,000 kilograms (4,409,200 pounds) of sulphur black and 200,000 kilograms (440,921 pounds) of other sulphur colors. The production of azo and basic dyes totals about 2,000,000 kilos (4,409,200 pounds), making a total of 4,200,000 kilos (9,259,300 pounds). Among the basic dyes produced in Italy are: Methyl violet, Methylene blue, Vesuvine, Chrysoidine, and Malachite green.

In 1922 the Cesana Maderno works began the construction of a large indigo plant, but the work was suspended. No attempt has been made to manufacture anthraquinone vat dyes in Italy.

TABLE 35.—*Italy: Production of coal-tar dyes, 1918–1922*

[Department of Commerce: Trade Information Bulletin No. 234]

Dyes	1918	1919	1920	1921	1922
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Synthetic organic colors, sulphur	2,190,776	8,139,372	3,438,240	6,362,948	8,485,400
Synthetic organic colors, all other	16,530	606,100	1,020,452	1,556,024	2,327,424

TABLE 36.—*Italy: Imports and exports of coal-tar dyes, 1922, and first nine months of 1923*

	1922		First 9 months, 1923	
	Pounds	Value	Pounds	Value
IMPORTS				
Sulphur dyes	274,032	$160,089	413,583	$216,402
German reparation	31,967			
Other colors:				
In dry state or with less than 50 per cent water	3,214,968	2,429,087	2,162,051	1,573,672
German reparation	1,389,559		1,764,562	
In paste or liquid with 50 per cent or more of water	329,147	162,198	132,937	58,436
German reparation	244,711		392,198	
EXPORTS				
Sulphur dyes	38,801	12,163	30,433	21,660
Other colors:				
In dry state or with less than 50 per cent of water	318,565	231,529	379,853	383,713
In paste or liquid with 50 per cent or more of water	15,212	10,558	22,707	12,533

One quintal = 220.46 pounds.
One lire, year 1922 = $0.04752.
One lire, January–September, inclusive, 1923 = $0.0466.

[8] "The Italian Dyestuffs Industry," Chemical Trade Journal, May 2, 1924, p. 530.
[9] L'industria delle materie coloranti in Italia ed i nuovi processi per la fabbricazione di taluni dei grandi prodotti. Conferenza tenuta al Congresso Nazionale di Chimica; Rome, June, 1923.

The Japanese Dye Industry

War developments.—Previous to the outbreak of the World War, Japan was largely dependent upon imports of synthetic coal-tar colors from Germany. The exports of coal-tar dyes from Germany to Japan in 1913 were 9,744,333 pounds, valued at $3,453,900. In view of the importance of her textile industries, Japan was seriously affected by the shortage of dyes when German imports were cut off at the beginning of the war. Although Japan has in its coal-gas industry a domestic source of crude coal-tar materials, it is reported that the Japanese production of coal tar is insufficient to supply crudes for all the dyestuffs required. The nine gas and other companies producing coal-tar products in 1918 are credited with an output for that year of 5,415 tons of crudes, including 3,100 tons of benzene; 590 tons of toluene; 40 tons of xylene; 125 tons of phenol; 1,400 tons of refined naphthalene, and 160 tons of crude anthracene. With the encouragement of the Government, the dye industry developed so that more than 100 factories were engaged in that industry during the war. There were large post-war imports of foreign dyes and the manufacturers who have remained in business have had to receive considerable aid from the Japanese Government.

Production.—Figures for 1918–1923 are given in the following table:

TABLE 37.—*Japan: Production of coal-tar dyes, 1918–1923*

[From "Chemical Trade Bulletin No. 24-B," and "Trade Information Bulletin No. 217," U. S. Department of Commerce]

Class	1918	1919	1920	1921	1923
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Direct	923,848	557,575	276,861	396,660	628,026
Acid	141,685	205,474	144,632	119,113	242,204
Basic	409,994	324,231	364,360	463,227	264,377
Mordant	153,478	.....	86,003	170,034	13,546
Acid mordant	53,182	.....	13,508	9,205	4,802
Vat	106	.....	265	96,442	3,144
Sulphur	7,353,034	14,130,935	6,659,532	10,585,063	11,296,931
Miscellaneous	2,746,897	1,250,063	471,718	766,708	1,004,705
Total	11,782,224	16,468,278	8,016,879	12,606,452	13,457,735

The tendency in Japan to-day is to import the more expensive dyes and to manufacture the cheaper colors. As may be seen from the above table, sulphur colors form the bulk of the requirements of the domestic market. Sulphur black in large quantities, as well as smaller amounts of the other sulphur colors, are used for dyeing cotton fabrics to be made into garments. In addition to the manufacture of sulphur colors the Japanese manufacturers have successfully produced direct colors, among which may be mentioned Benzo fast red A; Congo red; Benzo purpurine; Chrysophenine yellow; Direct black and Direct blue; basic dyes, such as Methylene blue; Methyl violet, and Rhodamine B; also some acid dyes and alizarines. It is reported that only two dye factories are now operating on a large scale in Japan—the Japan Dye Manufacturing Co., Osaka, and the Mitsui Mining Co.

Imports, 1920–1923.—Since 1918 there has been a steady increase in the quantity of foreign dyes imported. The present duty (May, 1924) on natural indigo dry is $12.69 per 100 pounds; on natural

indigo paste 20 per cent ad valorem. The duty on artificial indigo is 20 per cent ad valorem, and on other coal-tar dyes 35 per cent ad valorem. Germany has made a strong effort to capture this market and in 1921 was the leading exporter; on the other hand, imports of dyes from the United States have more or less steadily declined until, in 1923, they amounted to less than 4 per cent of the total.

TABLE 38.—*Japan: Imports of coal-tar dyes, by classes, 1920, 1921, 1922, and first six months of 1923*

Class	1920		1921		1922		1923 (6 months)	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Indigo, dry natural	1,915,515	$3,940,086	1,186,765	$1,611,763	375,115	$392,258	49,851	$34,164
Indigo, artificial	480,864	1,237,374	2,174,319	3,374,973	3,175,726	2,498,463	1,537,131	992,115
Aniline dyes	4,330,299	7,457,798	5,461,901	6,262,283	8,999,886	6,198,386	5,745,564	2,807,693
Other coal-tar dyes	114,074	273,911	116,576	221,551	351,205	328,374	51,720	48,720

TABLE 39.—*Japan: Imports of coal-tar dyes, 1922 and first six months of 1923*

Imports from—	1922		1923 (6 months)	
	Pounds	Value	Pounds	Value
Great Britain	39,551	$26,201	32,032	$21,087
France	73,401	59,413	74,098	52,330
Germany	8,264,733	5,946,265	4,983,203	2,416,377
Switzerland	154,518	126,839	336,726	237,560
United States	796,093	353,203	338,428	107,133
Other countries	22,795	14,837	32,798	21,925
Total	9,351,091	6,526,760	5,797,284	2,856,413

One kin.=1.32277 pounds avoidupois.
Exchange rate for yen, 1920=$0.50066.
Exchange rate for yen, 1921=$0.48154.
Exchange rate for yen, 1922=$0.47808.
Exchange rate for yen, 1923=$0.48745 first six months.

THE DYE TRADE OF OTHER COUNTRIES

TABLE 40.—*Argentina: Imports of coal-tar dyes, 1921 and 1922*

	1921		1922	
	Pounds	Value	Pounds	Value
Aniline dyes	919,556	$322,435	1,043,799	$401,574
Indigo	985	402	741	468

One gold peso, average, 1921=$0.7290.
One gold peso, average, 1922=$0.81814.

TABLE 41.—*Austria: Imports and exports of coal-tar dyes, 1921, 1922, and first six months of 1923*

	Imports		Exports	
	1921	1922	1921	1922
	Pounds	*Pounds*	*Pounds*	*Pounds*
Germany	3,405,886		6,834	
Switzerland	18,298		220	
Czechoslovakia	6,393		46,297	
Hungary	1,323		120,592	
France	441			
Great Britain			220	
Italy	220		3,527	
Turkey				
Netherlands				
Poland			20,723	
Jugoslavia			88,404	
Rumania			75,177	
Other countries	5,071		8,818	
Total	3,437,632	2,760,380	370,812	179,895

1923 (6 months)

Country	Alizarin colors		Synthetic indigo		Other coal-tar colors	
	Imports	Exports	Imports	Exports	Imports	Exports
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Germany	41,887		22,046	5,512	382,939	3,086
Italy		661				
Rumania		441				20,062
Switzerland	4,189		15,653		33,510	
Hungary		1,323		661	220	14,109
Czechoslovakia			10,803		7,055	2,866
Poland						3,307
Jugoslavia						20,282
Other countries		661			3,968	3,086
Total	46,076	3,086	48,501	6,173	427,692	66,799
Value	$18,639	$1,418	$10,535	$1,621	$176,870	$23,907

TABLE 42.—*Belgium: Imports and exports of indigo, natural and artificial, 1922 and 1923*

	1922		1923	
	Pounds	Value	Pounds	Value
Imported from—				
Great Britain	5,922	$3,239	8,285	$1,699
British India	3,053	5,689		
Netherlands				
France			185,012	33,403
Other countries	2,317	699		
Total	11,292	9,627	193,297	35,102
Exported to—				
China				
Great Britain	31,753	25,331		
Japan				
Other countries	3,655	641	33,737	7,531
Total	35,408	25,972	33,737	7,531

One franc, average of year, 1922=$0.07676.
One franc, average of year, 1923=$0.0519.

TABLE 43.—*Brazil: Imports of coal-tar dyes, 1922*

	1922	
	Pounds	Value
Aniline or fuchsine dyes	1,541,952	$702,535
Indigo and ultramarine blue	1,142,025	248,145

One milreis, paper, average of year, 1922=$0.12935.

TABLE 44.—*Canada: Imports of coal-tar dyes, fiscal year ended March 31, 1923 and 9 months ended December 31, 1923*

	Fiscal year ended March 31, 1923		Nine months ended December 31, 1923	
	Pounds	Value	Pounds	Value
Aniline and coal-tar dyes soluble in water, including alizarin and artificial alizarin:				
United Kingdom	326,393	$166,179	207,366	$100,841
United States	1,974,555	1,214,598	1,347,474	786,462
Germany	254,533	358,288	509,964	354,245
Netherlands	338,251	238,508	193,158	155,046
Switzerland	202,786	183,026	142,930	115,195
Sweden			142,270	67,050
Other countries	88,043	76,667	4,947	2,139
Total	3,184,561	2,237,265	2,548,109	1,580,978
Indigo:				
United States	639	933	322	371
Other countries				
Total	639	933	322	371
Indigo, paste and extract:				
United Kingdom				
United States	54,691	11,998	85,371	16,497
Germany	11,431	28,576		
Other countries	39,027	8,387	43,935	7,136
Total	105,149	48,961	129,306	23,633

Canadian dollar, average for year ended March 31, 1923=$0.99137.
Canadian dollar, average April-December, inclusive, 1923=$0.97791.

TABLE 45.—*China: Imports of "dyes, colors, and paints" (aniline), 1921*

Imported from—	Value	Imported from—	Value
Hong Kong	$1,062,621	Switzerland	$103,456
Macao	21,777	Austria and Hungary	319
French Indo-China	1,132	Russia, Pacific Ports	777
Siam	225	Korea	482
Singapore, Straits, etc	129	Japan (including Formosa)	531,951
British India	4,847	Philippine Islands	281
Great Britain	190,534	Canada	881
Sweden	62,668	United States (including Hawaii)	520,029
Germany	2,576,611	Direct gross import	$6,476,397
Netherlands	791,310	Reexported abroad	412,726
Belgium	570,097		
France	7,362	Total net import	6,063,671
Italy	28,907		

Haikwan tael, 1921=$0.76.
The 1921 Chinese imports of synthetic indigo and unclassified dyes were published in the "Census of Dyes and other Synthetic Organic Chemicals, 1922," pp. 148, 149.

TABLE 46.—*China: Imports of dyes, colors, and paints, 1922*

(Foreign Trade of China, 1922)

Imported from—	Aniline		Indigo, artificial		Dyes and colors, unclassed [1]	
	Value	Pounds	Value	Pounds	Value	
Hongkong	$1,058,423	1,790,800	$709,624	12,186,264	$508,195	
Macao				94,000	2,653	
French Indo-China	6,242	22,533	15,764	198,533	3,682	
Siam	235			400	105	
Singapore, Straits, etc	138			683,867	36,631	
Dutch Indies	10,397	1,333	664	123,200	7,622	
British India	12,087			103,867	14,321	
Great Britain	93,854	235,333	162,658	183,733	44,376	
Norway	1,892			10,533	7,282	
Sweden	13,140					
Denmark	10,269			1,067	104	
Germany	2,574,609	13,374,263	4,397,183	1,282,800	241,229	
Netherlands	1,431,709	8,030,665	2,768,004	610,667	90,550	
Belgium	322,164	1,130,400	418,003	277,733	38,258	
France	5,726	932,133	360,633	173,200	23,378	
Switzerland	33,848	5,234,265	1,604,105		92	
Italy	447	479,867	133,739	45,600	4,362	
Austria and Hungary						
Russia and Siberia by land frontier	1,610	1,733	962	70,267	5,693	
Russia and Amur ports				61,867	7,320	
Russia and Pacific ports	310			643,866	41,311	
Korea	6,661	267	108	1,942,133	30,090	
Japan (including Formosa)	308,600	13,200	5,234	7,385,198	779,238	
Canada	274	33,333	11,970	8,933	5,094	
United States (including Hawaii)	150,607	2,137,200	795,500	43,467	27,915	
Turkey, Persia, Egypt, etc					7	
Total	6,043,242	33,417,325	11,384,151	26,131,194	1,919,505	
Reexport	358,649	3,117,733	1,174,150	130,400	25,475	
Net total	5,684,593	30,299,592	10,210,001	26,000,793	1,894,030	

Equivalent of the "haikwan tael," 1922, =$0.83.
Converted from "piculs" to pounds=133.3333 pounds to picul.

[1] Probably includes colors other than coal-tar dyes.

TABLE 47.—*Czechoslovakia: Imports of coal-tar dyes, 1920, 1921, and 1922*

	1920		1921		1922	
	Pounds	Value	Pounds	Value	Pounds	Value
Indigo, natural:						
France			24,057	$60,996	1,545	$2,013
Austria			2,817	7,144	44	45
Germany			351	889	14,112	18,636
Total	7,906	$6,653	27,225	69,029	15,701	20,694
Alizarin, alizarin colors, indigo, synthetic:						
Germany			1,649,041	1,412,570	401,678	82,340
Switzerland			4,189	3,588	661	145
Austria			441	378		
Total	425,267	148,533	1,653,670	1,416,536	402,339	82,485
Azo and sulphur dyes:						
Germany			1,509,269	951,531	299,826	150,259
Switzerland			22,707	14,316	38,581	18,345
Total	1,558,873	1,088,934	1,531,976	965,847	338,407	168,604
Coal-tar dyes, other:						
Germany			7,353,443	4,333,689	6,684,127	5,198,925
Switzerland			250,443	147,596	364,641	285,798
Austria			39,903	23,517	20,503	16,836
France			23,589	13,902	8,157	5,959
Hungary			882	520	441	289
China			220	130		
Italy					5,291	4,426
Poland					1,323	1,128
Saar Basin					1,102	723
Total	4,223,352	3,097,686	7,668,481	4,519,354	7,085,584	5,514,084

TABLE 48.—*Czechoslovakia: Exports of coal-tar dyes, 1920, 1921, and 1922*

	1920		1921		1922	
	Pounds	Value	Pounds	Value	Pounds	Value
Indigo, natural:						
Jugoslavia			35	$89	11	$15
Ethiopia			2	6		
Great Britain						
Total			37	95	11	15
Alizarin, alizarin colors and indigo, synthetic:						
British possessions in Asia			359,791	320,525	112,876	24,686
Hamburg			139,772	124,518		
Switzerland			93,475	83,274	31,746	6,943
Netherlands			12,566	11,195	79,145	17,309
Germany			8,157	7,267	661	145
Belgium			5,732	5,106		
Poland			3,527	3,142	4,850	1,061
Austria			1,323	1,178	3,086	675
Italy			1,102	982		
Denmark					1,102	241
Japan					5,071	1,109
Total	697,756	$194,964	625,445	557,187	238,537	52,169
Azo and sulphur dyes:						
Germany			4,850	3,158	14,550	7,377
Poland			16,094	10,477	5,512	2,290
Austria					4,409	1,929
Rumania			4,189	2,727		
Jugoslavia					2,425	928
Italy					220	84
Other countries			9,700	6,315		
Total	11,905	9,148	34,833	22,677	27,116	12,608
Coal-tar dyes, other:						
Germany			54,454	31,719	59,304	47,472
Poland			33,069	19,262	23,589	18,447
Jugoslavia			21,385	12,456	67,020	51,068
Rumania			19,180	11,172	8,157	6,625
Italy			11,905	6,934	14,109	11,147
Hungary			4,850	2,825	4,189	3,404
Austria			3,036	1,798	14,330	9,517
Spain					3,086	2,141
Belgium					3,527	2,739
Possessions of France in Africa					1,543	1,051
France					3,086	2,411
Other countries			7,937	4,623	2,205	1,639
Total	227,294	166,713	155,866	90,789	204,145	157,661

One crown, average 1920=$0.0154.
One crown, average 1921=$0.0151077.
One crown, average 1922=$0.024107.
One quintal=220.46 pounds

TABLE 49.—*Czechoslovakia: Imports and exports of coal-tar dyes, 1923*

	1923	
	Pounds	Value
IMPORTS		
Germany	4,348,847	$2,253,434
Hungary	2,983	1,095
Switzerland	573,024	362,722
Other countries	193,487	71,305
Total	5,118,341	2,688,556
EXPORTS—OUT OF FREE TRAFFIC		
Netherlands	124,511	27,195
Germany	226,095	55,336
Poland	23,946	7,058
Jugoslavia	8,139	3,502
Switzerland	55,552	25,723
East Indies	167,371	30,377
Other countries	180,233	85,860
Total	785,847	235,051

Exchange rate for Czecho crowns, 1923=.029465 average.

TABLE 50.—*Dutch East Indies: Imports of coal-tar dyes, 1922 and 1923*

	1922				1923
	Wet		Dry		Wet and dry
	Pounds	Value	Pounds	Value	Pounds
Alizarin dyes:					
Netherlands	250,398	$134,613	21,054	$21,211	206,836
Great Britain	56,416	24,526	110	88	246,430
Germany	180,006	85,584	33,962	36,055	250,471
Belgium					7,936
Japan					45,770
Total	486,820	244,723	55,126	57,354	757,443
Aniline dyes:					
Netherlands	4,674		125,742		98,579
Great Britain					2,130
Germany	2,888		196,176		373,153
Belgium			14,037		11,072
Italy					6,107
Switzerland			7,793		49,626
Singapore			4,852		260
Hongkong					244
Other countries	110		10,723		440
Total	7,672		359,323		541,611
Synthetic indigo:					
Netherlands	591,505	357,507	5,558		214,012
Great Britain					30,093
Germany	499,322	282,527	1,462		194,911
France					142,285
Belgium	6,614	2,887			
Italy	51,632	19,012	4,189		71,947
Switzerland	19,841	7,044			153,793
Hongkong					42,651
China					86,112
Japan					2,248
Other countries			2,039		132
Total	1,168,914	668,977	13,248		939,184

One gulden, average 1922=$0.3849.

TABLE 51.—*Dutch East Indies: Exports of natural indigo, 1920–1923*

Java and Madura	1920	1921	1922	1923
Indigo, dry:	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Netherlands	586	2,363	7,394	
Singapore	58,510	97,399	11,023	
China				441
Japan	9,963	54,068	10,582	8,457
Total	69,059	153,830	28,999	8,898
Indigo, wet:				
British India			5,445	
Singapore	346,299	13,779	4,409	2,646
Other countries	127			
Total	346,426	13,779	9,854	2,646

TABLE 52.—*Egypt: Imports and reexports of coal-tar dyes, 1923*

	Pounds	Value
IMPORTS		
Synthetic indigo:		
United Kingdom	4,478	$1,431
Belgium	5,884	2,267
France	68,261	21,423
Germany	230,537	177,282
Switzerland	267,259	101,269
United States		
Total	576,419	303,672
Other coal-tar dyes:		
United Kingdom	6,920	2,922
Belgium	24,830	4,623
France	5,088	2,709
Germany	224,918	115,597
Switzerland	36,565	32,104
Syria	578	1,333
United States		
Other countries	1,411	1,222
Total	300,310	160,510
REEXPORTS		
Synthetic indigo	1,766	1,134
Other coal-tar dyes	4,200	4,126

£ E. Par = $4.943; applying the percentage of the fluctuation of the pound sterling for 1923, or 93.99 per cent = $4.646.

INDIA

India, with its large population, ranks among the world's leading consumers of dyes. An analysis of the German dye export figures for 1913, the year of maximum exportation for that country, shows that British India was fifth among the world's nations receiving German dyes by quantity (15,008,916 pounds) and sixth by value ($3,168,060). As it is primarily a cotton-consuming country, cotton dyes constitute the great majority of imports, and with continued expansion in cotton manufacturing it promises to become an increasingly large market for synthetic dyes. A few natural dyes are extensively used, particularly natural indigo. In 1907 and 1908, 405,900 acres of indigo were under cultivation, the exports in that year amounting to 3,249,000 pounds, valued at $2,665,766. This product is now, however, relatively unimportant as an export item, being unable to compete with synthetic indigo in the world's market. Synthetic indigo is even imported into the country.

As an indication of the position occupied by India among the dye-consuming nations, imports for the pre-war year, 1913, totaled 16,923,607 pounds, valued at $3,741,031, of which "alizarin dyes made up nearly 25 per cent by value and 38 per cent by weight." Imports in 1922 were 11,731,237 pounds, valued at $11,798,262, with red as the prevailing color, led by alizarin paste, used for the production of turkey red. In 1914, 72 per cent of the alizarin dyes came from Germany and 15 per cent from the United Kingdom.

Estimates for the imports of the individual leading dyes for 1922 are as follows: Alizarin, 3,600,000 pounds; Congo red, 2,100,000 pounds; and Sulphur black, 1,000,000 pounds. The imports of Congo red are reported to exceed all other direct cotton dyes, while the imports of sulphur black similarly exceed all other Sulphur colors

Basic dyes have a less extensive consumption; they find application for cotton, silk, jute, and coir. The principal members of that class used in India include Magenta, Auramine, Methyl violet, and Malachite green; in the case of the latter two dyes, the trade is accustomed to large crystals.

Acid dyes are imported for wall paper and ceremonial powders, while chrome dyes are in small demand. As to methods of dyeing, yarn dyeing leads, followed by piece and raw stock dyeing. Considerable hand printing with wooden blocks is also carried on. Bombay, on account of the large number of cotton mills in that Province, is probably the leading Indian port for the importation of coal-tar dyes. It is a distributing dye center for coastwise and country shipments.

Recovery of import trade by Germany.—An examination of the import figures of British India shows that Germany in 1921 and 1922 regained a large share of the import trade which had been taken over by Great Britain, the United States, and Switzerland during the war. According to Indian official figures, more than three-fourths of the dye imports of 1914, both by weight and value, originated in Germany. In 1920, the year before Germany reentered the world's markets, imports of German dyes into India were insignificant. In 1921, however, they reappeared in the world's markets and comprised slightly over one-third of that year's imports into India, increasing to about one-half of the imports in 1922. The increase in Germany's share in the import trade is reflected in a conspicuous drop in the 1922 dye imports, as compared with 1921, from the United Kingdom and even more so from the United States. Imports from the United Kingdom in 1921 totaled 3,613,820 pounds, valued at $3,619,734; they declined in 1922 to 2,960,634 pounds, valued at $3,107,969. The decrease in the imports of dyes from the United States is still more striking; in 1921 they amounted to 2,019,871 pounds, valued at $2,831,326, as compared with 1922 figures of 723,285 pounds and $1,029,090, respectively.

TABLE 53.—*India: Imports of coal-tar dyes and exports of natural indigo, British India, 1923*

Imports of coal-tar dyes year ended Mar. 31, 1923	Pounds	Exports of natural indigo year ended Mar. 31, 1923	Pounds
Alizarin dyes	5,285,661		
Aniline dyes	8,741,929		
Other coal-tar dyes	92,232		
	14,119,822		
From—		To—	
United Kingdom	1,326,261	United Kingdom	86,128
Germany	9,922,018	Asiatic Turkey	129,808
Belgium	1,002,955	Persia	63,728
Switzerland	53,259	Japan	41,216
United States	726,391	Egypt	129,136
Other countries	1,088,938	Other countries	57,904
Total	14,119,822	Total	507,920

TABLE 54.—*Mexico: Imports of coal-tar, May, 1920, and May, 1921*

	May, 1920		May, 1921	
	Pounds	Value	Pounds	Value
Aniline, alizarin (natural and artificial) and anthracene colors:				
United States	14,198	$5,507	130	$67
Germany	5,244	2,423	4,980	647
Great Britain			6,265	2,101
Total	19,442	7,930	11,375	2,815

One peso, average, May, 1920, $0.49352.
One peso, average, May, 1921, $0.48983.

TABLE 55.—*The Netherlands: Imports and exports of coal-tar dyes, 1922*

	1922	
	Pounds	Value
IMPORTS		
Aniline and other coal-tar dyes:		
Germany	3,035,734	$1,778,238
Belgium	48,501	36,950
Switzerland	191,800	153,960
All other countries [1]	171,959	61,969
	3,447,994	2,031,117
Synthetic indigo	368,168	93,146
EXPORTS		
Aniline and other coal-tar dyes:		
Germany	121,253	60,044
Great Britain	154,322	68,897
France	35,274	37,720
United States	57,320	42,724
Dutch East Indies	33,069	12,702
All other countries [1]	194,004	97,765
	595,242	319,852
Synthetic indigo	2,205	385

One ton, 2,204.6 pounds; 1,000 gulden, average for 1922, $384.90.

[1] Computed on difference between given total and individual countries.

TABLE 56.—*Persia: Imports and exports of indigo, years ended March 20, 1922, and March 20, 1923*

	Year ended Mar. 20, 1922		Year ended Mar. 20, 1923	
	Pounds	Value	Pounds	Value
IMPORTS				
Natural indigo:				
Afghanistan			62	$55
Great Britain	937	$955	105	59
British India	290,218	308,174	215,947	154,419
France	21	32		
Russia			72	64
Switzerland			514	369
European Turkey	128	205		
Total	291,304	309,366	216,700	154,966
Germany	94,210	134,015	114,596	98,309
Great Britain	111	251	56	33
British India	524	655	94,425	63,045
France			15	19
Russia	1,928	2,579	7	4
Switzerland			2,744	1,972
Total	96,774	137,500	211,843	163,382

TABLE 56.—*Persia: Imports and exports of indigo, years ended March 20, 1922, and March 20, 1923*—Continued

	Year ended Mar. 20, 1922		Year ended Mar. 20, 1923	
	Pounds	Value	Pounds	Value
EXPORTS				
Natural indigo:				
Afghanistan			963	$577
Russia	888	$873	28,145	26,331
Mascoti			98	38
Oman			1,408	553
Total	888	873	30,614	27,499
Synthetic indigo:				
Afghanistan			295	607
Russia			7,709	7,525
Switzerland			7	9
Total			8,011	8,141

One kran approximately equivalent to French franc.
Average exchange franc 1922, $0.08193.
Average exchange franc, 1923, $0.0607.
One Batman—2.970 kilos—6.55 pounds.

TABLE 57.—*Spain: Imports of coal-tar dyes, 1922, and first six months of 1923*

	1922		1923 (6 months)	
	Pounds	Value	Pounds	Value
Colors derived from coal and other artificial colors in powder or crystal, including thio carbon	1,725,320	$1,574,904	983,618	$892,064
Indigo, synthetic	325,258	171,061	105,226	54,983
Colors derived from coal in paste or solid containing 50 per cent water	65,049	31,973	26,881	13,127

One peseta, average of 1922, $0.1548.
One peseta, average, January to June, 1923, $0.1538.

TABLE 58.—*Sweden: Imports and exports of coal-tar dyes, 1921*

	1921	
	Pounds	Value
IMPORTS		
Alizarin colors	42,531	$43,393
Aniline and other coal-tar colors	914,475	793,064
Indigo:		
Artificial	23,713	14,133
Natural	22	47
Other indigo colors	3,309	675
EXPORTS		
Alizarin colors	82	272
Aniline and other coal-tar colors	64,921	60,819

One krona, average of 1921, $0.225.

Reparation Dyes [10]

1. Under the terms of the treaty of Versailles provision was made for deliveries in kind by Germany. Annex VI to Part VIII of the treaty dealt with the delivery of dyes and pharmaceutical products. The full text of Annex VI follows:

I

Germany accords to the Reparation Commission an option to require as part of reparation the delivery by Germany of such quantities and kinds of dyestuffs and chemical drugs as the commission may designate, not exceeding 50 per cent of the total stock of each and every kind of dyestuff and chemical drug in Germany or under German control at the date of the coming into force of the present treaty.

This option shall be exercised within 60 days of the receipt by the commission of such particulars as to stocks as may be considered necessary by the commission.

II

Germany further accords to the Reparation Commission an option to require delivery during the period from the date of the coming into force of the present treaty until 1st June, 1920, and during each period of six months thereafter until 1st January, 1925, of any specified kind of dyestuff and chemical drug up to an amount not exceeding 25 per cent of the German production of such dyestuffs and chemical drugs during the previous six months' period. If in any case the production during such previous six months was, in the opinion of the commission, less than normal, the amount required may be 25 per cent of the normal production.

Such option shall be exercised within four weeks after the receipt of such particulars as to production and in such form as may be considered necessary by the Commission; these particulars shall be furnished by the German Government immediately after the expiration of each six months' period.

III

For dyestuffs and chemical drugs delivered under paragraph 1, the price shall be fixed by the commission, having regard to pre-war net export prices and to subsequent increases of cost.

For dyestuffs and chemical drugs delivered under paragraph 2, the price shall be fixed by the commission, having regard to pre-war net export prices and subsequent variations of cost, or the lowest net selling price of similar dyestuffs and chemical drugs to any other purchaser.

IV

All details, including mode and times of exercising the options, and making delivery, and all other questions arising under this arrangement shall be determined by the Reparation Commission; the German Government will furnish to the commission all necessary information and other assistance which it may require.

V

The above expression "dyestuffs and chemical drugs" includes all synthetic dyes and drugs and intermediate or other products used in connection with dyeing, so far as they are manufactured for sale. The present arrangement shall also apply to cinchona bark and salts of quinine.

DYES

As regards dyestuffs the intention of the Reparation Commission was as follows:

1. To place at the disposal of the Allied and Associated Powers the dyes immediately necessary for their industries.

2. To furnish a continuous supply up to January 1, 1925.

Following the signing of the treaty, consideration was given to Annex VI in view of the urgent needs of dyes by the Allied countries.

[10] The information on reparation dyes is taken from "Report on the Works of the Reparation Commission from 1920-1922, printed and published by His Majesty's Stationery Office, 23 Imperial House, King's Way, London, WC2.

The subcommittee, composed of dye experts from the United States, Great Britain, Italy, and Belgium, was appointed, as was also a German expert committee, comprising representatives of the leading German dye firms and presided over by Herr Carl von Weinberg.

Agreement was made at the first meeting on August 8, 1919, at Versailles, to take an inventory of stocks on hand in the German factories as on August 15. The inventory of dyes on hand submitted by Germany totaled 20,706,114 kilos (20,380 tons[11]) and in addition 816,610 kilos (804 tons) of intermediates. The following table shows the stocks of dyes and intermediates on hand in each of the German factories on August 15, 1919:

TABLE 59.—*Stock of dyestuffs in German factories, August 15, 1919*

Factory	Dyestuffs	Intermediates	Total dyestuffs and intermediates	50 per cent of the total of dyestuffs and intermediates
	Kilograms	*Kilograms*	*Kilograms*	*Kilograms*
A. G. F. A. (Berlin)	1,077,759,000	47,963,000	1,125,722,000	562,861,000
Badische	7,984,435,000	143,494,000	8,127,929,000	4,063,964,500
Bayer	5,444,805,000	27,433,000	5,472,238,000	2,736,119,000
Cassella	2,235,683,000	45,536,000	2,281,219,000	1,140,609,500
Griesheim	506,330,500	49,167,400	555,497,900	277,748,950
Grunau		1,992,000	1,992,000	996,000
Jäger	22,540,000		22,540,000	11,270,000
Kalle	339,855,300	25,325,000	365,180,300	182,590,150
Meister L. & B	2,566,721,158	473,601,200	3,040,322,358	1,520,161,179
Muehlheim	80,306,000	300,000	80,606,000	40,303,000
Weiler-ter-Meer	423,004,000	798,000	423,802,000	211,901,000
Wülfing Dahl	24,675,000	1,000,000	25,675,000	12,837,500
Grand total	20,706,113,958	816,609,600	21,522,723,558	10,761,361,779

In theory the option on these stocks could not be exercised until the treaty entered into force. None the less, in view of the urgent needs of France, Italy, and Belgium, it was decided, with the consent of Germany, in the course of a meeting of the Allies held in London for that purpose on September 15, 1919, to authorize the immediate withdrawal of 5,200 tons from the stocks of August 15. This agreement was ratified by the organization committee on September 17, the details governing the deliveries were arranged with the German experts at the beginning of October, and a protocol finally signed on November 3.

Deliveries on the 5,200-ton account began on November 22, 1919. After a prolonged consideration of the distribution of the remainder of the stocks on hand (August 15, 1919) it was decided to divide the dyes into groups and to base the percentage of distribution on the German export statistics of 1913. These figures were modified to allow for new conditions and for home consumption. The following table shows the percentage distribution:

TABLE 60.—*Percentages of distribution of dyestuffs—Balance of the stock of August 15, 1919*

Group	United States	Great Britain	France	Italy	Belgium
I. Alizarine red	25	35	16	16	8
II. Indigo	5	29	28	18	20
III. Vat dyes other than indanthrene blue G. C. D	39	30	13	13	5
IV. Indanthrene blue G. C. D	55	30	8	7	
V. Alizarine dyes other than red	37	30	14	14	5
VI. Direct cotton colors	15	25	23	20	17
VII. Developed cotton colors	20	25	26	20	9
VIII. Acid wool colors	15	25	28	20	12
IX. Chrome colors	20	30	23	18	9
X. Basic colors	15	25	25	23	12
XI. Sulphur colors	10	35	17	17	21
XII. Lake colors	25	25	25	15	10
Intermediates	20	30	21	19	10

[11] Except where otherwise stated, the "ton" is the long ton.

Orders for deliveries from the stocks on hand continued to be forwarded up to September 1, 1920, and the total deliveries of dyes amounted to 9,889,650 kilos (9,733 tons).

Paragraph 2 of Annex VI gave the commission an option for each six monthly period for delivery "of any specific kind of dyestuff and chemical drug up to an amount not exceeding 25 per cent of the German production of such dyestuffs and chemical drugs during the previous six months' period." The option came into force with the treaty, that is, on January 10, 1920.

At a meeting held in January, 1920, the German experts proposed that the Allies should establish a program, to be carried out by Germany, of their real needs for three months and that the Reparation Commission should exercise its option on the monthly production. This proposal was accepted and a provisional protocol for its execution was signed on January 30, 1920. Since that date Germany has had to inform the commission each month of the production of the preceding month of all dyestuffs, as well as of the lowest prices at which they have been supplied to other purchasers. In practice the prices quoted are always those of the German internal market. The monthly lists of production are communicated to the interested Governments and they are given a certain time to pass orders up to the amount of the percentages attributed to them. These percentages were drawn up on the basis employed for the distribution of the balance of the stocks of August 15; they have been modified on more than one occasion, owing to unforeseen demands from Japan, and again owing to the provisional abandonment of deliveries by Japan and subsequently by the United States.

The two following tables show the percentage distribution by countries of 25 per cent of the daily production of dyes, (1) when the United States received them, and (2) after withdrawal of the United States:

TABLE 61.—*Percentages of distribution of the 25 per cent of the daily production of dyestuffs*

[United States included]

Group	United States	Great Britain	France	Italy	Belgium
I. Alizarin red	25	35	16	16	8
II. Indigo	5	35	23	23	14
III. Vat dyes other than indanthrene blue G. C. D	42	35	9	9	5
IV. Indanthrene blue G. C. D	60	35	5		
V. Alizarin dyes other than red	45	35	8	8	4
VI. Direct cotton colors	15	25	25	18	17
VII. Developed cotton colors	28	30	18	15	9
VIII. Acid wood colors	15	33	26	15	11
IX. Chrome colors	25	33	18	15	9
X. Basic colors	20	30	20	20	10
XI. Sulphur colors	10	35	17	17	21
XII. Lake colors	30	30	15	15	10
Intermediates	20	30	21	19	10

TABLE 62.—*Existing percentages of distribution of the 25 per cent of the daily production of dyestuffs*

Group	Great Britain	France	Italy	Belgium
I. Alizarin red	45	15	25	15
II. Indigo	37	20	25	18
III. Vat dyes other than indanthrene blue G. C. D	50	20	20	10
IV. Indanthrene blue G. C. D	35	25	25	15
V. Alizarin dyes other than red	55	20	17	8
VI. Direct cotton colors	34	26	21	19
VII. Developed cotton colors	42	25	21	12
VIII. Acid wool colors	37	30	19	14
IX. Chrome colors	43	20	25	12
X. Basic colors	38	25	25	12
XI. Sulphur colors	35	15	20	30
XII. Lake colors	40	20	25	15
Intermediates	37	26	24	13

After the expiration of the time limit the remaining dyes were offered to the different countries without regard to the percentages, and withdrawals were also made for deliveries to countries having no percentage (the Serb-Croat-Slovene State and Greece):

The drawing up of the quarterly program of the needs of the Allied countries for the purpose of the agreement, which was to replace the provisional agreement of January 30, 1920, presented serious difficulties, and the protocol of that date was first renewed on April 28, 1920, and a second time in a slightly different form on May 31.

The protocol for the delivery of dyes of May 31, 1920, follows:

Pending the final execution of the agreement outlined at the meeting of the dyestuff subcommission of the Reparation Commission, January 28, 1920, or of a similar agreement, the German Government undertakes to deliver to the Reparation Commission from June 1, 1920, forward, 25 per cent of the German daily production of dyestuffs.

It will likewise deliver intermediate products used in dyeing and printing in such quantities as shall equal the quantities of those same products delivered to the various countries before the war for the same uses.

The prices at which these dyestuffs and intermediate products will be delivered shall be the lowest price at which these same dyestuffs and intermediate products have been offered [12] during the same month to any buyer, German or other.

These deliveries will be credited to Germany in the reparation account.

It is understood that the present agreement in no way constitutes a renunciation by the Reparation Commission of any of the rights conferred upon it by the treaty of Versailles, particularly as regards the paragraphs above concerning intermediate products and prices.

(Signed) DUBOIS.
D'AMELIO.
BERGMANN.

N. B.—This protocol and all the other protocols and agreements concerning Annex VI having been prepared in the French language, and the French text being the only one signed by the Germans, the French text alone is authentic.

The German factories continued to turn out large quantities of the simpler dyestuffs, which were also being produced in United States, British, French, and Italian factories, with the result that a proportion of them remained at the disposal of the commission. In order not to disturb the markets by putting these dyestuffs on sale, the commission negotiated the sale of the untaken balances to the Association of German Dyestuff Manufacturers (Interessengemeinschaft) and on February 3, 1921, an agreement was signed under which this association bought them back at 75 per cent of the value shown on the monthly lists of production. This contract dealt with all the balances of the 25 per cent of production from February to May, 1920, and the sum paid to the commission amounted to 44,384,420 paper marks (3,026,100 gold marks).

In the case of many types of dyestuffs 25 per cent of the German production was not sufficient to satisfy the needs of the Allied countries, and, indeed, many of the products for which there was a demand were not even manufactured. The commission sought to fill this gap. The chief requirements were to enable the Allied distributing organizations to satisfy their own clients, whatever might be the quantity called for, and to provide the materials at a reasonable price. Several conferences were held with the German experts in July, 1921. It appeared desirable, in order to interest the German factories in the smooth working of the agreement which was under negotiation, to make a concession on the price of the quantities in excess of those the delivery of which was provided for in the earlier protocols, and it was in this spirit that the supplementary agreement of the 19th August, 1921, was signed after long negotiations.

[12] In the French text "tarifés."

This agreement follows:

APPENDIX XXVIII

AGREEMENT SUPPLEMENTARY TO THE DYESTUFFS PROTOCOL OF MAY 31, 1920

PARIS, *19th August, 1921.*

The following clauses shall be applied to the protocol of 31st May, 1920, which governs, in so far as dyestuffs are concerned, the execution of paragraph 2, Annex VI to Part VIII of the treaty of Versailles.

ARTICLE 1

The I. G. of the German dye factories, whilst continuing to hold at the disposal of the Reparation Commission 25 per cent of the amount of dyestuffs manufactured each month, agrees to deliver, as far as possible, on reparation account, dyestuffs asked for in quantities superior to 25 per cent of the production of such dyes.

However, the total value of the dyes delivered on reparation account out of the production of any one month shall not exceed 25 per cent of the total value of the total production for that month.

ARTICLE 2

Those quantities superior to 25 per cent of the production of each dyestuff shall be debited in reparation account at the lowest price that the I. G. of the German dye factories shall have sold at [13] in each of the receiving countries during the month preceding the month of delivery or during the month of delivery, but always at the lower of these two prices.

However, the prices fixed by the protocol of 31st May, 1920, shall be applied to a minimum quantity of each dyestuff to be delivered in accordance with articles 1 and 2, such minimum quantity to be agreed upon jointly by the Reparation Commission and the I. G. on the basis of the production of each dyestuff during the 15 months from 1st February, 1920, to 30th April, 1921 (see letter from I. G. attached).

ARTICLE 3

For such dyestuffs as the amount asked for is liable to exceed 25 per cent of the production, firm orders shall be given by each Allied and Associated Power within one month of the signing of the present agreement for the first three months' period and for the succeeding three-monthly periods during the last month of the preceding period. The quantities thus ordered shall not exceed the needs of the consuming industries of each country.

ARTICLE 4

The Reparation Commission recognizes that dyestuffs delivered on reparation account should not be reexported, and will therefore ask the Governments of the Allied and Associated Powers receiving dyestuffs to give to their respective distributing organizations the instructions necessary to prevent, as far as possible, this reexportation.

ARTICLE 5

As to dyestuffs of which deliveries are not to exceed 25 per cent of the production and of which 25 per cent of the production is held at the disposal of the Reparation Commission, the commission agrees that firm orders for these shall be given within 60 days after receipt of the monthly lists of production. Quantities for which firm orders are not given within this period shall automatically remain at the free disposal of the I. G.

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[13] In the French text "au plus bas prix que l'I. G. * * * aura pratiqué," which is less restrictive than the term "sold."

ARTICLE 6

There shall be left at the free disposal of the I. G.—

(*a*) On the signing of this agreement the reliquats of the seven months from 1st June to 31st December, 1920;

(*b*) Within 30 days of the date of signature of this agreement, the reliquats of the months of January and February, 1921;

(*c*) Within 60 days of the date of signature of this agreement, the reliquats of the three months from 1st March to 31st May, 1921.

ARTICLE 7

The Reparation Commission will forward to the "Centrale des Usines de Matieres Colorantes" at Frankfort within 30 days of the date of this agreement a provisional list of specified dyestuffs, which in future will no longer have to be held at the disposal of the Reparation Commission. This list will be subject to change as the Reparation Commission may direct.

It is, moreover, understood that the monthly lists of production handed over to the Reparation Commission by the "Centrale" of Frankfort shall continue to show the production of all dyestuffs manufactured, whether or not they are to be held at the disposal of the commission.

ARTICLE 8

The present agreement will remain in force until revoked by the Reparation Commission. Notice of such revocation must be given at the beginning of a three-monthly period to take effect for the next period.

ARTICLE 9

The I. G. will do the necessary to be assured that the German Government will not oppose the present agreement.

For the I. G. of German synthetic dyestuff factories.

(Signed) SALVAGO RAGGI.
B. A. KEMBALL-COOK.
C. VON WEINBERG.

ANNEX TO AN AGREEMENT SUPPLEMENTARY TO THE PROTOCOL OF MAY 31, 1920

Letter from the I. G. of German synthetic dyestuff factories to the bureau for dyestuffs and pharmaceutical products of the Reparation Commission:

PARIS, *12th July, 1921.*

The I. G. declares that it will carry out article 2 of the supplementary agreement to the protocol of 31st May, 1920, concerning dyestuffs, as follows:

When a product is concerned which has not been manufactured during the 15 months taken as a basis, and such manufacture is undertaken to fill an order from the Allies, during the first three-montlfly period 50 per cent of the amount delivered will be priced at the price prevailing on the German interior market. This, however, does not apply to products never manufactured before the coming into effect of the treaty.

When a product is concerned which was manufactured during the 15 months taken as a basis, but in quantity considered insufficient, the lower price will be applied to a quantity to be determined by common agreement, which quantity will be between the 25 per cent of the average monthly production of the 15 months and 50 per cent of the amount ordered.

However, the lower price will always be applied to a quantity equal at least to 25 per cent of the actual production.

For the I. G. of German synthetic dyestuff factories.

(Signed) C. VON WEINBERG.

This agreement enabled the Allied distributing agencies to place quarterly orders for their requirements and to provide for reserves. It only binds Germany to deliver "as far as possible," and does not fix the price in advance. However, in nearly all cases the syndicate manufactured the desired products, and with few exceptions prices were reasonable.

The quarterly orders under this agreement up to December, 1922, are indicated below:

	Tons ordered
July–September, 1921	496
October–December, 1921	1, 178
January–March, 1922	1, 198
April–June, 1922	1, 549
July–September, 1922	2, 061
October–December, 1922	2, 433

The agreement of August 19, 1921, was modified on June 12, 1922, to facilitate the calculation of prices.

This amendment, given below, was extended "sine die" on December 15, 1922.

PARIS, *June 12, 1922.*

PROVISIONAL AMENDMENT TO THE SUPPLEMENTARY AGREEMENT OF AUGUST 19, 1921, RELATIVE TO DYESTUFFS

I. To facilitate the application of the supplementary agreement of August 19, 1921, it is decided that the following rules will apply to the quarterly orders July-September, and October-December, 1922. In so far as these two periods are concerned, the text which follows shall constitute a provisional amendment to such clauses of the supplementary agreement as might be contradictory to the present text.

II. All quarterly orders for July-September and October-December, 1922, will be invoiced as follows: 50 per cent at the price fixed by the protocol of May 31, 1920; 50 per cent at the lowest price that the I. G. shall have sold at in each of the receiving countries during the month preceding the month of delivery or during the month of delivery, but always at the lower of these two prices.

III. Upon receipt of the quarterly orders, the Centrale will furnish, for information, the export prices quoted for the countries interested at the time the orders are placed.

IV. To obtain the 25 per cent of the daily production, the quantities ordered in the quarterly orders will be deducted from the total actual production of the factories during the corresponding quarter. The 25 per cent of the difference between the actual production and the quarterly orders will appear in the production lists of the months from July to December, 1922. This entire 25 per cent will be at the disposal of the Reparation Commission in accordance with the Protocol of May 31, 1920.

(Signed) LEON DELACROIX.
JOHN BRADBURY.
VON WEINBERG.

Two other agreements of minor importance included: (1) An agreement between the German factories and the French holders of prewar contracts of dyes; (2) a Belgian-German agreement under which Belgium could order on reparation account, at open market prices, any dyes not obtainable within its share of the 25 per cent of daily production or within the quarterly orders.

A question of interpretation arose on the intermediates in paragraph 5 of Annex VI, as the French and English texts were not identical. The question was whether the commission's option extended to intermediates used in making dyes or was limited to those products used in dyeing and printing. The Reparation Commission provisionally limited its option to the intermediates used in dyeing and printing. The Allied experts considered it desirable to encourage the dye makers

in their respective countries to produce their own intermediates and, in order to avoid their use in dye making, the option was restricted to the pre-war consumption by the Allied countries. In order to provide for new products and such products as naphthol A. S., the provision was further modified. Group I includes intermediates used in dye making. Orders were passed without restriction at the lowest price of the German factories, provided that the products be used only for dyeing and printing and not reexported. Group II includes products specially employed in dyeing or printing. Option is accorded at prices provided for by the treaty up to 25 per cent of production, and quantities in excess can be ordered at the lowest price quoted by Germany in the country placing the order.

Shortly after the treaty came into force the Reparation Commission organized a bureau for dyestuffs and pharmaceutical products which works in liaison with the Allied expert committee, while Germany created at Frankfort a service (Zentrale der Farbstoff Fabriken, under the direction of Herr Muehlen), in touch with the German expert committee. Since the Reparation Commission allots dyes as a general rule only to Allied Governments or to agencies specifically appointed for this purpose by the Governments, France and Italy each set up a "Union des Producteurs et Consommateurs de Matieres Colorantes" for the receipt and distribution of reparation dyes. Great Britain appointed first of all the Central Importing Agency and later the British Dyestuffs Corporation. The Belgian Government itself receives and distributes its dyestuffs. The United States gave a mandate to the Textile Alliance (Inc.) of New York, but withdrew the mandate on the 14th December, 1921, without replacing the Textile Alliance. Nevertheless, the commission at that time decided, in consideration of the requirements of the United States industry and in the absence of objection from the United States Government, to continue to deliver to the Textile Alliance the portion previously assigned to the United States. On the 29th November, 1922, the Textile Alliance informed the commission that it renounced any right to order reparation dyes, and the share of the United States was then distributed between Great Britain, France, Italy, and Belgium.

The Frankfort Zentrale draws up every month lists indicating, in the case of each product manufactured in Germany during the preceding month, 25 per cent of the production and the lowest current price. These lists are immediately communicated by the dyestuffs bureau to the different Governments, which have 30 days in which to forward their orders up to the amount of their percentages to the Zentrale at Frankfort. After 30 days the dyestuffs bureau draws up a new list indicating the quantities still available. This list is immediately communicated to the Allied Governments, who have a further period of 30 days within which to forward to the bureau their orders for these balances. The balances are distributed a first time in proportion to the orders received on the tenth day and then later distributed in accordance with the orders without regard to percentages. Quantities not ordered within the total period of 60 days remain at the disposal of Germany. Orders for the 25 per cent of the daily German production must be carried out by Germany within three weeks except in the case of "force majeure." An invoice accompanies each consignment, and the amount, after conversion into gold marks, is then credited to Germany and debited to the receiving country on reparation account. As regards the United States, which has no reparation account, payments were made in dollars to the commission by the receiving agency. The same method was adopted for the dyes sold directly to the Textile Alliance.

Certain Allied countries were put to inconvenience through the reexportation of dyestuffs made by other Allied countries, and requested the commission to take steps to prevent such reexports. The attitude of the commission was defined in a letter addressed to the delegations of all the interested countries, the gist of which is contained in the two following extracts:

Dyes received subsequent to August 9, 1921:

It is definitely understood that such dyes are ordered for domestic consumption and are not to be reexported to countries receiving dyes through the medium of the Reparation Commission. In distributing these dyes to domestic consumers the receiving countries are expected to bring home this understanding to purchasers in such a way as to make it practically effective.

* * * * * * * *

Dyes delivered before August, 1921:

If practicable, the commission would be desirous of having the same restrictions as to reexportation of these dyes as are adopted for the dyes delivered since August. As regards dyes ordered under the supplementary agreement of the 19th August, 1921, or its amendment, the question of reexportation was regulated by article 4 of the former.

The deliveries of the dyes by the commission to the various countries up to December 31, 1922, are given below:

	Quantity (kilos)	Value (gold marks)
United States Textile Alliance:		
Stock	1,948,958	2,102,913.21
Daily production	280,734	1,499,291.13
Supplementary agreement	161,823	1,281,132.53
Total	2,391,515	4,883,336.87
Great Britain:		
Stock	2,923,453	3,806,101.03
Daily production	2,280,452	5,774,614.66
Supplementary agreement	955,678	4,653,776.82
Total	6,159,583	14,234,492.51
France:		
Stock	2,259,829	2,871,672.16
Daily production	1,826,247	8,687,467.25
Supplementary agreement	127,207	796,465.34
Pre-war contracts	28,549	86,419.32
Total	4,241,832	12,442,024.07
Belgium:		
Stock	1,103,195	1,202,216.24
Daily production	1,732,281	4,040,346.14
Supplementary agreement	1,158,028	4,245,975.63
Total	3,993,504	9,488,538.01
Italy:		
Stock	1,566,214	1,811,728.18
Daily production	3,180,866	11,106,367.33
Supplementary agreement	403,804	1,787,400.49
Total	5,150,884	14,705,496.00
Japan:		
Stock	88,001	64,487.61
Daily production	591,312	2,565,227.76
Total	679,313	2,629,715.37
Serb-Croat Slovene State: Daily production	10,140	22,623.61
Greece: Daily production	63,004	251,084.79
Total:		
Stock	9,889,650	11,859,118.43
Daily production	9,965,036	33,947,022.67
Supplementary agreement	2,806,540	12,764,750.81
Pre-war contracts	28,549	86,419.32
Grand total	22,689,775	58,657,311.23

TABLE 63.—*Reparation dyes delivered to December 31, 1923*

	Kilos	Gold marks
United States	2,391,589	4,875,568
Great Britain	7,664,993	19,197,311
France	4,276,533	12,515,487
Italy	6,274,601	18,722,218
Belgium	4,219,215	9,913,905
Japan	679,313	2,629,705
Greece	67,006	256,200
Serbia	10,140	22,624
Total	25,583,390	68,133,019

PHARMACEUTICAL PRODUCTS

The questions involved in the case of pharmaceutical products were intrusted to a subcommittee of experts. At the first meeting, held September 12, 1919, the United States, Great Britain, France, Italy, and Belgium were represented. The German experts suggested September 20, 1919, as the date on which inventories should be taken of stocks on hand, and this date was agreed upon. The French and Belgian experts desired prompt exercise of the option, in view of the needs of pharmaceuticals in their countries. The United States and British experts stood for a compliance with legal limitation of the treaty, whereby the option could be exercised only by the commission itself, i. e., after the treaty came into force.

On December 9, 1919, Germany reported the inventories of pharmaceuticals, and the experts met on January 5 to 10 for their examination. It was found that the quantities were too low for certain products and that other products covered by the treaty were not listed.

As a result of a discussion on January 30, 1920, and the explanations offered, the German inventories were accepted "en bloc," to which stocks of certain products were to be added. In the case of codeine and cocaine, only half of their stocks were declared, as it was not proved that the patents covering their synthesis were being operated. Synthetic pharmaceuticals were defined as "all organic products which are not natural or which are not obtained by simple extraction from a natural product and which are employed in therapeutics."

After the treaty came into force pharmaceuticals were dealt with in the same manner as dyes. A distribution organization for pharmaceutical products was maintained at Frankfort, Germany.

Agreement was made on April 9, 1920, for the distribution of pharmaceuticals on the basis of pre-war imports, and on April 12 the Allied and German experts signed a protocol governing the delivery of 50 per cent of the stocks.

The deliveries were modified as a result of the abandonment of their respective shares by the United States and Great Britain and of a request of Japan to participate. Percentages were allotted to France, Italy, and Belgium, and Japan received a small fixed amount. On August 28, 1920, the option on stocks was exercised, the total deliveries amounting to 93,776 kilos (92 tons).

It was decided, in agreement with Germany, to exercise the option on the daily production in a manner which differed slightly from that stipulated in the treaty; it was agreed that Germany should forward monthly to the commission a list of the quantities manufactured in the course of the preceding month and that orders for 25 per cent of this production should be forwarded immediately. The protocol of October 19, 1920, governs these deliveries:

PARIS, *October 19, 1920.*

PROTOCOL FOR THE DELIVERY OF PHARMACEUTICAL PRODUCTS

The German Government, in execution of paragraph 2, Annex VI, Part VIII of the treaty of Versailles, undertakes to deliver to the Reparation Commission any synthetic pharmaceutical products and salts of quinine up to an amount not exceeding 25 per cent of the German production manufactured from July 1, 1920, onward.

The production of cocaine and codeine, however, will be delivered only up to an amount of 12.5 per cent of the total production of these products.

The prices at which these products shall be delivered shall in principle be the lowest net selling price at which these products have been quoted [14] during the month of their production to any other purchaser (German or otherwise). The Reparation Commission, however, reserves the right to fix the prices, according to the provisions of paragraph 3, Annex VI, Part VIII of the treaty of Versailles, if it considers that the prices charged by Germany are excessive.

These deliveries will be credited to Germany in the reparation account.

The present agreement, until revoked or modified by the Reparation Commission, will govern all future deliveries of pharmaceutical products under the provisions of the treaty above quoted.

It is understood that in making the present agreement the Reparation Commission reserves all the rights conferred upon it by the treaty of Versailles.

(Signed) DUBOIS.
THEUNIS.
BERGMANN.

[14] In the French text "les prix les plus bas auxquels ces memes produits ont ete tarifes."

The distribution of these quantities among the different Allies gave rise to long discussions and was subjected to modifications when the United States and Great Britain provisionally renounced their right to participate. For a few months Japan received fixed quantities, the balance being distributed between France, Italy, and Belgium in proportions which will be found in the following table:

PERCENTAGE DISTRIBUTION OF THE 25 PER CENT OF THE DAILY PRODUCTION OF PHARMACEUTICAL PRODUCTS SINCE JULY, 1920

Titles of the groups:

I. Quinine and its salts (No. 380 A of the German customs tariff of 1913).

II. Salicylic and benzoic acids and their salts (No. 317 N).

III. Alkaloids other than quinine and the glucosides (No. 380 B).

IV. Ethyl ether and the esters (No. 382).

V. Chloroform and chloral hydrate (No. 382).

VI. General synthetic products (Nos. 346 F, 346 G, 278, 317 G, 350, 351, 383, 390).

	Groups					
	I	II	III	IV	V	VI
France	33.0	42.5	42.5	57.5	40.0	51.5
Italy	60.5	43.0	42.5	17.0	40.0	33.0
Belgium	6.5	14.5	15.0	25.5	20.0	15.5

Rumania, the Serb-Croat-Slovene State, and Greece receive pharmaceutical products drawn from the quantities of which the other countries do not avail themselves, quantities which are relatively important in the aggregate owing to the development of the pharmaceutical industry in France and in Italy.

Rumania, the Serb-Croat-Slovene State, and Greece, in particular, urgently requested the delivery of salts of quinine and, the German manufacture of this product having greatly declined since the war, several special agreements were made for the delivery of a total quantity of over 56 tons.

The table below shows the deliveries of pharmaceutical products made to the different countries up to December 31, 1922:

TABLE 64.—*Pharmaceuticals delivered to December 31, 1922*

	Quantity (kilos.)	Value (gold marks)		Quantity (kilos.)	Value (gold marks)
France:			Japan:		
Stock	29,879	176,148.67	Stock	1,401	5,696.13
Daily production	26,431	189,527.48	Daily production	16,108	132,688.57
Total	56,310	365,676.15	Total	17,509	138,384.70
Italy:			Serb-Croat-Slovene State:		
Stock	49,507	481,731.93	Daily production	123,445	1,570,828.89
Daily production	268,797	2,073,392.82	Greece: Daily production	201,194	1,769,134.18
Total	318,304	2,555,124.75	Rumania: Daily production	80,790	5,608,020.59
Belgium:			Grand total	1,013,847	13,550,944.19
Stock	12,989	145,241.00			
Daily production	203,306	1,398,533.93			
Total	216,295	1,543,774.93			

TABLE 65.—*Pharmaceuticals delivered to December 31, 1923.*

	Kilos	Gold marks		Kilos.	Gold marks
France	57, 525	394, 399	Serbia	176, 093	2, 563, 340
Italy	417, 180	3, 528, 279	Rumania	80, 790	5, 608, 020
Belgium	248, 892	1, 617, 427			
Japan	17, 509	138, 385	Total	1, 299, 549	16, 891, 446
Greece	301, 560	3, 041, 596			

In December, 1923, it was reported that the I. G. agreed to resume normal reparation deliveries in kind under Annex VI of the Versailles treaty and later agreements with the Reparation Commission.

PART VI

APPENDIX

STATISTICS OF DOMESTIC IMPORTS AND EXPORTS

STATISTICS OF IMPORTS AND EXPORTS

TABLE 66.—*Imports of coal-tar products entered for consumption, calendar years 1917 to 1923*

[Act of Sept. 8, 1916]

GROUP I, CRUDE (FREE)

	Years			
	1917		1918	
	Quantity	Value	Quantity	Value
Acids, carbolic, which on being subjected to distillation yield in the portion distilling below 200° C. a quantity of tar acids less than 5 per cent of original distillate—pounds	151, 254	$9, 894	155, 236	$17, 260
Anthracene oil—gallons	61, 200	3, 105		
Benzene—pounds	3, 598, 733	341, 700	2, 673, 855	87, 570
Cresol—do	7, 665, 442	532, 529	8, 873, 271	779, 045
Dead or creosote oil—gallons	9, 817, 085	786, 638	1, 545, 247	162, 869
Naphthalene having a solidifying point less than 79° C.—pounds	5, 206, 980	175, 554	3, 902, 731	130, 098
Pyridine and quinoline—do	12, 247	1, 480	9, 237	1, 036
Coal tar, crude—barrels	6, 780	10, 745	13, 087	21, 200
Pitch, coal tar—do	5, 926	12, 039	14, 029	29, 095
Metacresol, orthocresol, and paracresol—purity less than 90 per cent—pounds	20, 708	1, 404		
Xylene—do	9, 332	2, 928		
All other products found naturally in coal tar whether produced or obtained from coal tar or other sources, n. s. p. f.—pounds		10, 448		2, 756
All other distillates, which on being subjected to distillation yield in the portion distilling below 200° C. a quantity of tar acids less than 5 per cent of the original distillate—pounds		1, 502		10, 473
Anthracene, purity less than 25 per cent—do	(1)	(1)	18	5
Acenaphthene, cumol fluorene, methylanthracene, and methylnaphthalene—pounds	(1)	(1)		
Carbazole, purity less than 25 per cent—do	(1)	(1)		

	Years			
	1919		1920	
	Quantity	Value	Quantity	Value
Acids, carbolic, which on being subjected to distillation yield in the portion distilling below 200° C. a quantity of tar acids less than 5 per cent of original distillate—pounds	1, 965, 289	$187, 788	192, 692	$19, 848
Anthracene oil—gallons	18, 699	3, 994	15, 054	3, 945
Benzene—pounds	217, 865	5, 617	486, 619	10, 868
Cresol—do	6, 435, 650	557, 214	10, 318, 070	901, 381
Dead or creosote oil—gallons	11, 268, 379	1, 374, 217	18, 427, 152	3, 796, 399
Naphthalene having a solidifying point less than 79° C.—pounds	3, 239, 256	92, 265	15, 012, 096	530, 219
Pyridine and quinoline—do	165, 064	20, 543	863, 456	168, 800
Coal tar, crude—barrels	22, 339	38, 476	11, 901	24, 140
Pitch, coal tar—do	3, 364	8, 598	8, 780	26, 022
Metacresol, orthocresol, and paracresol—purity less than 90 per cent—pounds	11, 200	1, 221		
Toluene—do	1, 195, 706	30, 768		
All other products found naturally in coal tar whether produced or obtained from coal tar or other sources, n. s. p. f.—pounds	380, 525	6, 334	240, 096	14, 046
All other distillates, which on being subjected to distillation yield in the portion distilling below 200° C. a quantity of tar acids less than 5 per cent of the original distillate—pounds	104, 568	10, 548		
Anthracene, purity less than 25 per cent—pounds	82, 669	2, 022	202, 569	16, 590
Acenaphthene, cumol fluorene, methylanthracene, and methylnaphthalene—pounds	15, 759	946		
Carbazole, purity less than 25 per cent—pounds	112	82		

[1] Imports not available by calendar year.

TABLE 66.—*Imports of coal-tar products entered for consumption, calendar years 1917 to 1923*—Continued

GROUP I, CRUDE FREE—Continued

	Years			
	1921		1922	
	Quantity	Value	Quantity	Value
Acids, carbolic, which on being subjected to distillation yield in the portion distilling below 200° C. a quantity of tar acids less than 5 per cent of original distillate...pounds	214,185	$22,849	311,914	[2] $33,781
Anthracene oil...gallons	12,776	5,019	13,368	3,242
Benzene...pounds	1,722,085	442,370	172,528	1,223
Cresol...do	3,353,882	253,886	3,756,651	258,536
Dead or creosote oil...gallons	33,239,432	4,756,618	41,566,767	4,239,949
Naphthalene having a solidifying point less than 79° C....pounds	4,495,806	135,943	3,144,332	54,029
Pyridine and quinoline...do	72,515	11,367	119,973	21,113
Coal tar, crude...barrels	21,551	46,784	23,431	54,324
Pitch, coal tar...do	417	1,264	1,422	4,193
Metacresol, orthocresol, and paracresol—purity less than 90 per cent...pounds			3,962	352
Toluene...do			144,237	6,061
All other products found naturally in coal tar whether produced or obtained from coal tar or other sources, n. s. p. f....pounds	40,707	3,111	424,530	8,049
All other distillates which on being subjected to distillation yield in the portion distilling below 200° C. a quantity of tar acids less than 5 per cent of the original distillate...pounds	7,310	959	459,727	50,652
Anthracene, purity less than 25 per cent...do	58,111	1,198	33,600	400
Acenaphthene cumol fluorene, methylanthracene and methylnaphthalene...pounds	100	64	66	17
Carbazole, purity less than 25 per cent...do				

	1923	
	Quantity	Value
Benzene...pounds	701,857	$21,902
Dead or creosote oil...gallons	64,199,636	10,071,393
Napthalene, solidifying at less than 79° C...pounds	20,992,439	575,702
Coal tar, crude...barrels	10,131	31,671
Pitch, coal tar...do	4,644	15,154
Toluene...pounds	194,660	7,928
Acenaphthene, fluorene, methylanthracene, and methylnaphthalene...do	23,673	2,826
Anthracene, purity less than 30 per cent...do	869,780	23,925
Anthracene oil...gallons	31,198	7,078
Cumene, cymene...pounds	2	24
Metacresol, orthocresol, and paracresol, purity less than 90°...do	3,805	2,846
Pyridine...do	764,918	266,184
Xylene...do	136,488	8,179
All other distillates n. s. p. f., which on being subjected to distillation yield in the portion distilling below 190° C. a quantity of tar acids less than 5 per cent of the original distillate...pounds	5,761,011	489,824
All other products found naturally in coal tar, whether produced or obtained from coal tar or other sources, n. s. p. f....pounds	1,635,025	69,373

[2] First 9 months.

TABLE 66.—*Imports of coal-tar products entered for consumption, calendar years 1917 to 1923*

GROUP II (DUTIABLE AT 15 PER CENT AD VALOREM PLUS 2½ CENTS PER POUND; DUTIABLE AT 55 PER CENT PLUS 7 CENTS PER POUND AFTER SEPTEMBER 21, 1922)

Article and year	Pounds	Value	Duty	Actual and computed ad valorem rate
Not colors, dyes, or stains, photographic chemicals, medicinals flavors, or explosives, n. s. p. f.:				
Acids—				
Amidosalicylic—				
1917				
1918				
1919				
1920	11,199	$8,182	$1,507	18.42
1921				
1922				
1923				
Arsanilic—				
1923	223	3,345	1,855	55.47
Benzoic—				
1917	4,653	20,539	3,190	15.53
1918	1,791	14,060	2,154	15.32
1919	63	374	58	15.42
1920	250	1,087	169	15.58
1921	11,263	3,012	733	24.35
1922 [1]	100	365	57	15.68
1923	100	410	233	56.71
Carbolic (phenol) which on being subjected to distillation yields in the portion distilling below 200° C. a quantity of tar acids equal to or more than 5 per cent of the original distillate—				
Crystal—				
1917	30,676	4,954	1,510	30.48
1918	148,261	47,085	10,769	22.87
1919				
1920				
1921	250	142	28	19.40
1922 [1]	280,224	30,414	11,568	38.03
1922 [2]	69,310	16,102	13,708	85.13
1923	126,618	21,389	20,627	96.44
Liquid—				
1917	314,585	24,246	11,502	47.44
1918	134,406	15,186	5,638	37.13
1919	2,061	264	91	34.52
1920	1,040	244	63	25.66
1921				
1922 [1]	1,702	1,801	313	17.36
1922 [2]	145,375	18,488	20,345	110.04
1923	2,815	257	338	131.67
Cinnamic—				
1923	112	389	222	57.02
Dichlorophthalic—				
1923	10	8	5	63.75
Phenylglycine orthocarboxylic—				
1923	17,376	74,492	42,187	56.63
Salicylic—				
1917	26,273	23,575	4,193	17.79
1918	117	112	20	17.62
1919				
1920				
1921				
1922 [1]	2,276	1,881	339	18.02
Salicylic and salts of, not medicinal—				
1923	1,107	854	547	64.07
Sulphanilic—				
1923	16	19	12	60.89
Amidonaphthol—				
1917				
1918				
1919	150	72	15	20.21
1920				
1921	11,025	9,990	1,774	17.76
1922				
1923				

[1] Act of 1916. [2] Act of 1922.

TABLE 66.—*Imports of coal-tar products entered for consumption, calendar years 1917 to 1923*—Continued

GROUP II (DUTIABLE AT 15 PER CENT AD VALOREM PLUS 2½ CENTS PER POUND; DUTIABLE AT 55 PER CENT PLUS 7 CENTS PER POUND AFTER SEPTEMBER 21, 1922)—Continued

Article and year	Pounds	Value	Duty	Actual and computed ad valorem rate
Not colors, dyes, or stains, photographic chemicals, medicinals flavors, or explosives, n. s. p. f.—Continued.				
Amidophenol—				
1917				
1918				
1919	1,028	$2,417	$388	16.06
1920				
1921	14,623	11,699	2,120	18.12
1922				
1923				
Aniline oil—				
1917				
1918				
1919				
1920	220	72	16	22.64
1921	11,243	1,799	551	30.62
1922 (included in aniline oil and salts) [1]				
Aniline salt—				
1917				
1918	21,273	3,250	1,019	31.36
1919				
1920	4	1		25.00
1921	18,316	12,109	2,274	18.78
1922 (included in aniline oil and salts)				
Aniline oil and salts—				
1922 [2]	55	11	10	90.00
1923	30	220	123	55.95
Anthracene, purity of 25 per cent or more—				
1917				
1918				
1919	51,895	8,011	2,499	31.19
1920	648,095	87,413	29,314	33.54
1921	261,645	12,639	8,437	66.75
1922 [2]	2	2	1	62.00
1923				
Anthraquinone—				
1917				
1918				
1919	3,147	2,643	375	14.20
1920	13,053	5,612	1,168	20.82
1921	127,427	78,255	14,924	19.07
1922				
1923				
Benzaldehyde—				
1917				
1918				
1919	24,472	17,790	3,280	18.44
1920	9,479	5,928	1,126	19.00
1921	1,056	465	96	20.68
1922 [2]	20	11	7	67.73
Benzaldehyde, not medicinal—				
Nitrobenzaldehyde	200	240	146	60.83
1923				
Benzidine, bensidine sulphate—				
1923	7	23	13	57.13
Benzylchloride—				
1917	5	7	1	16.86
1918				
1919	1,000	430	90	20.81
1920	150	22	7	32.05
1921				
1922 [1]				
Benzylchloride, benzalchloride, and benzoylchloride—				
1922 [2]	29	10	8	75.30
1923	10	22	13	58.18
Binitrotoluol—				
1917	61,632	10,471	3,111	29.71
1918	22,635	3,333	1,066	31.98
1919	6,896	1,331	372	27.95
1920	4,692	1,216	300	24.64
1921	1,164	155	52	33.77
1922				
1923				

[1] Act of 1916. [2] Act of 1922.

TABLE 66.—*Imports of coal-tar products entered for consumption, calendar years 1917 to 1923*—Continued

GROUP II (DUTIABLE AT 15 PER CENT AD VALOREM PLUS 2½ CENTS PER POUND; DUTIABLE AT 55 PER CENT PLUS 7 CENTS PER POUND AFTER SEPTEMBER 21, 1922)—Continued

Article and year	Pounds	Value	Duty	Actual and computed ad valorem rate
Not colors, dyes, or stains, photographic chemicals, medicinals flavors, or explosives, n. s. p. f.—Continued				
Binitrobenzol—				
1921	5	$3		19.33
1922				
1923				
Carbazole, purity of 25 per cent or more—				
1917				
1918				
1919				
1920	157	27	$8	29.56
1921				
1922 [1]	8,820	3,865	800	20.70
1922 [2]				
1923				
Dimethylaniline—				
1917				
1918				
1919	1,120	427	92	21.56
1920	22,400	15,968	2,955	18.51
1921				
1922 [1]	23,565	3,828	1,163	30.39
1922 [2]				
Dimethylaniline and benzylethylaniline—				
1923	1	2	1	58.50
Metacresol, orthocresol, and paracresol, purity of 90 per cent or more—				
1917				
1918				
1919				
1920	2,444	2,230	396	17.74
1921	556	341	65	19.08
1922 [1]	2,224	107	72	66.96
1922 [2]	1,008	167	162	97.24
1923	8,754	5,410	3,588	66.33
Methylanthraquinone—				
1917				
1918				
1919	3,147	2,643	375	14.20
1920	13,053	5,612	1,168	20.82
1921				
1922				
1923	977	1,221	740	60.60
Napthalene solidifying at 79° C. or above—				
1917	267,057	12,125	8,497	70.02
1918	2,795	171	96	55.87
1919	7,650	384	249	64.80
1920	3,697,562	416,172	154,865	37.21
1921	441,685	31,458	15,761	50.10
1922 [1]	75,680	7,684	3,045	39.61
1922 [2]				
1923	9,605	194	779	401.57
Naphthol—				
1917	1,027	1,069	186	17.40
1918				
1919				
1920				
1921	333,356	112,922	25,272	22.38
1922 [1]	658	799	136	17.96
1922 [2]				
Naphthol, alpha and beta not medicinal—				
1923	13,376	29,569	17,199	58.17
Naphthylamine—				
1917				
1918	11,761	5,985	1,192	19.91
1919				
1920	69,695	7,208	2,824	39.18
1921				
1922				
1923				
Naphthylenediamine—				
1923	5	6	4	60.83

[1] Act of 1916. [2] Act of 1922.

TABLE 66.—*Imports of coal-tar products entered for consumption, calendar years 1917 to 1923*—Continued

GROUP II (DUTIABLE AT 15 PER CENT AD VALOREM PLUS 2½ CENTS PER POUND; DUTIABLE AT 55 PER CENT PLUS 7 CENTS PER POUND AFTER SEPTEMBER 21, 1922)—Continued

Article and year	Pounds	Value	Duty	Actual and computed ad valorem rate
Not colors, dyes, or stains, photographic chemicals, medicinals flavors, or explosives, n. s. p. f.—Continued				
Nitrobenzol—				
1917				
1918				
1919	21,513	$4,003	$1,138	28.44
1920	45,891	6,009	2,049	34.09
1921				
1922				
1923				
Nitronaphthalene—				
1917	18,102	7,758	1,616	20.83
1918				
1919				
1920				
1921				
1922				
1923				
Nitrophenylenediamine—				
1921	1,132	6,590	1,017	15.43
1922				
1923				
Nitrotoluol—				
1917				
1918				
1919	542	452	81	18.00
1920	684	359	71	19.76
1921				
1922				
1923				
Phenylenediamine—				
1917				
1918				
1919	2,746	1,769	334	18.88
1920	2,429	1,887	344	18.22
1921				
1922 [1]	6	16	9	57.62
1922 [2]				
1923				
Phenylhydrazine—				
1923	18	39	23	58.23
Phthalic anhydride—				
1917	98	1,853	280	15.13
1918				
1919				
1920				
1921				
1922 [1]	3,374	2,517	1,621	64.38
1922 [2]				
1923				
Resorcin—				
1917	134	672	104	15.50
1918				
1919				
1920	51,529	39,932	7,278	18.23
1921	109,658	75,022	13,995	18.65
1922				
1923	12,520	16,976	10,213	60.16
Tolidine—				
1923	5	6	4	60.83
Toluidine—				
1923	60	31	21	68.55
Tolylendiamine—				
1921	175	238	40	16.48
1922				
1923				
Xylidine—				
1917				
1918				
1919				
1920	56,047	41,237	7,587	18.40
1921				
1922				
1923	150	60	44	72.50

[1] Act of 1916. [2] Act of 1922.

TABLE 66.—*Imports of coal-tar products entered for consumption, calendar years 1917 to 1923*—Continued

GROUP II (DUTIABLE AT 15 PER CENT AD VALOREM PLUS 2½ CENTS PER POUND; DUTIABLE AT 55 PER CENT PLUS 7 CENTS PER POUND AFTER SEPTEMBER 21, 1922)—Continued.

Article and year	Pounds	Value	Duty	Actual and computed ad valorem rate
All distillates n. s. p. f., which on distillation, yield in the portion distilling below 200° C. a quantity of tar acid equal to or more than 5 per cent of the original distillate:				
1917				
1918	1,550	$2,008	$340	16.93
1919	3,170	4,587	767	16.73
1920	85,474	36,041	7,543	20.93
1921	16,240	11,811	2,178	18.43
1922 [1]	328,601	33,784	13,283	39.32
1922 [2,3]	22,163	9,128	6,572	72.00
1923 [3]	245,119	30,328	33,839	111.58
All distillates of coal, blast-furnaces, oil-gas, and water-gas tar which on being subject to distillation below 215° C. a quantity of tar acids equal to or more than 75 per cent of the original distillate:				
1922 [2]	18,257	4,102	3,534	86.16
1923	195,757	36,382	33,713	92.66
All similar products, obtained, derived, or manufactured in whole or in part from the products provided for in Group I (free):				
1917	193,021	17,595	7,465	42.43
1918	13,445	8,640	1,632	18.89
1919	51,214	39,861	7,260	18.21
1920	87,911	74,514	13,375	17.95
1921	87,207	41,965	8,475	20.19
1922 [1]	389,708	153,625	32,786	21.34
1922 [2]	187,377	61,967	47,198	76.17
1923	1,436,982	330,514	282,371	85.43
All sulfoacids or sulfoacid salts of Group II:				
1917				
1918				
1919				
1920	100	87	16	17.88
1921	6,789	2,944	611	20.76
1922 [1]	11,374	12,058	2,093	17.36
1923				

[1] Act of 1916. [2] Act of 1922. [3] At 190° C. instead of 200° C.

GROUP III (DUTIABLE AT 30 PER CENT AD VALOREM; DUTIABLE AT 60 PER CENT AD VALOREM PLUS 7 CENTS PER POUND AFTER SEPTEMBER 21, 1922)

Article and year	Pounds	Value	Duty	Actual and computed ad valorem rate
When obtained, derived, or manufactured in whole or in part from any of the products provided for in Group I (free) or II, including natural indigo and their derivatives:				
Alizarin, natural—				
1917	6,899	$12,216	$3,665	30.00
1918	108,711	158,816	47,645	30.00
1919	6,684	8,612	2,584	30.00
1920	58,583	41,381	12,414	30.00
1921	59,306	81,816	24,545	30.00
1922 [1]	28,399	63,304	18,991	30.00
1922 [2]	1,547	3,094	1,965	63.50
1923	9,283	18,600	11,810	63.49
Alizarin, synthetic—				
1917	19,180	55,179	16,554	30.00
1918				
1919				
1920	73,232	24,072	7,222	30.00
1921	136,283	49,707	14,912	30.00
1922 [1]	21,614	22,190	666	30.00
1923	1,836	3,699	2,348	63.47

TABLE 66.—*Imports of coal-tar products entered for consumption, calendar years 1917 to 1923*—Continued

GROUP III (DUTIABLE AT 30 PER CENT AD VALOREM; DUTIABLE AT 60 PER CENT AD VALOREM PLUS 7 CENTS PER POUND AFTER SEPTEMBER 21, 1922)—Continued

Article and year	Pounds	Value	Duty	Actual and computed ad valorem rate
When obtained, derived, or manufactured in whole or in part from any of the products provided for in Group I (free) or II, including natural indigo, and their derivatives—Continued				
Dyes obtained, derived, or manufactured from alizarin—				
1917	34	$75	$23	30.00
1918	6,446	13,399	4,020	30.00
1919	1,920	3,864	1,159	30.00
1920	29,436	25,498	7,647	30.00
1921	246,837	356,658	106,997	30.00
1922 [1]	293,005	468,134	140,440	30.00
Colors, dyes, stains, etc., obtained, derived, or manufactured from alizarin—				
1922 [2]	56,294	82,981	53,729	64.75
1923	274,799	379,673	247,040	65.07
Dyes obtained, derived, or manufactured from anthracene and carbazole—				
1917	23,146	11,326	3,398	30.00
1918	12,827	20,087	6,026	30.00
1919	7,162	7,772	2,332	30.00
1920	216,508	208,754	62,626	30.00
1921	226,956	422,941	126,882	30.00
1922 [1]	330,129	605,187	181,556	30.00
Colors, dyes, obtained, derived, or manufactured from anthracene or carbazol—				
1922 [2]	17,697	26,002	16,840	64.76
1923	7,319	8,126	5,388	66.30
ndigoids, whether or not obtained from indigo—				
1917	129,983	140,932	42,280	30.00
1918	3,376	13,744	4,123	30.00
1919	34,049	82,779	24,834	30.00
1920	86,439	196,783	59,035	30.00
1921	76,123	72,154	21,646	30.00
1922 [1]	184,886	267,059	80,118	30.00
1923				
Indigo, natural—				
1917	2,261,122	4,230,510	1,269,153	30.00
1918	1,637,914	2,007,958	602,387	30.00
1919	234,991	285,925	85,778	30.00
1920	36,537	69,528	20,858	30.00
1921	77,121	154,538	46,361	30.00
1922 [1]	14,461	19,074	5,722	30.00
1922 [2]				
1923	9,102	4,149	3,427	73.70
Indigo, synthetic—				
1917	1,379,349	871,267	261,380	30.00
1918	690,414	342,589	102,777	30.00
1919	537,697	327,133	98,140	30.00
1920	171,101	207,299	62,190	30.00
1921	70,975	84,901	25,470	30.00
1922 [1]	86,585	123,702	37,111	30.00
1922 [2]				
1923	356	117	95	81.30
Colors, dyes, stains, etc., derived from indigo—				
1922 [2]	872	1,482	950	64.11
1923	13,864	18,636	12,152	65.21
Colors, or color lakes obtained, derived, or manufactured from alizarin—				
1917	7,062	18,680	5,957	31.89
1918	1,499	4,490	1,422	31.67
1919	15,358	14,405	5,089	35.33
1920	98,735	172,841	56,789	32.86
1921	59,290	66,171	22,816	34.48
1922 [1]	79,542	62,986	27,077	35.95
1922 [2]				
1923 (see, "Dyes, etc., from alizarin").				

[1] Act of 1916. [2] Act of 1922.

TABLE 66.—*Imports of coal-tar products entered for consumption, calendar years 1917 to 1923*—Continued

GROUP III (DUTIABLE AT 30 PER CENT AD VALOREM; DUTIABLE AT 60 PER CENT AD VALOREM PLUS 7 CENTS PER POUND AFTER SEPTEMBER 21, 1922)—Continued

Article and year	Pounds	Value	Duty	Actual and computed ad valorem rate
When obtained, derived, or manufactured in whole or in part from any of the products provided for in Group I (free) or II, including natural indigo and their derivatives—Continued				
Colors, or color lakes obtained, derived, or manufactured from anthracene and carbazols—				
1917	53,205	$49,729	$17,579	35.35
1918	27,900	22,546	8,159	36.19
1919	38,073	55,475	18,546	33.43
1920	260,060	529,966	171,993	32.45
1921	62,748	65,635	22,828	34.78
1922 [1]	27,535	63,102	20,032	31.75
1922 [2]				
1923 (see, "Dyes, etc., from anthracene and carbazole").				
All other color, dyes, or stains, whether soluble or not in water, color acids, color bases, or color lakes—				
1917	2,257,476	2,574,363	885,183	34.38
1918 [3]	1,799,467	2,161,799	738,513	34.16
1919	1,991,687	2,848,294	954,073	33.50
1920	2,807,807	4,093,389	1,368,407	33.43
1921	2,751,535	3,968,319	1,328,072	33.47
1922 [1]	2,077,712	2,941,773	965,640	32.83
1922 [2]	677,849	894,844	584,356	65.30
1923	3,059,361	4,154,091	2,706,610	65.16
Phenolic resin, synthetic—				
1917	134,702	11,596	10,214	88.08
1918				
1919	1,114	2,860	914	31.95
1920	2,479	2,681	928	34.63
1921	1,420	2,366	781	33.00
1922 [1]	762	1,404	452	32.17
1923				
Resinlike products prepared from articles provided for in pars. 27 and 1549:				
1922 [2]	1,756	2,094	1,379	65.87
1923	3,183	10,512	6,530	62.12
Photographic chemicals—				
1917	12,632	101,406	31,053	30.62
1918	14,550	108,537	33,289	30.67
1919	12,059	77,876	23,966	30.77
1920	21,808	67,640	21,382	31.61
1921	29,281	65,906	21,236	32.22
1922 [1]	3,287	4,465	1,471	32.94
1922 [2]	8,183	8,208	5,498	66.98
1923	10,182	28,504	17,815	62.50
Coal tar medicinals:				
Acetanilid—				
1917	15	22	6	25.00
1918				
1919	124	50	13	25.00
1920				
1921				
1922				
1923	58	82	53	64.95
Acetphenetidin—				
1917	3,280	40,352	10,088	25.00
1918				
1919				
1920				
1921				
1922				
1923	25	238	145	60.74
Acetylsalicylic acid—				
1917	1,474	4,670	1,168	25.00
1918				
1919	26	76	19	25.00
1920				
1921				
1922				
1923	1	7	4	61.00

[1] Act of 1916.
[2] Act of 1922.
[3] Does not include 110 pounds, valued at $322, duty $81.68, from Cuba.

TABLE 66.—*Imports of coal-tar products entered for consumption, calendar years 1917 to 1923*—Continued

GROUP III (DUTIABLE AT 30 PER CENT AD VALOREM; DUTIABLE AT 60 PER CENT AD VALOREM PLUS 7 CENTS PER POUND AFTER SEPTEMBER 21, 1922)—Continued

Article and year	Pounds	Value	Duty	Actual and computed ad valorem rate
Coal tar medicinals—Continued				
Antipyrene—				
1917	21,842	$62,411	$15,603	25.00
1918	9,416	106,643	26,661	25.00
1919	13,736	135,565	33,891	25.00
1920	14,737	53,293	13,323	25.00
1921				
1922 [1]	12,604	18,468	4,617	25.00
1922 [2]	913	1,740	1,108	63.68
1923	14,250	20,602	13,359	64.89
Arsphenamine (salvarsan) and neo-arsphenamine—				
1923	5	211	127	60.17
Benzaldehyde—				
1922	571	914	588	64.38
1923	2,780	4,059	2,630	64.80
Novocain or procaine—				
1923	5	210	126	60.17
Phenolphthalein (25 per cent)—				
1917				
1918	100	1,200	300	25.00
1919				
1920	200	726	181	25.00
1921	5,055	2,385	596	25.00
1922 [1]	64	36	9	25.00
1922 [2]	1,487	8,877	5,430	61.17
1923	2,931	10,891	6,740	61.88
Salicylic acid and its salts, medicinal—				
1923	40	81	51	63.46
Medicinals—				
1917		284,346	85,304	30.00
1918		301,074	90,322	30.00
1919		168,466	50,540	30.00
1920		165,055	49,517	30.00
1921		280,299	84,090	30.00
1922 [1]		154,620	46,386	30.00
1922 [2, 3]	7,937	24,410	15,202	62.27
1923	43,325	164,238	101,576	61.85
Flavors—				
1917	35	408	122	30.00
1918	160	816	245	30.00
1919				
1920	14	27	8	30.00
1921				
1922				
1923	31	90	56	62.41
Saccharin—				
1917	554	6,544	360	5.50
1918				
1919				
1920	40	39	26	66.67
1921	46	103	30	29.03
1922 [1]	1	15	1	4.33
1922 [2]	1	14	8	60.50
Explosives: Picric acid—				
1923	1,980	3,929	2,496	63.53
Ink powder—				
1923	261	308	203	65.93
Synthetic tanning material—				
1923	1,412	2,162	1,396	64.57

[1] Act of 1916. [2] Act of 1922. [3] Other coal-tar medicinals.

TABLE 67.—*General imports of coal-tar products, by countries, calendar years 1918–1923*

DEAD OR CREOSOTE OIL (FREE)

Imported from—	1918		1919		1920		1921	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Gallons		*Gallons*		*Gallons*		*Gallons*	
England			8,934,045	$1,085,617	12,514,150	$2,568,235	19,465,981	$3,114,867
Scotland	1,125	$862	60,756	10,462	147,377	21,096	819	189
Canada	1,543,660	161,693	2,273,578	278,138	1,619,903	227,624	374,845	64,713
All other countries	462	314			[1] 4,145,722	979,444	13,397,787	1,576,849
Total	1,545,247	162,869	11,268,379	1,374,217	18,427,152	3,796,399	33,239,432	4,756,618

Imported from—	1922		1923	
	Quantity	Value	Quantity	Value
	Gallons		*Gallons*	
United Kingdom	22,383,535	$2,235,686		
Netherlands	14,471,820	1,528,941		
Germany	2,406,364	193,804		
Belgium	1,537,376	184,485		
Canada	768,442	97,533		
All other countries				
Total	41,567,537	4,240,449	64,199,636	$10,071,393

BENZOL OR BENZENE

Imported from—	1918		1919		1920		1921	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Pounds		*Pounds*		*Pounds*		*Pounds*	
Canada	1,315,696	$33,303	217,865	$5,617	486,619	$10,868	1,562,951	$39,020
All other countries							159,134	3,350
Total	1,315,696	33,303	217,865	5,617	486,619	10,868	1,722,085	42,370

Imported from—	1922		1923	
	Quantity	Value	Quantity	Value
	Pounds		*Pounds*	
Canada	172,108	$1,167		
Germany	420	56		
All other countries				
Total	172,528	1,223	701,901	$21,937

[1] All from the Netherlands, except 6 gallons from Japan.

TABLE 67.—*General imports of coal-tar products, by countries, calendar years 1918–1923*—Continued

CRESOL [1]

Imported from—	1918		1919		1920		1921	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Pounds		*Pounds*		*Pounds*		*Pounds*	
England	3,051,833	$256,917	4,935,748	$408,407	6,037,223	$509,710	1,708,992	$139,737
Scotland	1,676,354	196,116	1,516,610	149,373	4,198,397	382,637	934,842	86,380
Canada			800	1,028	16,400	1,360	4,600	501
Germany					66,050	7,674	705,448	27,268
Total	4,728,187	453,033	6,453,158	558,808	10,318,070	901,381	3,353,882	253,886

[1] No imports in 1922 and 1923.

NAPHTHALENE

Imported from—	1918		1919		1920		1921	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Pounds		*Pounds*		*Pounds*		*Pounds*	
United Kingdom	424,147	$13,253	1,342,091	$47,076	10,155,579	$357,954	2,644,997	$83,353
Belgium					413,274	16,972	96,928	5,412
Canada	1,328,496	44,540	1,836,478	43,795	2,959,976	78,704	1,708,868	44,541
Germany					381,740	34,135	42,683	2,383
Japan			612	42	98,695	7,653	2,320	252
Italy					494,644	17,077		
Australia			60,075	1,352	168,923	3,528		
All other countries					339,340	14,198		
Total	1,752,643	57,793	3,239,256	92,265	15,012,171	530,221	4,495,796	135,941

Imported from—	1922		1923	
	Quantity	Value	Quantity	Value
	Pounds		*Pounds*	
United Kingdom	2,488,716	$38,619		
Canada	532,935	12,823		
Netherlands	110,365	2,047		
Germany	11,316	446		
Japan	1,000	94		
Total	3,144,332	54,029	21,036,458	$578,563

TAR AND PITCH OF COAL

Imported from—	1918		1919		1920		1921	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Barrels		*Barrels*		*Barrels*		*Barrels*	
England	51	$686	600	$2,725	1,127	$4,166	7	$82
Scotland			100	256	580	3,706		
Canada	26,499	49,069	25,003	44,093	18,824	41,940	21,948	47,913
All other countries					150	350	13	53
Total	26,550	49,755	25,703	47,074	20,681	50,162	21,968	48,048

TABLE 67.—*General imports of coal-tar products, by countries, calendar years 1918–1923*—Continued

TAR AND PITCH OF COAL—Continued

Imported from—	1922		1923	
	Quantity	Value	Quantity	Value
	Barrels		*Barrels*	
England	162	$1,241		
Scotland	100	956		
Canada	24,563	56,229		
All other countries	28	91		
Total	24,853	58,517	14,775	$46,825

TOLUOL OR TOLUENE

Imported from—	1918		1919		1920		1921	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Pounds		*Pounds*		*Pounds*		*Pounds*	
Canada			1,195,706	$30,768				
Total			1,195,706	30,768				

Imported from—	1922		1923	
	Quantity	Value	Quantity	Value
	Pounds		*Pounds*	
Canada	143,900	$6,044		
Sweden	337	17		
Total	144,237	6,061	194,660	$7,928

ALL OTHER CRUDES: VALUE

Imported from—	1918	1819	1820	1821	1922	1923
France	$823	$54	$10,903	$1,507	$308,895	
England	57,364	42,875	178,866	19,015	54,943	
Scotland	825	870	1,581		1,570	
Canada	104,765	1,891	876	840	8,199	
Germany			9,179	352	6,373	
Netherlands					142	
All other countries			2,886	4		
Total	163,777	45,690	204,381	21,718	380,122	$807,641

CARBOLIC ACID

Imported from—	1918				1919			
	Carbolic acid, free		Carbolic acid, dutiable (phenol)		Carbolic acid, free		Carbolic acid, dutiable (phenol)	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Pounds		*Pounds*		*Pounds*		*Pounds*	
England	155,236	$17,260	208,037	$54,884	1,619,823	$158,820	2,061	$264
Canada			75,300	7,613				
Scotland					345,466	28,968		
Total	155,236	17,260	283,337	62,497	1,965,289	187,788	2,061	264

TABLE 67.—*General imports of coal-tar products, by countries, calendar years 1918–1923*—Continued

CARBOLIC ACID—Continued

Imported from—	1920				1921			
	Carbolic acid, free		Carbolic acid, dutiable (phenol)		Carbolic acid, free		Carbolic acid, dutiable (phenol)	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Pounds		*Pounds*		*Pounds*		*Pounds*	
England	178,652	$18,258	1,040	$244	205,113	$21,841	250	$142
Scotland	14,040	1,590						
Canada					9,072	1,008		
Total	192,692	19,848	1,040	244	214,185	22,849	250	142

Imported from—	1922 [1]		1923 [1]	
	Quantity	Value	Quantity	Value
	Pounds		*Pounds*	
England	610,789	$87,325		
Netherlands	62,715	12,258		
Germany	11,098	898		
All other countries	1,702	1,801		
Total	686,304	102,282	61,561	$14,762

[1] Dutiable

ALL OTHER ACIDS

Imported from—	1918		1919		1920		1921		1922		1923	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Lbs.		*Lbs.*		*Lbs.*		*Lbs.*		*Lbs.*		*Lbs.*	
England	125	$1,114	63	$374	250	$1,087			60,471	5,228		
Japan	5	2							5	3		
France					11,199	8,182						
Germany					309	500	11,263	$3,012	4,445	2,394		
All other countries									8,938	9,936		
Total	130	1,116	63	374	11,758	9,769	11,263	3,012	73,859	17,561	18,944	$79,517

ANILINE OIL

Imported from—	1918		1919		1920		1921		1922		1923	
					Lbs.							
France					220	$72						

ANILINE SALTS

Imported from—	1918		1919		1920		1921		1922		1923	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Lbs.		*Lbs.*		*Lbs.*		*Lbs.*		*Lbs.*		*Lbs.*	
England	21,273	$3,250					18,301	$12,029				
Germany					4	$1	15	80				
Total	21,273	3,250			4	1	18,316	12,109				

TABLE 67.—*General imports of coal-tar products, by countries, calendar years 1918–1923*—Continued

ALL OTHER INTERMEDIATES

Imported from—	1918	1919	1920	1921
Belgium			$41,291	$18,774
France		$26,611	140,095	62,028
Germany			191,732	80,306
Italy			17,491	740
England	$15	48,722	302,235	98,502
Straits Settlements			41,237	
Japan	4,348	82	68,323	15
Canada		20,788		40,587
All other countries			29,264	40,650
Total	4,363	96,203	831,668	341,602

Imported from—	1922		1923	
Belgium				
France	45,666	31,180		
Germany	514,437	83,397		
Netherlands	83,998	18,898		
England	669,475	124,632		
Switzerland	62,261	43,856		
Japan	400	39		
Canada	329	308		
All other countries				
Total	1,376,566	302,310	2,598,281	513,692

ALIZARIN AND DERIVATIVES

Imported from—	1918		1919		1920		1921	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Pounds		*Pounds*		*Pounds*		*Pounds*	
Germany					141,213	$197,562	285,007	$393,374
Switzerland	440	$572	220	$2,517	222,417	81,393	110	374
United Kingdom	4,310	3,739	23,417	21,084	25,196	18,898	44,026	54,869
Canada	1	2	215	414	297	1,806	2	5
Japan	15,141	58,948						
Belgium					46,283	32,857	13,280	9,964
Netherlands					5,906	10,314	12,483	21,582
All other countries	500	7,629	23	265	444	689	20,204	29,870
Total	20,392	70,890	23,875	24,280	441,756	343,519	375,112	510,038

Imported from—	1922		1923	
	Quantity	Value	Quantity	Value
	Pounds		*Pounds*	
Belgium	1,232	$2,359		
Denmark	1,560	2,240		
France	7,379	10,137		
Germany	323,239	498,548		
Italy	46,340	57,686		
Netherlands	47,791	61,043		
Switzerland	28,672	41,670		
United Kingdom	22,758	28,002		
Canada	887	249		
All other countries				
Total	479,858	701,934	290,130	$403,612

TABLE 67.—*General imports of coal-tar products, by countries, calendar years 1918–1923*—Continued

ANTHRACENE AND CARBAZOLE COLORS AND DYES

Imported from—	1922 [1]		1923	
	Pounds	Value	Pounds	Value
Germany	11,900	$23,128		
England	5,797	2,874		
Total	17,697	26,002	8,319	$8,976

COLOR LAKES

France	16	23		
Germany	223	239		
Total	239	262	4,263	$3,635

[1] Beginning Sept. 22, 1922.

INDIGO

Imported from—	1918				1919			
	Indigo, natural (dutiable)		Indigo, synthetic (dutiable)		Indigo, natural (dutiable)		Indigo, synthetic (dutiable)	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Pounds		*Pounds*		*Pounds*		*Pounds*	
Switzerland	25,762	$38,719	770,212	$410,421	15,796	$29,857	726,440	$388,067
England	264,975	463,510	6,817	5,587	10,584	16,647	1,468	1,970
British India	1,138,176	1,284,434			99,597	99,901		
Salvador	234,452	299,554			60,940	67,262	8,400	5,729
All other countries	83,709	108,150			40,557	46,448	87,570	36,607
Total	1,747,074	2,194,367	777,029	416,008	227,474	260,115	823,878	432,373

Imported from—	1920				1921				1922			
	Indigo, natural (dutiable)		Indigo, synthetic (dutiable)		Indigo, natural (dutiable)		Indigo, synthetic (dutiable)		Indigo, natural (dutiable)		Indigo, synthetic (dutiable)	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Lbs.		*Lbs.*		*Lbs.*		*Lbs.*		*Lbs.*		*Lbs.*	
Switzerland	57,411	$150,957	285,153	$252,708	27,366	$55,142	59,873	$101,073	6,501	$9,482	63,355	$84,553
England	27,269	51,556	1,229	361	9,245	9,857	6,895	5,045	4,413	2,904	2,000	818
Salvador	10,214	20,296			13,158	11,112						
France	50,066	70,008	400,589	172,692			331,320	87,407			5,324	13,920
Germany	4,346	5,171	25,029	18,220	882	2,382	2,829	2,288	1,536	1,462	610	1,756
India	2,850	7,392										
Italy			54,422	37,311			532	128			929	401
All other countries	48	48			1,838	7,202	6,813	4,962				
Total	152,204	305,428	766,422	481,292	52,489	85,695	408,262	200,903	12,450	13,848	72,218	101,448

Imported from—	1923			
	Indigo, natural (dutiable)		Indigo, synthetic (dutiable)	
	Quantity	Value	Quantity	Value
	Pounds		*Pounds*	
Total	10,473	$5,216	631	$458

TABLE 67.—*General imports of coal-tar products, by countries, calendar years 1918–1923*—Continued

INDIGO, DYES, COLORS, STAINS, ETC. (DUTIABLE) [1]

Imported from—	1922		1923	
	Quantity	Value	Quantity	Value
	Pounds		*Pounds*	
Germany	100	$752		
Italy	772	730		
All other countries				
Total	872	1,482	13,809	$18,174

[1] Sept. 22 to Dec. 31.

COAL-TAR COLORS OR DYES (DUTIABLE)

Imported from—	1918, value	1919		1920		1921	
		Quantity	Value	Quantity	Value	Quantity	Value
		Pounds		*Pounds*		*Pounds*	
Belgium		36,968	$63,119	190,414	$153,020	31,813	$56,481
France	$76,506	11,746	20,853	70,821	100,884	62,468	90,328
Germany		143,031	83,563	1,155,501	1,565,300	1,050,028	1,718,776
Switzerland	1,762,688	1,284,199	2,176,463	1,372,490	2,693,653	1,504,970	2,005,265
England	561,699	609,703	664,548	345,889	394,668	287,377	358,463
All other countries	68,546	165,750	160,730	351,758	351,277	169,699	216,035
Total	2,469,439	2,215,397	3,169,276	3,486,873	5,258,802	3,106,355	4,445,348

Imported from—	1922 [1]		1922 [2 3]	
	Quantity	Value	Quantity	Value
	Pounds		*Pounds*	
Belgium	1,941	$849		
France	36,163	16,038	15,111	$17,523
Germany	1,138,951	1,662,608	266,255	344,569
Italy	49,657	51,584	48,248	64,608
Netherlands	48,266	75,911	73,244	149,538
Switzerland	1,109,301	1,809,778	295,470	390,457
England	165,683	139,577	31,374	27,812
All other countries	3,614	6,496	8,657	12,417
Total	2,553,576	3,762,841	738,359	1,006,924

	1923	
	Quantity	Value
	Pounds	
Germany	1,580,403	$1,945,814
Switzerland	857,466	1,331,075
United Kingdom	108,410	111,969
All other countries	706,103	1,035,453
Total	3,252,382	4,424,311

ALL OTHER COAL-TAR PRODUCTS

Imported from—	1918 [4]	1919	1920	1921	1922	1923
France	$11,900					
Netherlands	50					
Switzerland	3,045					
England	47,548					
Mexico	32					
Total	62,575					

[1] Jan. 1 to Sept. 21.
[2] Title changed to: Colors, dyes, stains, color acids and color bases, n. e. s.
[3] Sept. 22 to Dec. 31.
[4] July 1 to Dec 31.

TABLE 67.—*General imports of coal-tar products, by countries, calendar years 1918–1923*—Continued

MEDICINAL PREPARATIONS (VALUE)

Imported from—	1918	1919	1920	1921	1922 [1]	1923
France	$32,129	$58,749	$21,724	$45,378	$20,089	
Germany			59,133	124,862	74,983	
Italy		1,329	8	60	16,953	
Netherlands		12,257	21,203	11,680	25,462	
Spain		94	523	268	11	
Switzerland	154	1,761	18,571	39,151	35,473	
England	7,499	20,302	40,339	59,681	31,701	
Scotland		137	87			
Canada	53,324	77,162		1	16	
Peru	114					
Venezuela		69	7			
Japan	6,142	351	162	299	35	
All other countries	10		3,816	227	3,947	
Total	99,372	172,211	165,573	281,607	208,670	$212,255

[1] Sept. 22, to Dec. 31. Jan. 1 to Sept. 21, included in medicinal preparations (n. e. s.), a total value of $372,674.

EXPLOSIVES

	Quantity	Value
	Pounds	
Italy	5,470	$6,843
Total	5,470	6,843

ALL OTHER FINISHED PRODUCTS

Imported from—	1918	1919	1920	1921
France	$4,162	$25,955	$37,192	$39,314
Germany			21,406	6,518
Switzerland	2,901	1,447	6,715	15,011
England	54,502	57,166	10,307	2,657
Canada	816			
All other countries			29	302
Total	62,381	84,568	75,649	63,802

Imported from—	1922		1923	
	Quantity	Value	Quantity	Value
			Pounds	
France		$430		
Germany		16,658		
Switzerland		715		
England		2,157		
Canada		1		
All other countries				
Total		19,961	14,885	$51,303

TABLE 68.—*Domestic exports of coal tar and of dyes and dyestuffs, calendar years 1918–1923.*

COAL TAR

Exported to—	1918		1919		1920		1921	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Barrels		*Barrels*		*Barrels*		*Barrels*	
Europe	2,069	$12,297	230	$900	243	$1,441	212	$1,394
North America	54,149	139,456	71,749	158,205	74,374	208,561	91,716	185,063
South America	808	6,288	2,759	20,166	3,725	23,656	457	3,125
Asia	198	1,505	475	3,174	10	65	17	1,857
Oceania	154	1,739	45	301	81	995		
Africa	1,176	7,435	1,334	15,757	17	49	4	43
Total	58,554	168,720	76,592	198,503	88,350	234,767	92,406	191,482

TABLE 68.—*Domestic exports of coal tar and of dyes and dyestuffs, calendar years 1918–1923*—Continued

COAL TAR—Continued

Exported to—	1922		1923	
	Quantity	Value	Quantity	Value
	Barrels		*Barrels*	
Europe	46	$392		
North America	101,396	209,631		
South America	580	3,142		
Asia	63	545		
Oceania	57	245		
Africa	8	100		
Total	102,150	214,055	513,834	$1,694,494

COAL-TAR DISTILLATES, n. e. s.

Benzol

	1918		1919		1920		1921	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	Pounds		*Pounds*		*Pounds*		*Pounds*	
France	32,599,682	$1,854,216	12,319,900	$407,622	2,528,494	$138,850	24,344,624	$1,095,063
Chile					229,079	16,760		
England			113,300	10,197	57,500	4,970	46,073,896	1,797,780
Germany					669,494	36,902		
Canada	136,571	7,389	335,799	21,313	389,783	23,904	44,725	287
Belgium					3,150,240	238,617		
Argentina	75,442	7,329	973,978	60,563	353,522	23,907	549,896	37,571
Japan	136,480	8,680	280,442	18,590	67,200	6,720	900	81
Italy	299,659	22,704			4,961,878	357,956	348,880	22,030
All other countries	46,743	4,042	215,000	16,847	767,078	79,354	667,479	54,355
Total	33,294,577	1,904,360	14,238,419	535,132	13,174,268	927,940	72,030,400	3,007,086

	1922		1923	
	Quantity	Value	Quantity	Value
	Pounds		*Pounds*	
France	20,158,912	$738,078		
Spain	44,697	8,045		
England	39,649,410	1,390,924		
Ireland	448,728	27,400		
Canada	2,045,994	69,984		
Mexico	13,405	1,048		
Argentina	445,136	27,464		
Chile	156,251	9,521		
Java and Maderia	48,216	2,550		
Australia	86,350	7,067		
British South Africa	17,312	1,500		
Algeria and Tunis	1,529,483	68,935		
All other countries	96,508	10,305		
Total	64,740,402	2,362,821	111,336,768	$3,647,660

ALL OTHER COAL-TAR DISTILLATES (VALUE)

Exported to—	1918	1919	1920	1921
France	$2,188,439	$33,387	$445,520	$10,347
Belgium			474,793	
Italy	345,407	14,674	290,449	
England	927,295	127,583	1,632,599	28,498
Canada	1,477,984	105,335	314,641	156,917
Spain	96,798	64,917	615,284	26,334
Mexico	78,160	61,441	136,063	14,090
Brazil	72,162	101,305	193,089	32,550
Japan	475,377	250,061	1,158,196	79,746
Switzerland	46,831	8,144	1,632,599	44,833
All other countries	159,377	336,903	69,016	116,193
Total	5,867,830	1,103,750	6,962,249	509,508

TABLE 68.—*Domestic exports of coal tar and of dyes and dyestuffs, calendar years 1918–1923*—Continued

ALL OTHER COAL-TAR DISTILLATES (VALUE)—Continued

Exported to—	1922 [1]	1923 [1]
France	$995	
Belgium	12,849	
Canada	51,718	
Norway	1,444	
Honduras	15,454	
Mexico	13,691	
Brazil	29,738	
Cuba	2,561	
Japan	3,644	
All other countries	22,889	
Total	154,983	$300,257

[1] Includes toluol and solvent naphtha.

CARBOLIC ACID

Exported to—	1922		1923	
	Quantity	Value	Quantity	Value
	Pounds		*Pounds*	
Canada	15,306	$1,143		
Mexico	50,096	4,040		
Cuba	7,009	694		
Japan	91,073	9,100		
Kwangtung (leased territory)	44,211	4,563		
All other countries	15,451	3,683		
Total	223,146	23,223	232,830	$34,389

ANILINE OILS AND SALTS

Spain	10,000	$1,450		
Canada	211,010	40,919		
Mexico	26,895	3,575		
British India	29,302	7,000		
Japan	30,600	6,120		
Philippines	17,597	2,993		
Australia	9,012	1,610		
All other countries	6,804	1,945		
Total	341,220	65,602	497,457	$95,023

NAPHTHALENE

Switzerland	6,000	$1,600		
Canada	17,542	297		
Mexico	11,558	1,044		
Cuba	21,127	1,204		
British India	11,853	770		
Japan	14,610	4,329		
Philippines	8,388	739		
All other countries	18,426	2,674		
Total	109,514	12,657	95,164	$10,386

NITROBENZOL [1]

Norway	26,880	$2,957		
Canada	5,682	683		
Cuba	3,203	399		
Dominican Republic	3,040	608		
Australia	2,147	312		
All other countries	2,028	337		
Total	42,980	5,296		

[1] Included in other intermediates for 1923.

TABLE 68.—*Domestic exports of coal tar and of dyes and dyestuffs, calendar years 1918–1923*—Continued

OTHER INTERMEDIATES

Exported to—	1922		1923	
	Quantity	Value	Quantity	Value
	Pounds		*Ponnds*	
Greece	28,463	$7,280		
Spain	65,438	13,834		
Switzerland	5,054	1,500		
Canada	172,186	33,695		
Mexico	77,642	3,481		
Cuba	10,199	1,636		
Brazil	42,618	8,275		
Chile	12,192	1,823		
China	314,774	65,047		
Japan	54,888	12,910		
Australia	20,050	11,844		
All other countries	31,630	6,277		
Total	$35,134	167,602	1,218,183	$243,060

COLOR LAKES[1]

Canada	16,900	$14,627		
Cuba	7,616	1,028		
Peru	100	30		
China	1,000	800		
Hongkong	135	86		
Japan	2,440	3,298		
All other countries				
Total	28,228	19,928		

[1] Figures for 1923 included in other colors, dyes, and stains.

DYES AND DYESTUFFS (VALUE)

Exported to—	1918			1919		
	Aniline dyes	Logwood extracts	All other	Aniline dyes	Logwood extracts	All other
Portugal	$176,769	$10,541	$131,280	$70,296	$2,319	$36,063
Belgium				90	34,787	19,193
France	6,345	263,610	496,875	127,059	596,042	229,689
Germany				150	290	
Italy	274,903	70,237	234,238	269,130	58,716	180,359
Netherlands				26,284	21,735	9,104
Russia			12,825	8,570		
Switzerland	22,500	7,728	5,000	193	22,824	
United Kingdom	380,181	345,458	524,576	413,700	304,686	423,719
Canada	836,445	82,292	724,522	1,015,334	119,871	1,007,892
Mexico	289,327	5,666	181,029	467,806	17,438	230,359
Central America	5,617	400	5,498	5,941	892	14,544
West Indies	23,447	742	35,473	34,307	137	40,900
South America	1,719,408	128,645	931,600	1,651,872	66,099	585,127
Asia	4,248,367	504,542	2,720,399	5,565,053	48,063	1,921,202
Oceania	100,490	20,194	133,493	177,964	14,041	143,223
Africa	3,993	715	15,534	45,566	1,508	8,281
Denmark			1,055	5,334	9,671	2,438
Spain	518,895	104,748	472,222	535,383	18,349	84,544
Sweden				22,694	8,584	15,708
Norway		985	4,529	13,663	1,300	7,303
All other countries	22,924	4,877	6,761	267,682	8,584	44,780
Total	8,629,611	1,551,380	6,636,099	10,724,071	1,355,936	5,004,428

TABLE 68.—*Domestic exports of coal tar and of dyes and dyestuffs, calendar years 1918–1923*—Continued

DYES AND DYESTUFFS (VALUE)—Continued

Exported to—	1920			1921		
	Aniline dyes	Logwood extracts	All other	Aniline dyes	Logwood extracts	All other
Portugal	$66,752	$5,970	$20,688	$1,432		
Belgium	507,371	118,339	41,523	100,821	$6,843	$45
France	807,241	607,017	391,060	67,535	66,762	8,334
Germany	454	1,456	7,745	653	13,885	6,352
Italy	582,236	404,367	275,149	45,068	8,723	70
Netherlands	39,682	73,472	56,057	1,938	2,535	6,590
Russia (European)	100					
Switzerland	132,359	60,157	92,017	20,374		19
United Kingdom	1,318,498	729,026	1,079,871	165,711	21,096	58,630
Canada	1,547,109	183,061	982,665	584,664	71,331	423,914
Mexico	1,091,603	11,092	210,145	149,009	3,560	132,075
Central America	13,159	1,852	13,730	7,982	975	5,680
West Indies	52,745	18,144	97,922	1,585	91	2,057
South America	2,282,210	45,586	497,029	432,881	16,466	89,156
Asia	12,783,303	195,493	3,208,107	3,131,071	347,610	333,709
Oceania	277,660	41,283	134,196	207,473	13,190	51,743
Africa	65,077	1,248	28,251	61,699	486	13,179
Denmark	26,463	2,903	2,794	1,305		3,849
Spain	682,998	77,183	149,365	36,844	535	12,040
Sweden	67,921	1,250	29,802	2,786		8,976
Norway	4,568	1,110	15,998	1,800		1,304
All other countries	100,971	25,051	38,997	44,369	15,868	45,433
Total	22,450,480	2,605,060	7,373,111	5,067,000	589,756	1,203,155

OTHER COLORS, DYES, AND STAINS

Exported to—	1922		1923[1]	
	Quantity	Value	Quantity	Value
	Pounds		*Pounds*	
Belgium	107,712	$76,342		
France	12,100	11,975		
Greece	16,830	8,434		
Italy	25,702	51,469		
Netherlands	16,915	2,792		
Portugal	24,973	10,787		
Spain	87,566	42,426		
United Kingdom	16,139	5,342		
Canada	1,861,255	1,108,518		
Mexico	159,857	87,920		
Cuba	39,344	27,335		
South America	425,551	323,922		
British India	753,425	311,504		
China	3,588,563	924,026		
Japan	959,409	844,458		
Philippine Islands	33,584	8,618		
Australia	58,665	31,265		
New Zealand	36,680	21,439		
British South Africa	28,542	31,976		
All other countries	71,397	50,669		
Total	8,324,209	3,981,217	17,924,536	[1] $5,565,371

MEDICINALS

Belgium	3,040	$450		
Greece	3,300	850		
Turkey in Europe	297,223	80,954		
England	80,540	31,709		
Canada	55,874	13,001		
Honduras	5,916	3,091		
Mexico	37,829	30,476		
Cuba	11,375	16,122		
Venezuela	3,148	1,796		
British India	3,330	3,107		
Australia	27,575	21,135		
British South Africa	4,848	3,863		
All other countries	20,168	17,992		
Total	554,166	224,546	237,975	$164,160

[1] Includes color lakes.

TABLE 68.—*Domestic exports of coal tar and of dyes and dyestuffs, calendar years 1918–1923*—Continued

SYNTHETIC PHENOLIC RESINS[2]

	1922		1923	
	Quantity	Value	Quantity	Value
	Pounds		*Pounds*	
England	500	$69		
Canada	121,183	7,786		
Mexico	250	43		
China	1,600	1,762		
Japan	4,620	3,523		
Total exports	128,153	13,183		

[2] Included in total "Other coal-tar finished products, n. e. s," for 1923.

PHOTOGRAPHIC CHEMICALS

England	11,274	$4,896		
Canada	65,411	15,971		
Mexico	15,019	7,228		
Cuba	16,738	6,306		
Argentina	24,526	9,124		
Japan	39,815	26,809		
Philippines	11,709	5,509		
Australia	10,806	9,018		
New Zealand	13,094	4,302		
All other countries	39,727	14,690		
Total	248,119	103,853	214,160	$96,317

OTHER COAL-TAR FINISHED PRODUCTS, N. E. S.

Denmark	37,226	$1,540		
France	80,800	2,560		
Norway	48,767	1,275		
England	264,009	33,285		
Canada	2,797,967	63,908		
Costa Rica	28,262	2,655		
Panama	67,434	2,079		
Mexico	470,344	26,902		
British West Indies	95,545	5,401		
Cuba	984,063	43,497		
Argentina	107,043	8,831		
Brazil	39,692	2,598		
Chile	78,574	4,664		
Colombia	80,661	13,442		
Peru	80,470	13,415		
Japan	67,948	17,550		
Australia	21,533	4,533		
All other countries	194,752	24,707		
Total	5,545,090	272,842	4,527,146	$480,749

TABLE 69.—*Imports and exports of inks, 1918–1923*

IMPORTS FOR CONSUMPTION

Calendar year	Ink and ink powders[1]		Printers' ink[2]			Writing and copying inks			All other, including ink powders		
	Quantity	Value	Rate of duty	Value	Duty collected	Rate of duty	Value	Duty collected	Rate of duty	Value	Duty collected
	Pounds		*Per cent*			*Per cent*			*Per cent*		
1918			15	$4,154	$623	15	$13,363	$2,004	15	$6,343	$951
1919			15	199	30	15	15,116	2,267	15	8,143	1,221
1920			15	15,228	2,284	15	15,505	2,326	15	10,657	1,599
1921			15	5,554	833	15	4,625	694	15	10,813	1,622
1922[3]			15	9,259	1,389	15	6,279	942	15	7,907	1,186
1922[4]	33,783	13,132	20	7,070	1,414	20	3,125	625	20	2,877	575
1923	101,993	23,730	20	5,613	1,123	20	4,979	996	20	13,265	2,653

DOMESTIC EXPORTS

Exported to—	Calendar year									
	1918		1919		1920		1921		1922	
	Printers' ink	All other inks	Printers' ink	All other inks	Printers' ink	All other inks	Printers' ink	All other inks	Printers' ink	All other inks
Europe	$48,394	$25,371	$210,482	$68,382	$224,129	$96,699	$101,914	$71,818		
North America	256,507	206,360	320,008	297,959	366,784	328,889	321,389	200,361		
South America	353,023	100,833	603,758	210,212	535,265	208,272	140,612	49,336		
Asia	224,345	67,736	435,664	155,420	579,843	187,988	291,719	75,867		
Oceania	116,424	42,452	113,288	109,962	171,640	105,984	108,453	45,017		
Africa	42,189	5,429	29,726	14,282	15,091	8,887	6,743	6,700		
Total	1,040,882	448,181	1,712,926	856,217	1,892,752	936,719	970,830	449,099	$993,352	$328,978

Exported to—	Calendar year					
	1922			1923		
	Writing ink	Printers' and lithographic ink	Other ink	Writing ink	Printers' and lithographic ink	Other ink
Europe	$30,722	$103,790	$17,447			
North America	76,003	288,293	69,595			
South America	25,023	193,371	7,556			
Asia	62,790	255,151	20,191			
Oceania	7,992	140,653	8,474			
Africa	1,417	12,094	1,768			
Total	203,947	993,352	125,031	$257,909	$1,273,813	$200,744

[1] General import figures.
[2] Beginning Sept. 22, 1922, heading changed to "Printers' and lithographic ink."
[3] Jan. 1 to Sept. 21.
[4] Sept. 22 to Dec. 31.

Directory of manufacturers of dyes and other synthetic organic chemicals, 1923

No.	Name of company	Office address (location of plant given in parentheses if not in same city as office)
1	Abbott Laboratories	4753 Ravenswood Avenue, Chicago, Ill.
2	Acids Manufacturing Corporation	50 East Forty-Second Street, New York, N. Y. (Packer, Conn.)
3	Agawam Chemical Works (Inc.)	10 Weybosset Street, Providence, R. I. (North Attleboro, Mass.)
4	Althouse Chemical Co	500-540 Pear Street, Reading, Pa.
5	Alyco Manufacturing Co. (Inc.)	86-90 Orange Street, Bloomfield, N. J.
6	Amalgamated Dyestuff & Chemical Works (Inc.).	Plum Point Lane, Newark, N. J.
7	American Aniline Products (Inc.)	80 Fifth Avenue, New York, N. Y. (Lock Haven, Pa.)
8	American Tar Products Co. (Inc.)	208 South La Salle Street, Chicago, Ill. (Youngstown, Ohio; St. Louis, Mo.; Woodward, Ala.; Carrollville, Wis.; Follansbee, W. Va.; Chicago, Ill.)
9	Amido Products Co	126 Maiden Lane, New York, N. Y. (228 Emmet Street, Newark, N. J.)
10	Anderson Chemical Co	P. O. Box 307, Passaic, N. J. (266 Main Avenue, Wallington, N. J.)
11	Ansbacher & Co., A. B	527 Fifth Avenue, New York, N. Y. (Brooklyn, N. Y.)
12	Atlantic Dyestuff Co	Box 89, Portsmouth, N. H. (Newington, N. H.)
13	Atlantic Tar & Chemical Works (Ltd.)	P. O. Box 234, Bayway, Elizabeth, N. J.
14	Atlas Color Works	322 Ninth Street, Brooklyn, N. Y.
15	Baird & McGuire (Inc.)	Holbrook, Mass.
16	Barrett Co	40 Rector Street, New York, N. Y. (Plants distributed throughout United States.)
17	Bayer Co. (Inc.)	117 Hudson Street, New York, N. Y. (Rensselaer, N. Y.)
18	Beaver Chemical Corporation	Damascus, Va.
19	Beaver Manufacturing Co	Ballardvale, Mass.
20	Berghausen Chemical Co., E	915 Carr Street, Cincinnati, Ohio.
21	Berkheimer Manufacturing Co., J. E	2928 South M Street, Tacoma, Wash.
22	Brooklyn Color Works (Inc.)	Stewart Avenue and Cherry Street, Brooklyn, N. Y.
23	Brown Co	404 Commercial Street, Portland, Me. (Berlin, N. H.)
24	Bush Co. (Inc.), W. J	370 Seventh Avenue, New York, N. Y. (Linden, N. J.)
25	Butterworth-Judson Corporation	30 Church Street, New York, N. Y. (Newark, N. J.)
26	Cable Chemical Works	1700 Elston Avenue, Chicago, Ill. (Cable, Wis.)
27	Calco Chemical Co	Boundbrook, N. J.
28	California Ink Co	Station A, West Berkeley, Calif.
29	Carbide & Carbon Chemicals Corporation	30 East Forty-second Street, New York, N. Y. (Clendenin, W. Va.)
30	Carey Manufacturing Co., Philip	Lockland, Ohio.
31	Celluloid Co	36 Washington Place, New York, N. Y. (290 Ferry Street, Newark, N. J.)
32	Central Dyestuff & Chemical Co	Plum Point Lane, Newark, N. J.
33	Central Specialty Co	524 Delaware Street, Kansas City, Mo.
34	Certain-teed Products Corporation	100 East Forty-second Street, New York, N. Y. (East St. Louis, Ill.)
35	Chatfield Manufacturing Co., The	Seventy-fourth and Lebanon Streets, Cincinnati, Ohio.
36	Chemical Company of America (Inc.), The	46 Murray Street, New York, N. Y. (Springfield, N. J.).
37	Childs & Co. (Inc.), Charles M	43 Summit Street, Brooklyn, N. Y.
38	Chiris & Co., Antoine	147-153 Waverly Place, New York, N. Y. (Delawanna, N. J.)
39	Cincinnati Chemical Works (Inc.)	Evanston Station, Box 20, Cincinnati, Ohio. (Norwood and St. Bernard, Ohio.)
40	Citizens Gas Co	Majestic Building, Indianapolis, Ind.
41	Coleman & Bell Co., The	Norwood, Ohio.

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No.	Name of company	Office address (location of plant given in parentheses if not in same city as office)
42	Combustion Utilities Corporation	8-10 Bridge Street, New York, N. Y. (Toledo, Ohio.)
43	Commercial Solvents Corporation	17 East Forty-second Street, New York, N. Y. (Terre Haute, Ind.; Peoria, Ill.)
44	Commonwealth Chemical Corporation	25 West Forty-third Street, New York, N. Y (Newark, N. Y.)
45	Commonwealth Color & Chemical Co	Nevins, Butler, and Baltic Streets, Brooklyn, N. Y.
46	Consolidated Color & Chemical Co	122 Hudson Street, New York, N. Y. (Newark, N. J.)
47	Cooks Falls Dye Works (Inc.)	68 Williams Street, New York, N. Y. (Cooks Falls, N. Y.)
48	Cooper & Co. (Inc.), Charles	Van Buren and Clifford Streets, Newark, N. J.
49	Coopers Creek Chemical Co	West Conshohocken, Pa.
50	Corona Chemical Division (Pittsburgh Plate Glass Co.).	213-215 Lake Street, Milwaukee, Wis.
51	Crescent Color & Chemical Works	Fifty-ninth Street and Eleventh Avenue, New York, N. Y. (Dunnellen, N. J.)
52	Croton Color & Chemical Co. (Inc.)	293 Broadway, New York, N. Y. (Croton-on-Hudson, N. Y.)
53	Crown Tar Works	900 Fifteenth Street, Denver, Colo.
54	Crystal Chemical Co	3414 North Karlov Avenue, Chicago, Ill.
55	David Chemical Co., Albert	44 Watts Street, New York, N. Y. (Chicago Heights, Ill.)
56	Debrook Co. (Inc.)	1105 Metropolitan Avenue, Brooklyn, N. Y.
57	Dehls & Stein	237 South Street, Newark, N. J.
58	Delta Chemical & Iron Co	Wells, Delta County, Mich.
59	Devoe & Reynolds Co. (Inc.)	101 Fulton Street, New York, N. Y. (New York N. Y., and Chicago, Ill.)
60	Diarsenol Laboratories (Inc.)	454 Ellicott Square, Buffalo, N. Y.
61	Dovan Chemical Corporation	30 Church Street, New York, N. Y. (441 Riverside Avenue, Newark, N. J.)
62	Dow Chemical Co	Midland, Mich.
63	duPont de Nemours & Co., E. I	Wilmington, Del. (Deepwater Point and Lodi, N. J.)
64	Dye Products & Chemical Co	200 Fifth Avenue, New York, N. Y. (202 Vanderpool St., Newark, N. J.)
65	Dyes & Chemicals of New Jersey (Inc.)	702 Court Street, Brooklyn, N. Y.
66	Dyestuffs & Chemicals (Inc.)	11th and Monroe Streets, St. Louis, Mo.
67	Eakins (Inc.), J. S. & W. R	24 Wallabout Street, New York, N. Y.
68	Eastman Kodak Co	343 State Street, Rochester, N. Y.
69	Essential Oil Co	Mulberry and New York Avenues, Trenton, N. J.
70	Essex Aniline Works (Inc.)	88 Broad Street, Boston, Mass. (So. Middleton Mass.)
71	Federal Color Laboratories (Inc.)	Norwood, Ohio.
72	Finch Chemical Co., L. S	R. F. D. No. 2, Box 143, Los Angeles, Calif. (Vernon, Calif.)
73	Fine Colors Co. (Inc.)	2129 McBride Avenue, Paterson, N. J.
74	Fletcher Chemical Co	South River, N. J.
75	Florasynth Laboratories (Inc.)	Olmstead and Starling Avenues, Unionport, N. Y.
76	Foster-Heaton Co	2731 Badger Avenue, Newark, N. J.
77	Franken Color Works, A	116 West Thirty-second Street, New York, N. Y. (Chatham, N. J.)
78	Fries Bros	92 Reade Street, New York, N. Y. (Bloomfield, N. J.)
79	Fries & Fries Co	1501 West Sixth Street, Cincinnati, Ohio.
80	Garfield Aniline Works	Midland Avenue, Garfield, N. J.
81	Gary Chemical Co	749 Broadway, Gary, Ind. (Chesterton, Ind.)
82	Gaskill Chemical Corporation	157 Spencer Street, Brooklyn, N. Y.
83	Gebauer Chemical Co	619 Bangor Building, Cleveland, Ohio.
84	General Synthesis Co	53 Canal Street, Providence, R. I.
85	Goodrich Co., The B. F	Akron, Ohio.
86	Grahame Chemical Co	P. O. Box 88, Trenton, N. J.
87	Granton Chemical Co	350 Madison Avenue, New York, N. Y. (New Brunswick, N. J.)
88	Grasselli Chemical Co	Cleveland, Ohio. (Rensselaer, N. Y.; Grasselli, N. J.)
89	Harmer Laboratories Co	2 South Twenty-first Street, Philadelphia, Pa. (Lansdowne, Pa.)
90	Harmon Color Works (Inc.)	361-371 Harman Street, Brooklyn, N. Y.
91	Heller & Merz Co	338 Wilson Avenue, Newark, N. J.
92	Hermann Co., Morris	200 Fifth Avenue, New York, N. Y. (878 Mt. Prospect Ave., Newark, N. J.)
93	Heyden Co. of America (Inc.)	80 Fifth Avenue, New York, N. Y. (Garfield, N. J.)
94	Hind & Harrison Plush Co., The	Clark Mills, N. Y.
95	Hooker Electrochemical Co	25 Pine Street, New York, N. Y. (Niagara Falls, N. Y.)
96	Hord Color Products Co., The	1636 Columbus Avenue, Sandusky, Ohio.
97	Huggins & Son, James	239 Medford Street, Malden, Mass.

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98	Hydrocarbon Chemical Co	951 East Orange Street, Lancaster, Pa.
99	Hynson, Westcott & Dunning	Charles and Chase Streets, Baltimore, Md.
100	Imperial Color Works (Inc.)	Glens Falls, N. Y.
101	Independent Coal Tar Co	88 Broad Street, Boston, Mass. (Taunton, Mass.)
102	Interstate Chemical Co	667 Garfield Avenue, Jersey City, N. J.
103	Ising Corporation, The C. E	Flushing, N. Y.
104	Kent Color Corporation	2 South Ninth Street, Brooklyn, N. Y.
105	Kentucky Color & Chemical Co	Thirty-fourth Street south of Bank Street. (Louisville, Ky.)
106	Kerin Manufacturing Co., The	Central National Bank, Marietta, Ohio.
107	Klipstein & Sons Co., E. C	644 Greenwich Street, New York, N. Y. (Carteret, N. J.; South Charleston, W. Va.)
108	Kober Chemical Co	Nepera Park, N. Y.
109	Kohnstann & Co. (Inc.), H	87 Park Place, New York, N. Y. (Brooklyn, N. Y.)
110	Lakeview Laboratories	2 Jersey Street, Buffalo, N. Y.
111	LaMotte Chemical Products Co	13 West Saratoga Street, Baltimore, Md.
112	Lasher & Co. (Inc.), F. G	Maspeth and Gardner Avenues, Brooklyn, N. Y.
113	Lee Co., A	Lawrence, Mass. (Methuen, Mass.)
114	Lewis Mfg. Co., F. J	2513 South Robey Street, Chicago, Ill.
115	Lucas Paint Co., Alston	1031 Currier Street, Chicago, Ill.
116	Lucas & Co. (Inc.), John	322 Race Street, Philadelphia, Pa. (Gibbsboro, Camden County, Pa.)
117	Maas & Waldstein Co	45 John Street, New York, N. Y. (Newark, N. J.)
118	Mallinckrodt Chemical Works	3600 North Second Street, St. Louis, Mo.
119	Marx Color & Chemical Co., Max	192 Coit Street, Irvington, N. J.
120	Massachusetts Department of Public Health	Room 540, State House, Boston, Mass.
121	May Chemical Works	204 Niagara Street, Newark, N. J.
122	Maywood Chemical Works	Maywood, N. J.
123	Mepham & Co., George S	Twentieth and Lynch Avenues, E. St. Louis, Ill.
124	Merck & Co	45 Park Place, New York, N. Y. (Rahway, N. J.)
125	Merrimac Chemical Co	148 State Street, Boston, Mass. (Woburn, Mass.)
126	Metz Laboratories (Inc.), H. A	122 Hudson Street, New York, N. Y. (Brooklyn, N. Y.)
127	Miner-Edgar Co., The	110 William Street, New York, N. Y. (Newark, N. J.)
128	Monsanto Chemical Works	1724 South Second Street, St. Louis, Mo.
129	Morana (Inc.)	118 East Twenty-seventh Street, New York, N. Y. (Elizabeth, N. J.)
130	National Ammonia Co. of Pennsylvania	Delaware Avenue and Kirk Street, Philadelphia, Pa.
131	National Aniline & Chemical Co. (Inc.)	40 Rector Street, New York, N. Y. (Buffalo, N. Y.; Marcus Hook, Pa.)
132	Naugatuck Chemical Co	Naugatuck, Conn.
133	New England Aniline Works (Inc.)	95 Broad Street, Boston, Mass. (Ashland, Mass.)
134	New Haven Gas Light Co	80 Crown Street, New Haven, Conn.
135	New York Color & Chemical Co	Belleville, N. J. (Belleville, N. J.; Philadelphia, Pa.)
136	New York Quinine & Chemical Works (Inc.)	152–154 William Street, New York, N. Y. (Brooklyn, N. Y.)
137	Newport Company, The	P. O. Box, 1582, Milwaukee, Wis. (Carrollville, Wis.; Passaic, N. J.)
138	Niagara Alkali Co	Buffalo Avenue, Niagara Falls, N. Y.
139	Niagara Smelting Corporation	Bridge Station, Niagara Falls, N. Y.
140	Noil Chemical & Color Works (Inc.)	152 West One hundred and eighth Street, New York, N. Y.
141	Northwestern Chemical Co	137 Sixth Avenue, Wauwatosa, Wis.
142	Norvell Chemical Corporation	99 John Street, New York, N. Y. (Perth Amboy, N. J.)
143	Oldbury Electrochemical Co	Niagara Falls, N. Y.
144	Organo-Chemico Co	Columbus Avenue, Sandusky, Ohio.
145	Palatine Aniline & Chemical Corporation	81 North Water Street, Poughkeepsie, N. Y.
146	Passaic Color Corporation	50–60 Eighth Street, Passaic, N. J.
147	Peerless Color Co	521–535 North Avenue, Plainfield, N. J.
148	Pennsylvania Coal Products Co	Reiber Building, Butler, Pa.
149	Perth Amboy Chemical Works	709–717 Sixth Avenue, New York, N. Y. (Perth Amboy, N. J.)
150	Pfizer & Co., Charles	81 Maiden Lane, New York, N. Y.
151	Pharma Chemical Corporation	233 Broadway, New York, N. Y. (Bayonne, N. J.)
152	Portland Gas & Coke Co	Gasco Building, Portland, Oreg.
153	Powers-Weightman-Rosengarten Co	916 Parrish Street, Philadelphia, Pa.
154	Providence Chemical Laboratories	51 Empire Street, Providence, R. I.
155	Puritan Dye & Chemical Co	Northborough, Mass.
156	Quaker Oats Co	80 East Jackson Street, Chicago, Ill. (Cedar Rapids, Iowa.)
157	Radiant Dye & Color Works	2837 West Twenty-first Street, Brooklyn, N. Y.
158	Republic Creosoting Co	1614 Merchants Bank Building, Indianapolis, Ind. (Norfolk, Va.; Seattle, Wash.; St. Louis Park, Minn.; Mobile, Ala.; Indianapolis, Ind.)

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159	Rhodia Chemical Co	89 Fulton Street, New York, N. Y. (New Brunswick, N. J.)
160	Roessler & Hasslacher Chemical Co	709–717 Sixth Avenue, New York, N. Y. (Niagara Falls, N. Y.)
161	Rossville Co., The	Lawrenceburg, Ind.
162	Ruxton (Inc.), Philip	220 West Forty-second Street, New York, N. Y. (Brooklyn, N. Y.)
163	Sanborn Chemical Works	Putnam, Conn.
164	Selden Co	339 Second Avenue, Pittsburgh, Pa.
165	Sepoy Color & Chemical Co	371 Durham Avenue, Metuchen, N. J.
166	Seydel Chemical Co	86 Forrest Street, Jersey City, N. J. (Nitro, W. Va.)
167	Sherwin-Williams Co	601 Canal Road, Cleveland, Ohio. (Kensington, Ill.)
168	Siegle Corporation of America, G	Chestnut & Tompkins Avenue, Rosebank, Staten Island, N. Y.
169	Siemon & Elting (Inc.)	93 Nassau Street, New York, N. Y. (Irvington, N. J.)
170	Sinclair & Valentine Co	11 St. Clair Place, New York, N. Y.
171	Southern Dyestuffs Co	Nitro, W. Va.
172	Special Chemicals Co	Highland Park, Ill.
173	Springdale Finishing Co. (Inc.)	Pine Street, Canton, Mass.
174	Squibb & Sons, E. R	80 Beekman Street, New York, N. Y. (Brooklyn, N. Y.; New Brunswick, N. J.)
175	Stearns & Co., Frederick	6533 East Jefferson Avenue, Detroit, Mich.
176	Sterling Chemical Works (Inc.)	344 Thomas Street, Newark, N. J.
177	Sun Chemical & Color Co	309 Sussex Street, Harrison, N. J.
178	Synfleur Scientific Laboratories (Inc.)	Monticello, N. Y.
179	Synthetical Laboratories of Chicago	1326 W. Congress Street, Chicago, Ill.
180	T. M. & G. Chemical Co	Elizabeth, N. J.
181	Tar Products Corporation	1404 Turk's Head Building, Providence, R. I. (East Providence, R. I.)
182	Terpene Chemical Co	409 W. Washington Street, Sandusky, Ohio.
183	Texdel Chemical Co	120 Maiden Lane, New York, N. Y. (Jersey City and Nutley, N. J.)
184	Textile Chemical Co. (Inc.)	Public Street and Allens Avenues, Providence, R. I.
185	Thatcher Process Co. (Inc.)	523 Tracy Street, Syracuse, N. Y.
186	Todd Co., A. M	North Rose Street, Kalamazoo, Mich.
187	Trico Chemical Co	502 Iroquois Building, Buffalo, N. Y.
188	Uhlich & Co. (Inc.), Paul	11 Cliff Street, New York, N. Y. (Brooklyn, N. Y.)
189	Ullman Co., Sigmund	Park Avenue and One-hundred and Forty-sixth Street, New York, N. Y.
190	Ultro Chemical Corporation	41 Union Square, New York, N. Y. (Brooklyn, N. Y.)
191	U. S. Industrial Chemical Co	110 East Forty-second Street, New York, N. Y. (Baltimore, Md.)
192	Van Dyk & Co	4–6 Platt Street, New York, N. Y. (Jersey City, N. J.)
193	Van Schaack Bros. Chemical Works	3358 Avondale Avenue, Chicago, Ill.
194	Vernon Synthetic Chemical Corp. (Inc.)	166 Vernon Avenue, Long Island City, N. Y.
195	Verona Chemical Co	26 Verona Avenue, Newark, N. J.
196	Victor Chemical Works	343 South Dearborn Street, Chicago, Ill. (Chicago Heights, Ill.)
197	Wamesit Chemical Co	Lowell, Mass. (Wamesit, Mass.)
198	Warner-Jenkinson Co	2526 Baldwin Street, St. Louis, Mo.
199	Western Dry Color Co	Fifty-second and Wallace Streets, Chicago, Ill.
200	Westvaco Chlorine Products (Inc.)	52 Vanderbilt Avenue, New York, N. Y. (South Charleston, W. Va.)
201	White Tar Company of N. J. (Inc.), The	56 Vesey Street, New York, N. Y. (Kearney, N. J.; Cincinnati, Ohio.)
202	White Chemical Co., Wilbur	Owego, N. Y.
203	Wilhelm Co., The A	Third and Bern Streets, Reading, Pa.
204	Williamsburg Chemical Co. (Inc.)	230 Morgan Avenue, Brooklyn, N. Y.
205	Wolff-Alport Chemical Corporation	593 Irving Avenue, Brooklyn, N. Y.
206	Wyoming Dyestuff & Chemical Corp	1 Carbon Street, Scranton, Pa.
207	Yocum Laboratories (Inc.)	168 Coit Street, Irving, N. J.
208	Zinsser & Co	Hastings-on-Hudson, N. Y.