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LEAD.¹

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SUMMARY.

Statistics of refined lead, 1921 and 1922, in short tons.

PRODUCTION.

Domestic desilverized lead.....
Domestic soft lead.....
Domestic desilverized soft lead.....
Foreign desilverized lead.....
Total refined primary lead.....
Antimonial lead.....
Secondary lead.....

CONSUMPTION.^b

Apparent consumption of primary lead, stocks disregarded.....

^a "Primary lead," which is produced directly from ore, is here distinguished from "secondary lead," which is obtained by refining skimmings, drosses, and old metals. The statistics are given on p. 29. In this report the word "lead" used without qualification refers to primary lead. For method of calculating consumption see p. 34.

The output of refined lead in the United States in 1922 was 468,746 short tons, valued at \$51,562,000, as compared with 422,266 short tons, valued at \$44,414,000, in 1921. The selling price of pig lead, a gain, as compared with 1921, was 44 per cent in value.

PRODUCTION.

Quantity and value.—The refined lead produced from 1720 to 1914 from domestic ores and from foreign ores and its value at the average price in New York is given in the chapter on lead in Mineral Resources. The production in later years are shown in the annual chapters.

Refined lead produced in the United States, 1921 and 1922.

Year.	Quantity (short tons).				
	Desilverized lead. ^{a,b}	Soft lead. ^c	Total production. ^b	From domestic ores and base bullion. ^b	From foreign ores.
1917.....	422,266	188,503	610,769	548,450	15,872
1918.....	429,732	210,463	640,195	539,905	15,334
1919.....	334,476	147,744	482,220	424,433	7,656
1920.....	339,803	189,854	529,657	476,849	8,414
1921.....	291,076	157,513	448,589	398,222	7,110
1922.....	323,412	206,250	532,662	468,746	13,898

^a Desilverized soft lead is included; for quantity, see p. 28.

^b Antimonial lead is excluded; for quantity, see p. 29.

^c Desilverized soft lead is excluded.

^d Chapters on lead giving more than ordinary detail were published in 1917 (the lead industry in relation to the World War) and 1918 (the lead industry in relation to the World War).

Production by States.—In addition to the domestic lead ores smelted in this country, small quantities of domestic lead ore have been exported to smelters in Canada. In 1917 silver-lead ores from Idaho and Montana smelted in Canada produced 4,570 tons of lead. Ore from Washington yielded 1,388 tons of lead at Canadian smelters in 1918 and 3 tons in 1919, but no lead ore from the United States was treated in Canada in 1920-1922.

Primary lead smelted or refined in the United States, 1917-1922, by sources, in short tons.

Source of ore.	1917	1918	1919	1920	1921	1922
Domestic ore:						
Alaska.....	884	531	645	591	773	824
Arizona.....	7,450	6,195	5,407	5,987	3,313	7,215
Arkansas.....	300	14				
California.....	11,471	6,228	2,004	2,260	614	3,015
Colorado.....	29,327	29,395	18,867	17,752	12,104	11,108
Idaho.....	174,045	142,640	89,091	117,191	99,707	91,437
Illinois.....	857	1,010	977	948	271	750
Kansas.....	2,063	5,023	7,951	8,421	10,639	10,907
Kentucky.....	21	109	83	114	41	71
Missouri.....	218,197	187,743	150,341	171,999	151,028	202,245
Montana.....	5,933	17,586	17,513	13,231	11,505	14,511
Nevada.....	12,334	8,726	6,958	8,650	3,553	4,231
New Hampshire.....			18			
New Mexico.....	3,428	5,140	1,418	1,123	384	1,221
New York.....	19,046	58,755	49,984	68,494	40,902	67,431
Oklahoma.....	34	6	18	6	2	
Oregon.....						
South Dakota.....	843	2,371	2,705			
Tennessee.....	68	30	1			
Texas.....	82,081	76,169	65,102	64,006	51,872	63,115
Utah.....	147	59				
Virginia.....	629	906	1,090	2,450	325	
Washington.....	2,930	4,275	3,975	3,841	1,079	1,321
Wisconsin.....	145	50	119	201	101	117
Undistributed.....	0,489	5,359	4,887	4,306	713	1,221
Zinc residues.....						
	579,385	556,878	427,825	494,347	395,287	481,081
Foreign ore:						
Africa.....	1,738	1,519	644	1,171		
Australia.....	282	282	69	450		
Canada.....	1,100	7,550	1,895	1,186	2,877	3,511
Central America.....					6	
Mexico.....	7,007	4,708	2,261	2,728	1,912	
South America.....	1,633	1,101	2,537	2,747	2,235	
Other foreign.....	3,894	84	238	109	90	
Foreign base bullion:						
Canada.....	0,750	8,108	507	1,919	1,599	2,111
Mexico.....	30,508	76,809	49,564	42,421	41,048	47,711
South America.....	189	39		54		
	62,319	100,290	57,787	52,808	50,367	63,511
Grand total.....	641,704	657,168	485,612	547,155	445,654	545,592

* The lead produced by these States is nonargenticiferous or soft lead.

Soft lead.—The lead ores of the Mississippi Valley are almost free from silver, and the lead produced from them is known as "soft lead."

Soft lead produced in the United States, 1917-1922, in short tons.

Year.	Soft pig lead.			Soft lead recovered in pigments.	Total soft lead.	Total domestic lead.*	Soft lead produced in the United States, 1917-1922, in short tons.
	Undersilvered.	Desilvered.	Total.				
1917.....	188,503	56,268	244,771	12,870	257,641	574,338	
1918.....	210,463	47,418	257,881	13,093	270,974	592,218	
1919.....	147,744	67,938	215,682	11,479	227,161	444,250	
1920.....	189,854	66,868	256,722	15,960	272,682	500,841	
1921.....	157,513	52,747	210,260	10,158	220,418	415,055	
1922.....	209,250	74,305	283,555	13,892	297,447	488,448	

* Includes domestic refined lead, domestic lead in antimonial lead, and domestic lead in pigments.

Antimonial lead.—The production of by-product antimonial lead from all types of argentiferous lead ores derived from all types of lead refineries operating in this country, in 1917-1914 in Mineral Resources, 1914, and for 1915-1922 in Mineral Resources, 1922.

By-product antimonial lead produced in the United States, 1917-1922, in short tons.

Year.	Total lead refined from base bullion (short tons).	Percentage of by-product antimonial lead.	Antimonial lead.			
			From domestic ore (short tons).	From foreign ore (short tons).	Short tons.	Value.
1917.....	365,998	5.1	15,279	3,367	18,646	\$3,781.56
1918.....	382,314	4.9	10,777	7,793	18,570	2,826.35
1919.....	269,538	5.2	9,674	4,200	13,874	1,513.96
1920.....	273,135	4.6	9,604	2,931	12,535	1,963.22
1921.....	238,329	4.2	7,881	2,183	10,064	870.05
1922.....	249,107	3.2	7,068	1,007	8,075	844.90
Average.....		4.51				

Lead pigments.—Leaded zinc oxide, zinc lead, and sublimed blue lead are made directly from lead and the output given also in the chapter on lead and zinc pigments and in the column of the last table on page 28. The pigments of lead (white lead, red lead, orange minium) also discussed and the output given in the chapter on pigments.

Secondary lead.—Secondary lead is obtained from scrapings, drosses, old metal, and alloys, such as type metal. The recovery of lead by refining constitutes an integral part of the lead industry.

Secondary lead recovered in the United States, 1917-1922, in short tons.

Year.	Pig lead.
1917.....	45,100
1918.....	41,145
1919.....	55,684
1920.....	66,350
1921.....	46,370
1922.....	76,480

Mine production.—The preceding tables give the production of lead by smelting and refining operations, and the alloy antimonial lead, or as lead in pigments. The lead is much more accurately shown by the production of lead because smelters necessarily treat mixtures of

Type metal imported and entered for consumption in the United States, 1917-1922.

Year.	Type metal.		Lead content.	
	Pounds.	Value.	Pounds.	Percentage.
1917.....	651,794	\$35,838	513,166	83.0
1918.....	13,394,803	816,642	11,000,498	82.1
1919.....	29,887,353	1,349,495	25,761,543	86.2
1920.....	38,971,351	1,191,553	30,706,845	78.8
1921.....	43,365,120	1,082,832	32,785,042	75.6
1922.....				
Average lead content, 1917-1922.....				79.9

General imports of lead into the United States, 1917-1922, by classes, in pounds.

Year.	Lead in ore.	Base bullion.		Pigs, bars, sheets, and old.	Total lead content.
		Gross weight.	Lead content.		
1917.....	41,292,876	109,279,907	103,664,970	11,585,974	156,543,820
1918.....	37,070,340	155,810,003	149,663,889	10,480,531	197,214,760
1919.....	19,673,856	115,317,160	112,024,618	10,214,753	141,813,127
1920.....	29,438,816	101,476,560	96,103,003	71,437,108	197,029,527
1921.....	14,234,039	77,882,834	71,733,838	62,602,534	148,570,411
1922.....	24,474,481	(a)	124,074,455	7,101,623	155,650,569

a Figures not available.

General imports of lead into the United States, in ore, base bullion, and refined, 1917-1922, by sources, in pounds.

Year.	Canada.	Mexico.	South America.	Europe.	Other countries.	Total imports.
1917.....	11,738,379	125,782,759	4,558,460	8,945,899	5,520,323	156,543,820
1918.....	28,225,878	162,259,199	1,962,124	62,610	4,705,049	197,214,760
1919.....	10,391,115	125,541,614	5,504,416	89,840	286,142	141,813,127
1920.....	8,199,234	131,815,278	7,085,351	38,766,504	11,183,160	197,029,527
1921.....	8,127,158	106,406,238	2,381,365	30,224,701	1,430,949	148,570,411
1922.....	8,603,226	141,216,136	2,803,478	1,464,384	613,235	155,650,569

The high price of lead shortly before and during the World War made it profitable to export domestic lead. Beginning in March, 1914, the exports soon reached large quantities, but they declined rapidly after the war.

Refined lead made from domestic ores and exported from the United States, 1914-1922.

Year.	Short tons.	Value.	Year.	Short tons.	Value.
1914.....	58,722	\$4,501,674	1919.....	10,510	\$1,471,260
1915.....	88,306	7,928,518	1920.....	2,730	462,223
1916.....	100,600	13,494,065	1921.....	1,624	177,928
1917.....	53,688	9,580,598	1922.....	5,823	804,600
1918.....	41,831	5,839,381			

By foreign-lead exports are meant the exports of origin which has been smelted, refined, or manufactured in this country and then shipped abroad.

Foreign lead exported from the United States.

Year.	Exported from	
	Pigs, bars, and old.	Value.
1917.....	75,304,480	\$4,600,000
1918.....	118,832,344	8,300,000
1919.....	81,951,896	4,500,000
1920.....	84,725,601	2,500,000
1921.....	50,000,269	2,200,000
1922.....	64,708,305	3,100,000

a Since July 1, 1915, the Bureau of Foreign and Domestic Commerce has reported the exports of lead as refined in this country and exported as domestic exports of pigs, bars, and old. These figures include also the re-exports of foreign pigs and bars.

Domestic and foreign pig lead exported from the United States.

(Figures in parentheses are not duplicated in the total.)

Destination.	Domestic.	
	Short tons.	Value.
1921.		
Asia.....	47	\$1,000,000
Japan.....	(28)	(2,000,000)
Australia and Oceania.....	39	4,000,000
Philippine Islands.....	(30)	(2,000,000)
Canada.....	170	21,000,000
Cuba.....	79	9,000,000
Europe.....	979	97,000,000
Denmark.....	(516)	(51,000,000)
France.....	(224)	(21,000,000)
Germany.....	(3)	(3,000,000)
Great Britain.....	(118)	(11,000,000)
Netherlands.....	105	13,000,000
Mexico.....	99	14,000,000
South America.....	(26)	(2,000,000)
Argentina.....	(3)	(3,000,000)
Brazil.....	(17)	(1,000,000)
Uruguay.....	28	5,000,000
Panama.....	78	8,000,000
Other countries.....		
	1,624	177,000,000
1922.		
Asia.....	305	30,000,000
Japan.....	(240)	(24,000,000)
Philippine Islands.....	(38)	(4,000,000)
Australia and Oceania.....	337	43,000,000
Canada.....	84	12,000,000
Cuba.....	3,819	379,000,000
Europe.....	(112)	(11,000,000)
Denmark.....	(1,737)	(175,000,000)
France.....	(594)	(59,000,000)
Germany.....	(1,374)	(138,000,000)
Great Britain.....	(1)	(1,000,000)
Netherlands.....	78	10,000,000
Mexico.....	1,120	110,000,000
South America.....	(537)	(47,000,000)
Argentina.....	(466)	(46,000,000)
Brazil.....	1	1,000,000
Uruguay.....	78	11,000,000
Panama.....		
Other countries.....	5,823	604,000,000

CONSUMPTION.

Apparent consumption of refined primary lead in the United States, refinery stocks disregarded, in short tons, 1917-1922.

	1917	1918	1919	1920	1921	1922
Supply:						
Stock in bonded warehouse Jan. 1.....	535	2,085	472	234	1,322	347
Imports of pigs, bars, and old.....	5,793	5,240	5,107	35,719	31,301	3,551
Production.....	610,709	640,195	482,220	520,067	448,580	532,662
	617,097	648,120	487,709	555,010	481,212	536,500
Withdrawn:						
Exports of foreign lead—						
From warehouse.....	37,052	50,410	40,978	17,363	25,000	32,355
In manufactures, with benefit of drawback.....	7,537	3,426	1,936	6,175	9,309	5,677
Exports of domestic lead.....	53,688	41,831	10,510	2,730	1,624	5,823
Stock in bonded warehouse Dec. 31.....	2,685	472	234	1,322	347	(a)
	101,562	105,145	53,656	27,590	36,340	43,855
Apparent consumption.....	515,535	542,975	434,143	528,020	444,872	492,705

^a Figures not available.

CUSTOMS DUTIES ON LEAD.

In the following table are shown the tariff imposts on lead in ore and as metal in the tariff acts of 1909, 1913, and 1922. As the duties levied on lead in the tariff of 1913 were ad valorem, in part, the average duty collected over the whole period that the tariff of 1913 was in effect (October 3, 1913, to September 21, 1922) has been calculated, to make comparison easy. The total duty collected on each class has been divided by the total number of pounds of lead in that class to obtain the average duty collected per pound, and this has been inserted in the table in another column for comparison with the specific duties of other tariffs.

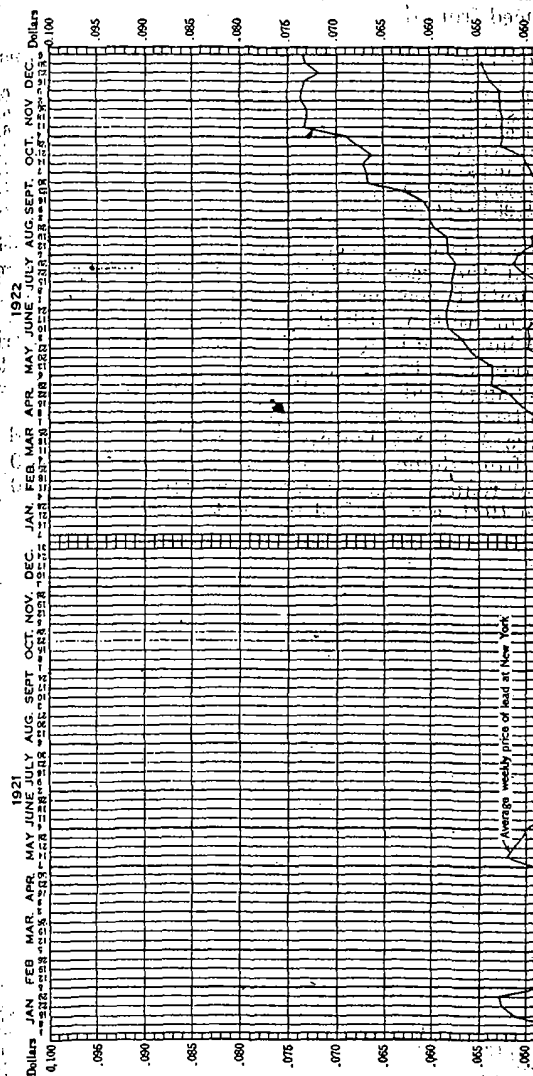
Comparison of tariff imposts on lead in acts of 1909, 1913, and 1922, in cents per pound.

	1909	1913		1922
		Tariff.	Average collected.	
	Cents.	Cents.	Cents.	Cents.
Lead-bearing ore, lead content.....	1 1/2	3 cent.....	3	1 1/2
Base bullion, lead content.....	2 1/2	25 per cent..	1	2 1/2
Lead, pigs, bars and old.....	2 1/2	25 per cent..	1 1/2	2 1/2
Sheets, pipe, shot, etc.....	2 1/2	25 per cent..	2	2 1/2
Type metal, lead content.....	1 1/2	15 per cent..	1	1 1/2

PRICES AND VALUE.

Lead was quoted for immediate delivery in New York at the beginning of 1922 at 4.7 cents a pound in the open market and remained at that figure through the first three months of the year. By early June the price had risen to 5.8 cents, and it stood slightly under this figure until the later part of August. A gradual rise brought the price to 7.25 cents at the end of the year.

The average quoted price for lead for prompt delivery in New York for the year was a little under 5.7 cents a pound, as compared



with 4.7 cents in 1921. The average selling price, figured on the total sales during the year, was 5.5 cents a pound, as compared with 4.6 cents in 1921. The average selling price is used in calculating the value of lead produced from domestic ores in the United States.

Prices quoted on lead by the American Smelting & Refining Co. in 1922, in cents a pound

Jan. 2.....	4.70	May 18.....	5.50	Sept. 27.....	6.35
Mar. 30.....	4.80	May 29.....	5.65	Oct. 6.....	6.50
Apr. 3.....	4.90	June 7.....	5.75	Nov. 1.....	6.75
Apr. 7.....	5.00	Aug. 21.....	5.90	Nov. 2.....	7.00
Apr. 20.....	5.10	Sept. 14.....	6.00	Nov. 24.....	7.10
Apr. 24.....	5.25	Sept. 19.....	6.10	Dec. 19.....	7.25
May 16.....	5.35	Sept. 22.....	6.25	Dec. 29.....	7.25

The London price of lead was very close to the New York price at the beginning of the year, but the difference between them gradually widened until it was nearly 2 cents a pound at the end of the year, in part owing to the tariff of 1922, which imposes a duty of 2½ cents a pound on imported lead. These facts are shown in a striking way by the graphs in Figure 1, which take into account the fluctuations in exchange and show that the London market was more responsive to trade conditions than the New York market.

As stated on page 27, the value of the refined lead produced in the United States from domestic ores in 1922 was \$51,562,000 at the average price of refined lead, as compared with \$35,840,000 at the average price in 1921, a gain of 44 per cent.

ZINC.

By O. E. SIEBENTHAL and A. STOLL.

SUMMARY.

Zinc produced and consumed in the United States, 1921-22, in

Production of primary zinc: a	
From domestic ore.....	
From foreign ore.....	
Production of secondary zinc: a	
Redistilled.....	
Remelted.....	
Consumption of primary zinc.....	

"Primary zinc," which is produced directly from ore, is here distinguished from which is obtained by refining zinc ashes, skimmings, drosses, and old metals. The and are given on page 40. Wherever in this report the word "zinc" is used without primary zinc.

Owing to necessary economies in Government printing it seemed advisable to omit the notes explaining the tables. The reader will find the full notes in the chapters on Mineral Resources for 1918. For the same reason the by the tables has generally been limited to the years 1917-1922. Some tables have been omitted.

PRODUCTION.

PRIMARY ZINC.

Primary zinc produced in the United States, 1917-1922, in

Apportioned according to source of ore.

	1917	1918	1919	1920
Total domestic.....	584,597	492,405	452,272	450,045
Foreign:				
Canada.....	6,787	8,700	4,007	1,583
Mexico.....	40,360	14,043	8,083	8,978
South America.....		886	751	536
Europe.....	11,689	113		
Australia.....	26,140	1,780	630	7,235
Total foreign.....	84,976	25,522	13,471	18,822
Total primary.....	669,573	517,927	465,743	468,867

Chapters on zinc that were more than ordinarily detailed were issued in Mineral Resources for 1918, dealing with the zinc deposits of the United States; and for 1918, dealing with the zinc industry in relation to the World War.

ZINC DUST.

Zinc dust produced in the United States, 1917-1922.

Year.	Prepared "blue powder."			Zinc dust "atomized."		
	Short tons.	Value. ^a	Average price per pound.	Short tons.	Value. ^a	Average price per pound.
1917	3,989	\$1,322,198	\$0.106	1,924	\$642,782	\$0.107
1918	4,016	877,171	.109	2,979	773,740	.130
1919	4,053	801,366	.098	2,515	524,904	.104
1920	2,000	333,390	.083	789	120,231	.078
1921	3,394	531,225	.078	3,634	530,920	.074

^a Value is calculated from the total value of material sold during year.^b Statistics of the quantity of secondary zinc recovered as zinc dust are given in the table below headed "Secondary zinc."

The average price of zinc dust, "blue powder," as calculated from sales during the year, was 7.8 cents a pound, and "atomized" zinc dust brought 7.4 cents a pound. "Blue powder" brought a higher average price than "atomized" dust because much of it was sold in the far West, where higher prices prevailed. The weekly fluctuation in the quoted price of zinc dust is shown in Figure 3 (p. 52).

ZINC PIGMENTS.

Zinc forms the base, either in whole or in part, of four white pigments—zinc oxide, leaded zinc oxide, zinc-lead oxide, and lithopone. Details of the production of zinc pigments and of market conditions are given in the chapter on lead and zinc pigments and salts.

The zinc content of the pigments made in the United States from ore, both domestic and foreign, for the period 1917-1922 is given in the table below. Statistics of the secondary zinc recovered in the form of pigments are given under the next heading.

Primary zinc content of zinc pigments made in the United States, 1917-1922, in short tons.

1917	97,573	1920	110,695
1918	102,778	1921	53,480
1919	96,817	1922	93,112

SECONDARY ZINC.¹

Secondary zinc recovered in the United States, 1920-1922, in short tons.

	1920	1921	1922
Secondary zinc, redistilled	21,371	17,573	32,835
Secondary zinc, remelted	21,479	16,260	36,325
Recovered zinc in alloys, excluding old brass remelted	7,650	5,840	10,250
Recovered zinc in remelted brass	65,000	38,627	60,225
Secondary zinc recovered as metal	115,500	78,300	139,640
Secondary zinc recovered in zinc dust	1,061	755	3,408
Secondary zinc recovered in pigments	12,870	4,024	8,605
Secondary zinc recovered in zinc salts	9,479	10,225	9,016
Total secondary zinc	139,000	93,000	161,000

¹ See page 37 for definition of secondary zinc.

BY-PRODUCT SULPHURIC ACID.

An important by-product of zinc-smelting operations is sulphuric acid made from the sulphur gases evolved in the smelting of sulphide ores preparatory to their distillation or conversion to zinc oxide or to zinc salts. Sulphur gases from zinc ores are utilized by Matthiessen & Hegeler, at La Salle, Ill.; there are numerous acid plants using these gases. They may be located at zinc smelters and zinc-oxide plants and magnetic separating plants, at the mines, or at other markets, the roasted concentrates being shipped to other zinc plants. Figures of output of this by-product for the period 1914-1920 were given in the chapter on Resources, 1920. The following table is made up from the biennial census of manufactures by the Bureau of the Department of Commerce. The quantity and value from copper ores is included for comparison.

By-product sulphuric acid produced in the United States, 1914-1920.

Acid made from zinc ores.	
Number of establishments	.....
Acid reported as 60°-60° Baumé	 short tons
Consumed at works	 do.
Sold	 do.
Value of acid sold	.....
Average	.....
Acid reported as 66° Baumé and stronger	 short tons
Consumed at works	 do.
Sold	 do.
Value of acid sold	.....
Average	.....
Total acid sold, equivalent in 60° Baumé	 short tons
Quantity	.....
Value	.....
Acid made from copper ores.	
Number of establishments	.....
Total acid sold, equivalent in 60° Baumé	 short tons
Quantity	.....
Value	.....

MINE PRODUCTION.

The preceding tables give the quantity of zinc recovered by smelting and by electrolytic reduction, or by zinc in pigments. The following table shows the domestic zinc that is recovered by metallurgical means. The origin of the zinc by States is obtained more accurately from reports of mines, because smelters necessarily treat the concentrates long after they have been received. The output of metallic zinc may not correspond at all with the product of the mines for the same year. The data for mine production are taken from the reports on gold, silver, lead, and zinc in the different States.

chemical reaction during manufacture, and not by grinding, as might be supposed.

In addition to the method of manufacture of calcium arsenate outlined above, by which practically all the calcium arsenate heretofore used has been made, there are several new methods being developed in response to the great demand caused by the ravages of the cotton-boll weevil. Of these, the one which is based on the use of a natural deposit of ferric arsenate (the mineral scorodite) has received the greatest notice and is now being operated on a commercial scale. In this process the arsenic does not have to be oxidized, for it is already present in the pentavalent form. Other methods using chlorine for the oxidation of arsenite to arsenate are being developed, but they have not yet assumed commercial importance.

Calcium arsenate from scorodite.—The Salt Lake Insecticide Co., at Salt Lake City, began in January, 1923, to manufacture calcium arsenate direct from ore, the principal arsenic mineral of which is scorodite, a hydrous ferric arsenate. As is common with new manufacturing plants, progress was slow at first while details of the process were being perfected, but the first car of calcium arsenate, routed for Georgia, was shipped in April, and the company is therefore in time to contribute to the late demands of the 1923 season.

The ore contains from 12 to 40 per cent of arsenic pentoxide and about 2 ounces of silver to the ton. The deposit is at Gold Hill, Utah, on a branch of the Western Pacific Railroad, and is probably the largest deposit of the kind in this country. The ore is crushed in rolls and ground with caustic soda solution in a ball mill. This mixture is further agitated in mixing tanks and filtered, after which the residue is washed. To the filtrate is added a calculated quantity of milk of lime, which precipitates basic calcium arsenate. The precipitate is filtered, washed, dried, and pulverized. The solution of regenerated caustic soda is concentrated and again used for leaching ore. The residue of the leached ore is sold to smelters for the recovery of silver and other metals.

LEAD ARSENATE.

A bulletin on the composition of lead arsenates and methods of home manufacture was published by the Department of Agriculture in 1910.⁵⁴

A mixture of the basic and acid arsenates of lead can be prepared electrolytically from disodium arsenate or arsenic acid.⁵⁵

ELEMENTAL ARSENIC.

A plant using the Hoskins process for the manufacture of elemental arsenic from white arsenic was operated near Chicago in 1920. The competition of a German product that sold for about 20 cents a pound prevented the operation of the plant in 1921 or 1922. The Hoskins plant as described⁵⁶ consisted of four furnaces in which metallic arsenic was made by reducing As_2O_3 with charcoal. The furnaces were heated by gas to temperatures between 1,200° and 1,300° F. The furnace charge ranged from 200 to 450 pounds, with the proportion of 1 pound of charcoal to 4 pounds of As_2O_3 . The smaller charge was reduced in 7 hours and the larger one in 10 hours.

⁵⁴ Haywood, J. E., and McDonnell, C. C., Lead arsenate: U. S. Dept. Agr. Bur. Chem. Ind. Bull. 131, p. 60, 1910.

⁵⁵ Tartar, H. V., and Grant, G. G., Jour. Ind. and Eng. Chemistry, vol. 101, p. 61, April 24, 1922.

⁵⁶ Jones, C. H., Pure metallic arsenic manufacture: Chem. and Met. Eng., vol. 23, pp. 957-960, Nov. 17, 1920.

LEAD AND ZINC PIGMENTS AND

By C. E. SIEBENTHAL and A. STOLL.

PRODUCTION.

Lead and zinc pigments and salts are made both by chemical processes. Sublimed lead, or basic lead, various lead oxides are examples of lead pigments. Sublimation in oxidizing furnaces; basic carbonate, white lead salts are made by chemical processes. Sublimed lead sulphate, is made directly from ore, but the lead as white lead and lead salts are made from pig lead.

Zinc oxide and leaded zinc oxide are made by the process directly from ore by sublimation in an oxidizing furnace. Some zinc oxide is made in this country, by the French process, in which metallic zinc is sublimated in an oxidizing furnace. Lithopone and zinc salts are made by chemical processes being derived from zinc ore, metallic zinc, galvanneal scrap zinc. Lithopone is made by mixing equivalent solutions of zinc sulphate and barium sulphide, which by mutual precipitation of zinc sulphide and barium sulphate, a chemical combination or as a very intimate mixture.

The increase in the quantity of lead and zinc pigments in 1922 over that marketed in 1921 is indicative of the industry and also of some expansion. The American Mining Co. began the construction of two zinc oxide plants, one at East Chicago, Ind., near the Anaconda Lead Production, an electrolytic white lead plant, and the other at Akron, Ohio, will make lead-free French process zinc oxide from electrolytic zinc for the rubber trade.

The new plant of the American Zinc Oxide Co., of which started operations early in 1921. An additional capacity was operated in 1922. Zinc sulphide ore, from Mascot, Tenn., roasted at Hillsboro, Ill., is used in the Wedge type were installed at Columbus in 1922. The gas produced is sold to an adjacent fertilizer plant. Zinc oxide is used in the rubber industry.

Marshall Evans, late of the Eagle-Picher Lead Plant at Charleston, W. Va., under the name of the Evans Production in 1923 will be limited to litharge and lead also will be made later on.

10253°—25—14

Lead pigments and salts marketed in 1921 and 1922.

	1921			1922		
	Short tons.	Value.		Short tons.	Value.	
		Total.	Per ton.		Total.	Per ton.
Sublimed lead, or basic lead sulphate:						
White.....	11,568	\$1,418,403	\$122.61	13,765	\$1,829,865	\$132.94
Blue.....	463	58,693	126.55	972	129,230	132.95
Red lead.....	21,805	3,414,452	156.59	30,509	5,104,290	167.30
Orange mineral.....	381	91,887	241.17	370	83,022	224.38
Litharge.....	41,909	5,735,824	136.86	58,261	8,892,172	152.63
White lead:						
Dry.....	26,738	3,755,418	140.45	41,698	5,785,165	139.07
In oil.....	143,545	27,505,145	191.61	153,393	29,728,230	193.80
Lead acetate.....	2,092	552,435	264.07	(a)	(a)	(a)
Lead arsenate.....	5,733	2,090,341	364.62	(a)	(a)	(a)

^a Statistics for lead arsenate and lead acetate collected biennially by the Bureau of the Census.

Zinc pigments and salts marketed in 1921 and 1922.

	1921			1922		
	Short tons.	Value.		Short tons.	Value.	
		Total.	Per ton.		Total.	Per ton.
Zinc oxide.....	74,329	\$11,231,716	\$151.11	128,465	\$17,994,704	\$140.07
Leaded zinc oxide.....	16,103	2,092,320	129.93	19,613	2,251,601	114.80
Lithopone.....	55,016	6,681,563	121.45	83,360	9,214,040	110.53
Zinc chloride, 50° Baumé.....	59,457	3,552,619	59.75	41,027	2,009,147	48.27
Zinc sulphate.....	3,295	189,369	57.47	5,078	251,528	49.53

SOURCE.

Metal content of lead and zinc pigments and salts, 1921 and 1922, by sources, in short tons.

Source.	1921				1922			
	Lead.		Zinc.		Lead.		Zinc.	
	Pigments. ^a	Salts.	Pigments.	Salts.	Pigments.	Salts.	Pigments.	Salts.
Domestic ore.....	9,989		52,087	3,749	13,892	(b)	91,874	1,801
Foreign ore.....	169		1,393			(b)	1,238	
Metal.....	200,599		7,465	528	241,096	(b)	16,298	1,041
Secondary material.....			4,024	10,225	111	(b)	8,609	9,016
	210,757	44,811	64,969	14,502	255,099	(b)	118,019	11,858

^a Includes lead from zinc oxide and leaded zinc oxide.

^b Statistics not collected in 1922.

^c Zinc ashes, skimmings, drosses, and old metal.

^d The source of the lead contained in lead salts is unknown to the Geological Survey. Lead acetate is made from litharge, from granulated lead, and from white lead residues. Lead arsenate is made from lead acetate or lead nitrate.

IMPORTS AND EXPORTS.

The following statistics of imports and exports of lead and zinc pigments and salts have been compiled from the publications or records of the Bureau of Foreign and Domestic Commerce, Department of Commerce, by J. A. Dorsey, of the United States Geological Survey.

LEAD AND ZINC PIGMENTS AND SALTS.

ment of Commerce, by J. A. Dorsey, of the United States Geological Survey.

Basic carbonate white lead, red lead, litharge, and orange mineral in consumption in the United States, 1917-1922.

Year.	Basic carbonate white lead.		Red lead.		Litharge.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1917.....	20,238	\$1,965	50	\$13		
1918.....	508	202	5	1	100	
1919.....	21,213	2,490	7,199	1,136		
1920.....	159,977	19,440	23,076	1,789	21,002	
1921.....	124,170	12,598	12,236	680	100	
1922.....	222,465	21,335	1,405	94	1,770	

Zinc oxide, lithopone, zinc sulphide (white), zinc chloride, and zinc acetate entered for consumption in the United States, 1917-1922.

Year.	Zinc oxide.			
	Dry.		In oil.	
	Short tons.	Value.	Short tons.	Value.
1917.....	119	\$52,649	5	
1918.....	162	62,703	4	
1919.....	105	44,338	3	
1920.....	1,431	289,890	14	
1921.....	1,296	145,071	57	
1922.....	2,712	361,599	42	

Year.	Zinc sulphide. ^a		Zinc chloride.	
	Pounds. ^a	Value.	Short tons.	Value.
1917.....	9,900	\$6,519	2	
1918.....	2,670	993	98	
1919.....	10,035	4,413	1	
1920.....	45,482	15,027	565	
1921.....	93,537	8,330	2,199	
1922.....	27,159	8,453	1,374	

^a Zinc sulphide is stated in pounds rather than tons because of its high value.

^b Less than 1 ton.

White lead and red lead exported from the United States.

Year.	White lead.	
	Short tons.	Value.
1917.....	9,869	\$2,089,656
1918.....	7,794	1,755,739
1919.....	14,017	3,037,292
1920.....	14,901	3,185,101
1921.....	5,181	993,130
1922.....	4,598	710,765

^a July 1-Dec. 31, inclusive. Not separately classified prior to July.

White lead exported from the United States in 1921 and 1922.

[Figures in parentheses not duplicated in totals.]

Destination.	1921		1922	
	Short tons.	Value.	Short tons.	Value.
Africa.....	18	\$5,253	1	\$220
Asia.....	52	13,398	60	10,897
Australia and Oceania.....	228	50,817	165	33,644
Australia.....	(16)	(3,299)	(9)	(1,568)
New Zealand.....	(21)	(4,697)	(1)	(375)
Philippine Islands.....	(182)	(41,042)	(141)	(28,348)
Canada.....	129	20,105	53	8,385
Cuba.....	51	11,744	65	14,194
Europe.....	2,833	504,973	2,809	391,940
Belgium.....	(622)	(105,209)	(938)	(127,275)
France.....			(56)	(7,821)
Great Britain.....	(1,568)	(273,105)	(1,377)	(193,670)
Netherlands.....	(732)	(124,988)	(417)	(59,749)
Mexico.....	263	58,365	124	28,944
Panama.....	236	62,488	6	1,467
South America.....	1,139	240,143	1,199	195,110
Brazil.....	(2)	(782)	(6)	(1,006)
Colombia.....	(14)	(3,100)	(22)	(4,251)
Uruguay.....	(109)	(26,366)	(83)	(12,923)
Venezuela.....	(7)	(1,913)	(9)	(2,014)
Other countries.....	114	25,844	116	24,903
	5,161	993,130	4,598	710,765

Zinc oxide exported from the United States, 1917-1922.

Year.	Short tons.	Value.
1917.....	15,446	\$3,148,698
1918.....	12,421	2,779,507
1919.....	14,703	3,059,278
1920.....	11,164	2,151,544
1921.....	2,511	426,253
1922.....	3,977	593,128

Zinc oxide exported from the United States in 1921 and 1922.

[Figures in parentheses not duplicated in totals.]

Destination.	1921		1922	
	Short tons.	Value.	Short tons.	Value.
Asia.....	18	\$5,488	4	\$1,113
Australia and Oceania.....	22	5,578	84	11,642
Philippine Islands.....	(14)	(2,905)	(37)	(7,481)
Canada.....	1,685	271,753	3,218	459,819
Cuba.....	24	7,068	53	7,583
Europe.....	489	70,617	381	53,624
France.....	(251)	(37,511)	(70)	(10,214)
Great Britain.....	(150)	(21,788)	(300)	(41,770)
Italy.....	(79)	(11,263)	(11)	(1,650)
Sweden.....	(a)	(45)		
Mexico.....	150	34,698	109	23,193
Panama.....	12	2,905	2	539
South America.....	109	25,143	123	26,561
Brazil.....	(9)	(2,527)	(14)	(2,869)
Other countries.....	11	3,007	43	9,044
	2,511	426,253	3,977	593,128

a Less than 1 ton.

LEAD AND ZINC PIGMENTS AND SALTS

CUSTOMS DUTIES.

In the following table are shown the tariff rates and zinc pigments and chemicals in the tariff act of 1913 were ad valorem, for lease of corresponding specific rates of the preceding and the average duty collected over the life of the tariff, to September 21, 1922) has been calculated in another column after the ad valorem rates.

Comparison of tariff imposts on lead and zinc pigments and chemicals, 1913, and 1922, in cents per pound.

	1913	1922
White lead.....	2 1/2	2 1/2
Red lead.....	2 1/2	2 1/2
Orange mineral.....	2 1/2	2 1/2
Litharge.....	2 1/2	2 1/2
Lead acetate:		
White.....	3	3
Brown, etc.....	2	2
Lead arsenate.....	2 1/2	2 1/2
Zinc oxide:		
Dry.....	1 1/2	1 1/2
In oil.....	1 1/2	1 1/2
Leaded zinc oxide, dry.....	1 1/2	1 1/2
Zinc sulphide.....	1 1/2	1 1/2
Lithopone.....	1 1/2	1 1/2
Zinc chloride.....	1 1/2	1 1/2
Zinc sulphate.....	1 1/2	1 1/2

a As "manufactured article" not specially provided for. Statistics of imports.
b As "other lead compounds not specially provided for." Statistics of imports.
c Not containing lead.
d Not more than 5 per cent of lead.
e Not more than 25 per cent of lead.
f Containing lead.
g More than 5 per cent of lead; statistics of imports not available.
h More than 25 per cent of lead.

The tariff act of 1922 contains the following provisions for lead and zinc pigments and salts:

PAR. 47. Lead: Acetate, white, 2 1/2 cents per pound; acetate, yellow, 2 cents per pound; nitrate, arsenate, and resinate, 3 cents per pound; other lead compounds not specially provided for, 30 per centum ad valorem.
PAR. 74. Lead pigments: Litharge, 2 1/2 cents per pound; orange mineral, 2 1/2 cents per pound; white lead, 2 1/2 cents per pound; red lead, 2 1/2 cents per pound; white lead, 2 1/2 cents per pound; lithopone, 1 1/2 cents per pound; and other compounds containing lead, dry or in pulp, or ground in or mixed with oil or water, 2 1/2 cents per pound; and other compounds specially provided for, 30 per centum ad valorem.
PAR. 79. Zinc oxide and leaded zinc oxides containing not more than 5 per cent of lead, in any form of dry powder, 1 1/2 cents per pound; with oil or water, 2 1/2 cents per pound; lithopone, and other compounds of zinc sulphide and barium sulphate, 1 1/2 cents per pound.
PAR. 93. Zinc chloride, 1 1/2 cents per pound; zinc sulphate, 1 1/2 cents per pound; and zinc sulphide, 1 1/2 cents per pound.

PRICES AND VALUE.

The total amount and the average per ton received for lead and zinc pigment and salt are given in the table. Figure 6 shows the relation of the average weekly price in New York to the weekly quotations on several pigments, as given in the Oil, Paint, and Drug Report.

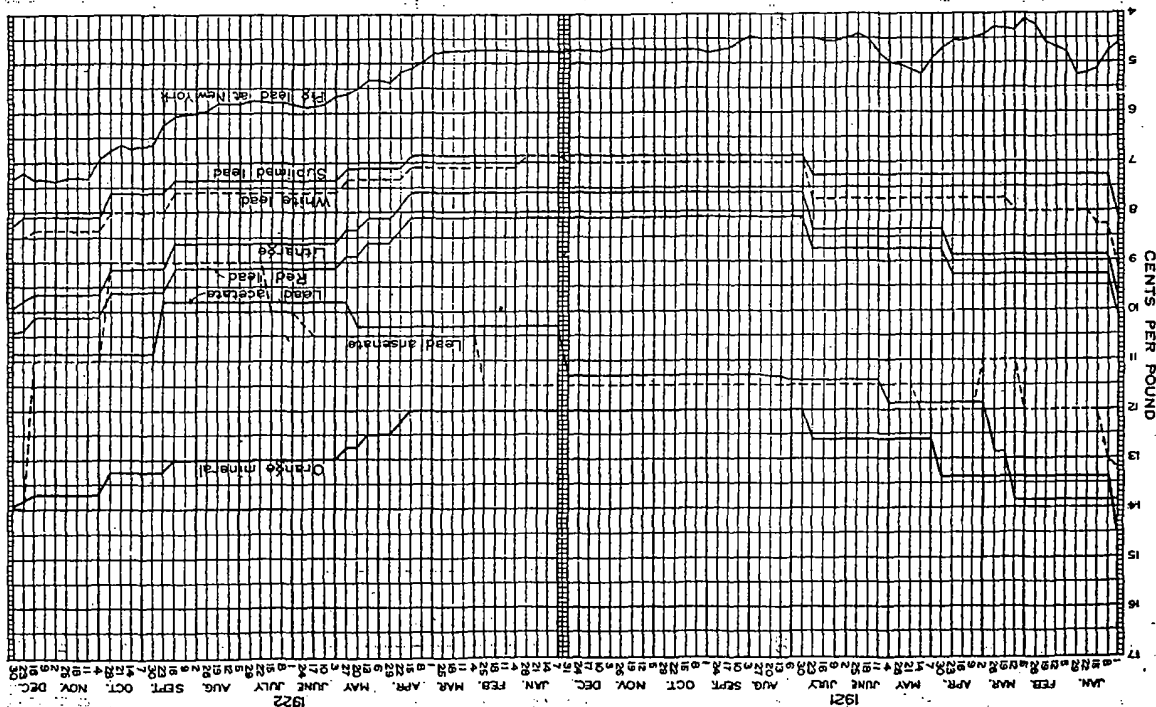


FIGURE 6.—Diagram showing relation of weekly prices of lead pigments and salts to the average weekly quoted price of lead at New York, 1921-22.

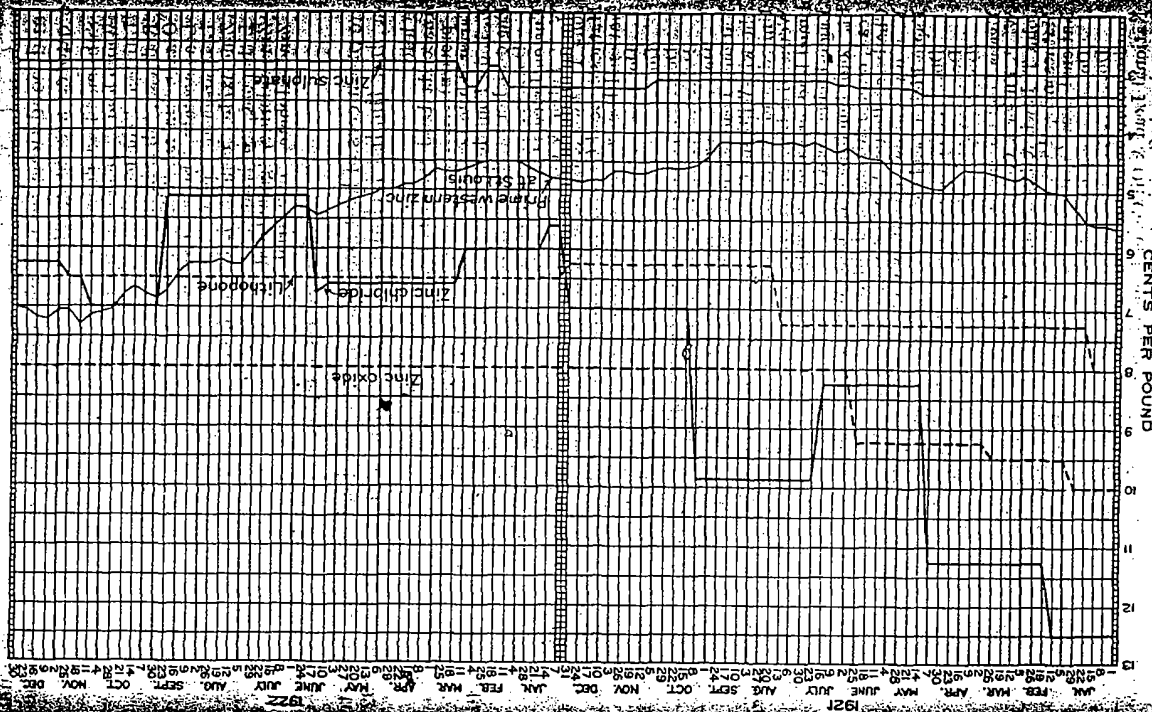


FIGURE 7.—Diagram showing relation of weekly prices of zinc pigments and salts to the average weekly quoted price of zinc at New York, 1921-22.

shows the relation of the weekly average quoted price of prime western slab zinc in St. Louis to the weekly quotations on certain pigments and salts of zinc, as given in the same journal. The qualities and conditions of the pigments and salts on which the prices were quoted are designated as follows:

Sublimed lead, or basic lead sulphate (white), "in casks."
 White lead, "American, dry, in casks."
 Litharge, "commercial, powdered, in casks."
 Red lead, "dry, in casks."
 Orange mineral, "American."
 Lead acetate, "brown, broken."
 Lead arsenate, "paste."
 Zinc oxide, "commercially lead-free."
 Lithopone, "in barrels."
 Zinc chloride, "granulated."
 Zinc sulphate, "industrial."

PRODUCERS.

The producers of lead and zinc pigments and salts in 1922 are listed below, but the list includes some plants that did not operate in 1922.

White lead:

Anaconda Lead Products Co. (electrolytic process)	East Chicago, Ind.
Carter White Lead Co.	South Chicago, Ill.
E. I. du Pont de Nemours & Co.	Philadelphia, Pa.
Eagle-Picher Lead Co.	Cincinnati, Ohio.
Do.	East St. Louis, Ill.
Euston Process Co.	Scranton, Pa.
W. P. Fuller & Co.	South San Francisco, Calif.
John T. Lewis & Bros. Co.	Philadelphia, Pa.
Matheson Lead Co.	Long Island City, N. Y.
National Lead Co.	Melrose, Calif.
Do.	Chicago, Ill.
Do.	St. Louis, Mo.
Do.	Brooklyn, N. Y.
Do.	Port Richmond, N. Y.
Do.	Cincinnati, Ohio.
National Lead & Oil Co. of Pennsylvania.	New Kensington, Pa.
Sherwin-Williams Co.	Chicago, Ill.
United Lead Co.	Perth Amboy, N. J.
Wetherill & Bro.	Philadelphia, Pa.

Sublimed lead, or basic lead sulphate:

Eagle-Picher Lead Co.	Joplin, Mo.
St. Louis Smelting & Refining Works	Collinsville, Ill.

Red lead, orange mineral, and litharge:

Chadwick-Boston Lead Co. ¹	Cambridge, Mass.
E. I. du Pont de Nemours & Co. ¹	Philadelphia, Pa.
Eagle-Picher Lead Co.	Joplin, Mo.
Do.	Newark, N. J.
Do.	Cincinnati, Ohio.
Do.	East St. Louis, Ill.
Evans Lead Co. (new)	Charleston, W. Va.
W. P. Fuller & Co.	South San Francisco, Calif.
John T. Lewis & Bros. Co.	Philadelphia, Pa.
Matheson Lead Co.	Long Island City, N. Y.
National Lead Co.	Melrose, Calif.
Do.	Chicago, Ill.
Do.	St. Louis, Mo.
Do.	Brooklyn, N. Y.
National Lead & Oil Co. of Pennsylvania.	New Kensington, Pa.
Pennsylvania Smelting Co.	Carnegie, Pa.
Sherwin-Williams Co.	Chicago, Ill.
Wetherill & Bro.	Philadelphia, Pa.

¹ No production in 1922.

LEAD AND ZINC PIGMENTS AND SALTS

Zinc oxide and leaded zinc oxide:

American Smelting & Refining Co. ¹	Omaha, Nebr.
American Steel & Wire Co. ¹	Donora, Pa.
American Zinc & Chemical Co.	Langeloth, Pa.
American Zinc Co. of Illinois	Hillsboro, Ill.
American Zinc Oxide Co.	Columbus, Oh.
Anaconda Copper Mining Co. (new)	Akron, Ohio.
Do.	East Chicago, Ind.
Bartlesville Zinc Co.	Bartlesville, Ok.
Bertha Mineral Co. ¹	Austinville, Va.
Eagle-Picher Lead Co.	Hillsboro, Ill.
Empire Zinc Co. ¹	Canon City, Colo.
Grasselli Chemical Co.	Grasselli, Ind.
Grubnau Chemical Co., Inc.	Waldo, N. Me.
Mineral Point Zinc Co. ¹	Depue, Ill.
Do.	Mineral Point, Mo.
New Jersey Zinc Co. of Pennsylvania	Palmerton, Pa.
Do. (French process)	Freemansburg, Pa.
Ohio Zinc Co. ¹	Canon City, Colo.
Ozark Smelting & Mining Co. ¹	Coffeyville, Kan.
River Smelting & Refining Co. ¹	Florence, Colo.
Shasta Zinc & Copper Co.	Winthrop, Cal.
Trenton Zinc & Chemical Co. (formerly M. S. Metal Co.)	Trenton, N. J.
U. S. Zinc Co.	Pueblo, Colo.
Utah Zinc Co.	Murray, Utah
Western Zinc Oxide Co.	Leadville, Colo.

Lithopone:

Collinsville Zinc Corporation ¹	Collinsville, Ill.
Consolidated Chemical Products Co. ¹	Federal, Ill.
E. I. du Pont de Nemours & Co.	Newark, N. J.
Do.	Philadelphia, Pa.
Glidden Co.	St. Helena, Mo.
Grasselli Chemical Co.	Grasselli, N. J.
Krebs Pigment & Chemical Co.	Newport, Del.
Metals & Chemicals Extraction Corporation	Oakland, Calif.
Midland Chemical Co. (Eagle-Picher Lead Co.)	Argo, Ill.
Mineral Refining & Chemical Corporation	St. Louis, Mo.
New Jersey Zinc Co.	Palmerton, Pa.
Sherwin-Williams Co.	Chicago, Ill.
United Color & Pigment Co.	Newark, N. J.

Zinc salts:

American Zinc & Chemical Co.	Langeloth, Pa.
Arkansas Preservative Co.	Argenta, Ark.
By-Products Steel Corporation	Warton, W. Va.
Consolidated Chemical Products Co. ¹	Federal, Ill.
Chas. Cooper & Co.	Newark, N. J.
Delaware Hard Fibre Co.	Wilmington, Del.
General Chemical Co.	Chicago, Ill.
Grasselli Chemical Co.	Grasselli, Ind.
Do.	Grasselli, N. J.
Do.	Cleveland, Ohio.
Great Western Electro-Chemical Co.	San Francisco, Cal.
Charles Lennig & Co. (Inc.)	Philadelphia, Pa.
Merrimac Chemical Co.	Everett, Mass.
Metals & Chemicals Extraction Corporation	Oakland, Calif.
Monsanto Chemical Works	East St. Louis, Ill.
New Jersey Zinc Co.	Palmerton, Pa.
Newport Co.	Milwaukee, Wis.
Pennsylvania Salt Manufacturing Co.	Wyandotte, Mo.

¹ No production in 1922.

1921. From the value given it seems probable that this material is tantalum ore. The records also show that 6,785 pounds of "tantalum steel-hardening ores," valued at \$1,827, were imported for consumption in 1921.

An excellent paper entitled "The story of the production and use of ductile tantalum," by Dr. Clarence W. Balke, was recently published.²

² Chem. and Met. Eng., vol. 27, pp. 1271-1273, 1922.

TITANIUM

By FRANK L. HESS, Editor

During 1922 the American Rutile Co. (owned by Metal Corporation, 120 Broadway, New York), operating at Roseland, Nelson County, Va., and produced 310 concentrates carrying about 95 per cent of titanium dioxide as by-product 600 tons of ilmenite concentrates carrying 85 per cent. The ilmenite concentrates carry a little more than the theoretical quantity of TiO_2 . Buckman & Pritchard (Inc.), a subsidiary of the American Cement Co. (Inc.), with works at Niagara Falls, N. Y., has been concentrated between high and low tide beach sands 4 miles south of Pablo Beach, Fla., also contains considerable zircon, a little rutile, and During the year 4,581 tons of ilmenite carrying 85 per cent of TiO_2 was shipped to Niagara Falls for manufacture of both ferrotitanium by the Titanium Company, affiliated company, and titanium pigment by the American Cement Co. (Inc.).

The use of titanium pigment is apparently not used alone but is precipitated with calcium salts or both, so that TiO_2 forms only 10 per cent of the mass. Even this is not used alone because it tends to "chalk." It is therefore mixed with iron and is thus said to form an excellent pigment. In the manufacture of the pigment it is, of course, advantageous to have as much iron as possible, because the iron and other impurities can be removed, and iron is the most troublesome because it destroys chemicals and has a high color. The operator of the pioneer pigment plant, that of Fredrikstad, Norway, has a deposit of ilmenite carrying about 35 per cent of TiO_2 and another carrying between 40 and 45 per cent. Both are at Raagefjord and Jössingfjord, south of Ekersund. The larger ilmenitic deposits in the United States are at Roseland, Va., unless concentrated artificially, as at Roseland, Va., by water action are the only known deposits of ilmenite. The largest known are probably those

¹ Jebsen, G., Den Norske titanhvitt-industri: Teknisk Ukeblad, 230, 1920.

Bahia, Brazil, where ilmenite concentrates of theoretical richness (52.7 per cent TiO_2) can be produced as a by-product of monazite mining. The high titanium content is probably in part due to small quantity of rutile in the sand.

After September 22, 1922, when the new tariff became effective, the imports of "titanium potassium oxalate and all compounds and mixtures containing titanium" amounted to 82,544 pounds, valued at \$20,596. The duty was 30 per cent ad valorem.

The market for rutile, used mostly for arc-light electrodes and for potassium-titanium oxalate to be used in dyeing and in the manufacture of leather, is small; that for ilmenite, to be used in ferrotitanium, is apparently not growing much; but the outlook for its use in the manufacture of pigments seems more promising.

TUNGSTEN.

By FRANK L. HESS.

In 1922, as in 1921, no tungsten ores were produced in the United States. The Cold Spring mine, in Boulder County, Colorado, pumped out by the Wolf Tongue Mining Co., as much as 100 tons of ore is exposed by the workings, but in only a few years was anything more than assessment work done.

The production of tungsten ore in the United States has been as shown in the table below.

Concentrated tungsten ores (carrying 60 per cent of tungsten) produced and sold in the United States, 1915-1922, and average prices.

Year.	Short tons.	Value.	Average price per unit.	Year.	Short tons.
1915.....	2,332	\$4,100,000	\$29.30	1919.....	32
1916.....	5,923	12,074,000	33.98	1920.....	21
1917.....	6,144	6,783,000	18.40	1921.....	None
1918.....	5,061	7,049,300	23.24	1922.....	None

Supplies of tungsten ores in the United States, 1916-1922.

Year.	Production.	Imports.			Turn and turn.
		Ore.	Tungsten and ferrotungsten.	Estimated equivalent in ore carrying 60 per cent of tungsten trioxide.	
1916.....	5,923	4,072	43	4,522	1916
1917.....	6,144	4,879	1	5,310	1917
1918.....	5,061	11,609	1	12,854	1918
1919.....	327	9,408	198	10,915	1919
1920.....	216	1,949	1,999	2,416	1920
1921.....	None.	1,614	253	2,371	1921
1922.....	None.	1,865	534	3,300	1922

Although it is known that some has been shipped abroad, no record of tungsten ore and concentrates (tungsten content) was kept until 1922, when "tungsten ore and concentrates (tungsten content)" were valued at \$594. These items include the ore except Chinese (considered as carrying 65 per cent of tungsten trioxide). Chinese ore imported has been considered as tungsten trioxide. Production plus imports minus estimated equivalent in ore of the exports. The apparent consumption is at best only an approximation. 1,000 pounds, valued at \$43,219. This evidently includes tungsten wire.