

MINER YEARBOOK

1908-1909 9



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N49771

WORLD REVIEW

Eire.—The small steel operations of the Irish Steel Co., Ltd., were not resumed until July 1946, when the first 35-ton open-hearth furnace was put into operation, and it was not until late in the year that indications showed that a substantial part of the capacity of 5,000 tons would soon be utilized.²

The scrap supply in Eire is protected by an export regulation which gives Irish industry the option of purchase on all scrap before it may be exported. Therefore, scrap producers must inform plants of scrap available, and if it is required by industry it cannot be exported. Opinions vary as to the quantity of scrap available in Eire. Some estimates are as high as 30,000 tons per year, while others indicate that Eire may have to import some scrap for future domestic requirements.

France.—It was reported in August that during the following 12 months France was to supply Belgium and Luxembourg with 15,000 tons of scrap iron from North Africa.³

Japan.—Previous to World War II, Japan used more than 50 percent scrap in its open-hearth furnaces. This requirement for scrap was covered by heavy imports from the United States and other countries. To make the Japanese industry less dependent on foreign sources for scrap the Japanese Government in 1937 and 1938 took steps to force the industry to increase the proportion of pig to scrap in the furnace charge. Consequently, the production of pig iron was increased from approximately 1,000,000 metric tons in 1932 to over 4,000,000 tons in 1942, and a goal was set for the use of 70 percent pig iron to 30 percent scrap in the furnace charge. The open-hearth mixture reached approximately 65 percent pig and 35 percent scrap by the end of the war.⁴

United Kingdom.—The supply of iron and steel scrap in the United Kingdom was adequate for most of 1946. However, during the last quarter of the year there were signs of a severe shortening of supplies. The Cleveland district, which had reported adequate supplies as late as October 1946, was having difficulty in supplying steel mills in the latter part of November and during December. Deliveries in South Wales also dropped off during the last 2 months of the year but had been satisfactory earlier. Suppliers seemed able to meet demands for scrap in the Birmingham district throughout the year. Consumers in the Midlands, Lancashire, and Yorkshire were using scrap as fast as it became available. The supply of the better grades of scrap in Scotland was becoming scarce at the close of the year.

¹ Iron Age, vol. 168, No. 14, Oct. 3, 1946, pp. 71-72.

² Metal Bulletin (London), No. 3116, Aug. 2, 1946, p. 18.

³ Iron Age, vol. 168, No. 16, Oct. 17, 1946, pp. 114-125.

Lead¹

By RICHARD H.

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GENERAL SUMMARY

LEAD production from domestic mines and, for the first time on record, the production of secondary lead. The demand for consumption continued to decline to an unprecedented 12.55 cents per pound. Primary production of lead and refined lead and base bullion declined to the lowest levels respectively. Total output of refined lead was 25 percent, and antimonial lead production was 15 percent. Imports of lead-bearing materials urgently needed to increase domestic mine output dropped to 10 percent. Outstanding among the many factors that retarded production this year were prolonged labor strikes in the refining industry; continued labor shortages, which reduced output at many producing plants; uncertain economic conditions; Office of Price Administration and ceiling on prices; and an unstable price structure during the month of January. The national railroad and coal-mine strikes, further retarded domestic lead production.

In contrast to the slump in the domestic lead smelter production of secondary lead—the heavy metal—increased 8 percent. Secondary lead recovery in 1946 exceeded primary lead production by 13 percent. Mine output of recoverable lead for the first time of refined lead, which declined 17 percent through provisions of Civilian Production Control Order M-38 and the general

¹ This report deals primarily with the smelting, refining, and casting of lead. For full details of domestic mining operations, see separate report.

obtain full allocations as allotted by the Civilian Production Administration.

The Government stock pile of refined lead was reduced to 45,493 tons at the end of 1946, approximately two-thirds of the quantity available for allocation at the beginning of the year. Stocks at primary smelters and refineries (physical inventory) gained 9 percent during 1946. Consumers' inventories declined 59 percent from 1945.

Coiling prices on virtually all commodities, including lead, were removed in November. Other Government controls of the lead industry that were revoked included removal of import restrictions (which had prevented public purchases of foreign lead), the 5-year-old General Preference Order M-38, Lead Chemical Order L-354, and Order L-355 pertaining to use of lead for manufacture of tetraethyl fluid.

Salient statistics of the lead industry in the United States, 1925-29 (average) and 1942-46, in short tons

	1925-29 (average)	1942	1943	1944	1945	1946
Production of refined primary lead:						
From domestic ores and base bullion...	660,525	467,367	408,544	394,443	356,535	293,309
From foreign ores and base bullion...	123,104	99,472	63,068	70,320	87,050	44,888
Recovery of secondary lead.....	783,629	566,839	460,612	464,763	443,585	338,197
Imports:	280,000	323,001	342,094	331,416	363,030	302,787
Lead in pigs, bars, and old.....	4,592	369,254	244,510	226,073	230,313	114,706
Lead in base bullion.....	95,747	43,855	4,583	58	8	125
Lead in ores and matte.....	40,096	79,302	69,945	93,570	70,006	44,407
Exports of refined pig lead ¹	98,048	5,814	13,261	15,523	1,784	700
Refined primary lead apparently shipped to domestic consumers.....	660,918	660,840	777,661	775,095	670,122	477,686
Estimated consumption of primary and secondary lead.....	900,260	1,043,000	1,113,000	1,118,643	1,061,602	956,476
Prices (cents per pound):						
New York:						
Average for year.....	7.47	6.48	6.50	6.50	6.50	8.11
Quotation at end of year.....	6.25	6.50	6.50	6.50	6.50	12.65
London average.....	5.87	4.49	4.40	4.49	4.09	8.63
Mine production of recoverable lead.....	604,230	400,230	453,313	416,861	390,831	335,475
World smelter production of lead.....	1,850,000	1,883,000	1,736,000	1,602,000	1,378,000	1,285,300

¹ Data include lead imported for immediate consumption plus material entering the country under bond.
² Includes 3,874 tons of foreign lead reexported in 1942, 11,268 tons in 1943, less than 1 ton in 1944, 377 tons in 1945, and 163 tons in 1946, according to records of the U. S. Department of Commerce.

Figure 1 shows trends in the domestic lead industry since 1900.

LABOR PROBLEMS

Most significant among the many labor problems confronting operators during 1946 were the widespread labor strikes at principal mines, mills, smelters, and refineries that paralyzed the industry during the first half of the year. Work stoppages began in Utah on January 21, when approximately 1,300 workers at the mining and smelting operations of the American Smelting & Refining Co. and the United States Smelting, Refining & Mining Co. went on strike following collapse of negotiations for increased wages. Strike conditions spread rapidly; and on February 25 workers in virtually every lead-mining, milling, and smelting operation of the American Smelting & Refining Co. joined in the dispute. Lead-zinc mining and milling

LEAD

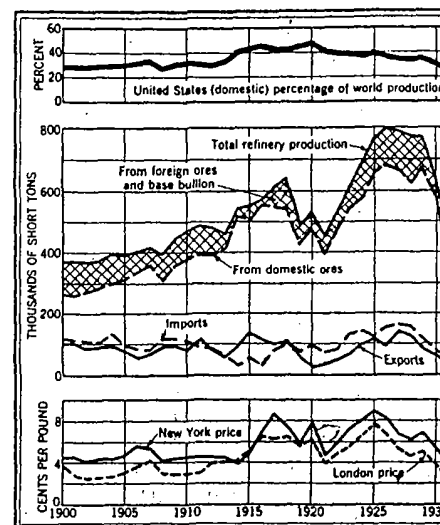


FIGURE 1.—Trends in the lead industry in the United States, 1900-1946. Data on lead exported in manufactures were from 1904-46.

operations of the Phelps Dodge Corp. at Phoenix, Arizona, were paralyzed by strike on March 20, along with certain operations in Texas, and New York copper mining and smelting. Although the smelter strikes did not materially reduce the Nation's large lead mines, many smelters' storage facilities and dependent upon price returns for operating expenses were forced to close strikes at lead mines, mills, smelters, and refineries. At the end of June, although one of brief duration, the strike of the St. Joseph Lead Co. in Michigan districts during the last week in October.

The shortage of mine and mill labor continued to limit domestic mine output during 1946, and to the mines of former employees who might have been paying wartime jobs fell far short of expected percentage of the labor supply that entered the war did not return to the mines and smelters. The manpower supply problem, however, was not expected to have improved somewhat by the end of the year.

GOVERNMENT REGULATIONS

Lead continued under Government control through provisions of Civilian Production Administration Order M-38. In operation, the order restricted lead for certain purposes but permitted consumption in essential uses. Several amendments to the year changing quotas (usually to a low

State	1925-29 (average)	1942
Western States and Alaska:		
Alaska.....	982	415
Arizona.....	9,743	14,772
California.....	2,070	5,151
Colorado.....	30,112	15,181
Idaho.....	141,610	113,936
Montana.....	18,871	20,060
Nevada.....	9,807	5,376
New Mexico.....	6,730	4,008
Oregon.....	0	23
South Dakota.....	21	85
Texas.....	213	181
Utah.....	149,508	71,930
Washington.....	1,323	4,881
Wyoming.....		3
Total.....	370,997	256,536
Central States:		
Arkansas.....	38	2
Illinois.....	552	2,344
Kansas.....	28,121	9,410
Kentucky.....	135	335
Missouri.....	202,240	199,548
Oklahoma.....	58,306	22,806
Wisconsin.....	1,745	775
Total.....	289,137	235,223
Eastern States:		
New York.....		2,434
Tennessee.....	250	238
Virginia.....	3,846	1,803
Total.....	4,096	4,475
Grand total.....	664,230	496,234

odge Corp. at Bisbee continued to be the largest Arizona lead producer in 1946; about 90 percent of the total lead was recovered from zinc-lead ore. Colorado production remained virtually unchanged; the California (Leadville) district continued to be the largest lead-producing area in the State. Zinc-lead ore yielded 54 percent of the total in 1946.

Mine production of recoverable lead in the United States, by districts that produced 1,000 tons or more during any year, 1942-46, in short tons

District	State	1942	1943	1944	1945	1946
Eastern Missouri region	Missouri	197,291	179,012	109,022	173,005	135,706
Idaho-Alene region	Idaho	106,474	89,813	70,813	63,430	50,548
State (Joplin region)	Kansas, Southwestern Missouri, Oklahoma	34,341	34,722	28,069	23,560	23,303
West Mountain (Bingham)	Utah	39,906	35,437	31,160	22,723	12,343
Arden (Bisbee)	Arizona	813	712	3,497	9,400	10,889
Rock City region	Utah	15,278	16,022	11,600	8,916	8,373
Idaho	California	755	2,448	2,609	5,214	7,708
Idaho	Arizona	1,801	3,140	4,161	5,216	4,731
Idaho (Leadville)	Colorado	3,348	4,950	5,762	5,010	4,441
Idaho (Leadville)	Virginia	1,661	1,700	4,235	4,222	4,381
Idaho	Utah	10,176	8,201	5,319	4,030	4,239
Idaho-Southern Illinois	Kentucky, Southern Illinois	2,546	2,199	2,048	2,649	3,687
Idaho	Nevada	2,704	2,942	4,066	2,987	3,493
Idaho Valley	Utah	3,988	3,505	3,283	3,137	3,490
Idaho	Colorado	2,124	2,657	2,236	2,613	3,207
Idaho	New Mexico	3,200	3,571	4,428	5,379	3,199
Idaho	Montana	2,290	2,350	2,430	3,175	2,648
Idaho San Miguel	Colorado	1,716	2,074	1,442	1,980	2,370
Idaho Valley (Butte)	Montana	7,206	3,200	3,261	2,870	2,357
Idaho (Sierritas, Papago, Twin Buttes)	Arizona	11	578	2,445	2,063	2,296
Idaho	Washington	4,553	4,581	5,278	3,506	2,224
Idaho (Rico)	Colorado	2,282	2,566	2,820	2,440	2,178
Idaho	Arizona	903	1,145	1,244	1,981	2,155
Idaho Mississippi Valley	Iowa, Northern Illinois, Wisconsin	908	1,004	1,508	2,261	1,861
Idaho	Idaho	3,783	3,635	3,333	2,347	1,649
Idaho	New Mexico	864	1,320	1,620	1,243	1,273
Idaho	California	4,044	2,938	1,800	1,192	1,233
Idaho	New York	2,434	2,355	1,644	862	1,073
Idaho	Arizona	6,132	3,406	2,212	1,066	692
Idaho	Colorado	2,240	1,761	1,444	672	690
Idaho	Idaho	1,644	1,481	2,069	1,302	553
Idaho	Montana	1,999	1,580	1,128	599	469
Idaho (Lewis and Clark County)	Idaho	1,988	2,389	1,364	223	463
Idaho	Arizona	1,050	1,302	784	752	309
Idaho	Montana	1,025	509	500	438	340
Idaho	Utah	1,023	1,401	305	115	336
Idaho	Idaho	1,044	316	15	61	44
Idaho	Montana	1,712	1,033	56	57	32

* Includes production from Smelter district in Utah; Bureau of Mines not at liberty to publish separate figures.

A study of the monthly mine-output figures since January 1941 discloses production trends that are obscure in the annual figures. Output from April through December 1941 remained fairly constant, with a stabilized price of 5.85 cents per pound, New York. Production increased sharply in January 1942, however, as a result of Government action January 13, which established the ceiling price of lead at 6.50 cents, New York. Peak monthly output of 45,305 short tons was reached in March. Labor shortages at mines, mills, and smelters developed rapidly thereafter owing largely to the lure of high wages in Government construction projects and expanded war industries and to the absorption of personnel by the armed forces. Despite an

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Army furlough in October 1942 of 4,000 so mines and the financial assistance available provisions of the Government's Premium Pay effective February 1, 1942, mine production without exception, through the remainder of 3 years. Production declined even more in the first half of 1946 as a result of widespread for 1933, the domestic mine output in June was monthly production of any year since the beginning in 1907.

Mine production of recoverable lead in the United States, by month, 1941-46, in short tons¹

Month	1941	1942	1943
January	37,627	44,182	37,627
February	37,627	42,940	37,627
March	37,627	45,305	40,423
April	38,197	44,318	39,078
May	38,078	43,301	37,627
June	38,090	42,238	36,829
July	36,829	41,770	36,829
August	36,829	39,821	36,829
September	37,769	37,834	37,769
October	39,503	35,191	39,503
November	40,423	37,065	40,423
December	41,775	39,268	41,775
Total	461,426	426,239	463,426

¹ Monthly data for 1941-44 were based largely on smelter receipts, which are actual mine output. All monthly figures have been adjusted to final figures.

² Monthly average for first quarter; actual monthly figures not available.

The 25 leading lead-producing mines in the United States, listed in the following table, yielded 67 percent of the total lead output; the 6 leading mines produced 33 percent of the total output; the 6 leading mines produced 50 percent of the total output.

Detailed information on the production of lead in the United States may be found in the chapters on the production of gold, silver, copper, and zinc with the mine production of gold, silver, copper, and zinc in the various States.

SMELTER AND REFINERY PRODUCTION

Pig lead in the United States is derived from domestic mine production, imports of foreign lead, and secondary smelter output from scrap metal at primary plants that treat ore, base bullion, and scrap and at secondary plants that produce pig lead. Of the eight primary smelters operating in the United States, two (Selby, Calif., and Bradley, Idaho) produce refined lead. The other six plants produce only base bullion, which is approximately 98 percent lead plus gold, silver, and antimony recovered from the ore smelted, which is then refined in the Middle Western and Eastern States for sale as pig lead and purification of the lead to meet the requirements of the various industries. Both primary and secondary smelters

25 leading lead-producing mines in the United States in 1946, in order of output

Rank	Mines	District	State	Operator	Type of ore
1	Federal Lead	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead
2	DeSage	do	do	do	Do.
3	DeSage Terre	do	do	do	Do.
4	United States and Lark	do	do	do	Do.
5	Copper Queen	West Mountain (Bingham)	Utah	U. S. Smelting, Refining & Mining Co.	Zinc-lead
6	Bunker Hill and Sullivan	Warren (Bisbee)	Arizona	Phebe Dodge Corp.	Do.
7	Darwin group	Yreka	Idaho	Bunker Hill & Sullivan Mining & Concentrating Co.	Do.
8	Mine La Motte	Coso	California	Anaconda Copper Mining Co.	Do.
9	Page	Southeastern Missouri	Missouri	St. Joseph Lead Co.	Lead
10	Star	Yreka	Idaho	Federal Mining & Smelting Co.	Zinc-lead
11	Stumpp-Collins	Hunter	Arizona	Sullivan Mining Co.	Do.
12	Old Hat	do	do	St. Anthony Mining & Development Co.	Do.
13	Burns	do	Idaho	St. Anthony Mining Co.	Do.
14	Wynne	do	Idaho	St. Anthony Mining Co.	Do.
15	Wynne	do	Idaho	St. Anthony Mining Co.	Do.
16	Wynne	do	Idaho	St. Anthony Mining Co.	Do.
17	Wynne	do	Idaho	St. Anthony Mining Co.	Do.
18	Wynne	do	Idaho	St. Anthony Mining Co.	Do.
19	Wynne	do	Idaho	St. Anthony Mining Co.	Do.
20	Wynne	do	Idaho	St. Anthony Mining Co.	Do.
21	Wynne	do	Idaho	St. Anthony Mining Co.	Do.
22	Wynne	do	Idaho	St. Anthony Mining Co.	Do.
23	Wynne	do	Idaho	St. Anthony Mining Co.	Do.
24	Wynne	do	Idaho	St. Anthony Mining Co.	Do.
25	Wynne	do	Idaho	St. Anthony Mining Co.	Do.

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refined lead or antimonial lead. Because hard lead—such as battery scrap—melts the output from this type of operation is alloys. Statistics on the production of secondary plants are given in the Second chapter. The 16 primary smelters and refineries in the United States in 1946 consumed 353,197 short tons of lead ore and concentrates, 12 percent of which was refined lead compared with 454,778 tons in 1945, 19 percent of which was refined lead.

ACTIVE LEAD SMELTERS AND REFINERIES

Primary lead smelters and refineries operating in 1946 were as follows:

California: Selby—Selby plant, American Smelting and Refining Co. (refinery).
 Colorado: Leadville—Arkansas Valley plant, American Smelting and Refining Co. (smelter).
 Idaho: Bradley—Bunker Hill Smelter (smelter and refinery).
 Illinois: Alton—Federal plant, American Smelting and Refining Co. (refinery).
 Indiana: East Chicago—International Smelting & Refining Co. (refinery).
 East Chicago—U. S. S. Lead Refinery, Inc. (refinery).
 Kansas: Galena—Galena plant, Eagle-Picher Co. (refinery).
 Missouri: Herculaneum—Herculaneum plant, St. Joseph Lead Co. (refinery).
 Montana: East Helena—East Helena plant, American Smelting and Refining Co. (smelter).
 Nebraska: Omaha—Omaha plant, American Smelting and Refining Co. (refinery).
 New Jersey: Carteret—United States Metals Refining Co. (refinery).
 Texas: El Paso—El Paso plant, American Smelting and Refining Co. (refinery).
 Utah: Midvale—Midvale plant, United States Smelting and Refining Co. (smelter).
 Murray—Murray plant, American Smelting and Refining Co. (refinery).
 Tooele—Tooele plant, International Smelting and Refining Co. (refinery).

REFINED LEAD

Primary refineries in the United States produced 462,110 tons of refined lead, a decline of 25 percent from 612,000 tons in 1945.

Of the 338,197 tons of primary lead produced in 1946, 87 percent was refined lead and 13 percent was base bullion. In 1945, 87 percent was refined lead and 13 percent was base bullion. The quantities of refined lead produced from foreign base bullion has been reported in the following tables give the production of refined lead from foreign base bullion. Details of the country of origin of the ore. Details of the domestic ores are given in the Mine Production chapter.

Refined lead produced at primary refineries in the United States, by sources, 1942-46, in short tons

Source	1942	1943	1944	1945	1946
Refined lead:					
From domestic ores and base bullion.....	467,367	406,644	394,443	356,535	293,309
From foreign ores.....	81,485	62,936	70,225	86,932	44,790
From foreign base bullion.....	17,987	132	95	118	98
Total from primary sources.....	566,839	469,612	464,763	443,585	338,197
From scrap.....	12,856	1,863	11,368	18,526	8,013
Total refined lead.....	579,695	471,475	476,131	462,110	346,210
Average sales price per pound.....	\$0.083	\$0.064	\$0.064	\$0.064	\$0.084
Total calculated value of primary refined lead.....	\$71,422,000	\$60,110,000	\$59,490,000	\$50,778,880	\$56,817,096

¹ Excludes value of refined lead produced from scrap at primary refineries.

Refined primary lead produced in the United States, by country of origin, 1942-46, in short tons

Source	1942	1943	1944	1945	1946
Domestic ore and base bullion.....	467,367	406,644	394,443	356,535	293,309
Foreign ore:					
Australia.....	19,638	16,180	22,210	22,087	7,534
Canada.....	5,980	4,837	7,461	11,161	5,026
Europe.....	14	2,213	5,250	3,097	2,056
Mexico.....	2,403	9,610	13,434	25,701	11,344
South America.....	23,127	30,396	21,870	24,896	18,830
Other foreign.....	30,323				
Total.....	81,485	62,936	70,225	86,932	44,790
Foreign base bullion:					
Australia.....	16,902		58	63	10
Mexico.....	111	60	37	55	88
South America.....	216	72			
Other foreign.....	758				
Total.....	17,987	132	95	118	98
Total foreign.....	99,472	63,068	70,320	87,050	44,888
Grand total.....	566,839	469,612	464,763	443,585	338,197

ANTIMONIAL LEAD

Antimonial lead production at primary refineries dropped to 50,480 tons in 1946, 11 percent under the 1945 output. The distribution of the lead, according to source, is shown in the following table. The quantity of antimony contained in antimonial lead produced in 1946 dropped to 6.5 percent owing to a greater demand for low-percentage alloys for use in the manufacture of such items as type metal, cable covering, sheet and pipe, and collapsible tubes and foil. Although antimonial lead is an important byproduct of the refining of base bullion, the quantity derived from this source is only a small part of the annual domestic output. The major production is recovered from the smelting of antimonial lead scrap at secondary smelters. Production data from lead-smelting plants treating scrap materials exclusively are summarized in the following section and discussed in detail in the Secondary Metals—Nonferrous chapter of this volume.

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Antimonial lead produced at primary lead refineries

Year	Production (short tons)	Antimony content	
		Short tons	Percent
1942.....	51,762	3,524	6.8
1943.....	63,615	3,371	5.3
1944.....	57,902	4,670	8.1
1945.....	56,495	4,148	7.3
1946.....	50,480	3,285	6.5

SECONDARY LEAD

Some scrap lead is treated at primary refineries; the greater part is received at a large secondary materials exclusively. Secondary form of refined lead, antimonial lead, and primary and other plants in 1942-46 is shown. Secondary lead recovery in 1946 exceeded primary lead production by 13 percent. Details of mine output of recoverable lead for the first details appear in the Secondary Metals—Nonferrous volume.

Secondary lead recovered in the United States

	1942	1943
As refined metal:		
At primary plants.....	12,856	1,863
At other plants.....	55,746	56,459
Total.....	68,602	58,322
In antimonial lead:		
At primary plants.....	11,561	32,887
At other plants.....	158,998	144,040
Total.....	170,559	176,927
In other alloys.....	83,840	108,845
Grand total:		
Short tons.....	323,001	342,094
Value.....	\$40,698,100	\$43,788,000

LEAD PIGMENTS

The principal lead pigments are litharge, red lead, leaded zinc oxide, and orange lead, manufactured for the most part from metallic lead. These materials are converted directly to pigments. Details of lead pigments are given in the Lead—Nonferrous chapter of this volume.

CONSUMPTION AND

A survey of 575 plants in 1946 represents the consumers of refined lead indicated by 530,588 short tons of refined lead, a decrease of 10 percent. Some secondary as well as primary refined

figure. Antimonial lead, unrefined scrap lead, and lead in alloys are excluded. Of the total consumed, 24 percent was used for making red lead and litharge; 13 percent for cable covering; 11 percent for storage batteries; 9 percent for tetraethyl fluid; 8 percent for white lead; 6 percent for solder; 5 percent for pipes, traps, and bends; 5 percent for sheet lead; 3 percent for ammunition; and 16 percent for a variety of products and uses shown in the following table. A distribution of the total consumed by related uses indicates 51 percent consumed for metallic products, 32 percent for pigments, 11 percent in chemical products, and 6 percent in miscellaneous uses, such as annealing, galvanizing, lead plating, and weights and ballast.

Reports to the Civilian Production Administration indicated a consumption of 956,476 tons of primary, antimonial, and secondary lead in 1946 compared with 1,051,602 tons in 1945.

Consumption of refined lead in the United States, 1942-46, by uses, in short tons

	1942	1943	1944	1945	1946
Ammunition.....	48,035	64,023	31,479	29,315	16,857
Bearing metals.....	8,460	10,189	15,941	14,104	11,012
Brass and bronze.....	6,294	6,748	7,845	7,099	5,328
Cable covering.....	128,535	117,802	110,417	88,158	60,004
Calking lead.....	9,047	8,618	9,411	13,374	8,314
Casting metals.....	3,108	3,072	4,425	5,322	3,695
Collapsible tubes.....	9,968	11,425	12,482	7,428	7,189
Foil.....	9,359	5,816	11,190	2,185	2,143
Pipe, traps, and bends.....	21,411	18,724	24,387	24,001	27,372
Sheet lead.....	31,700	27,738	31,545	30,624	26,430
Solder.....	13,371	15,472	22,390	27,475	32,279
Storage batteries.....	62,604	68,239	68,750	60,179	56,726
Terneplate.....	2,335	815	2,190	2,178	1,526
Type metals.....	943	812	1,269	1,401	1,487
White lead.....	55,475	36,809	54,333	35,611	43,294
Red lead and litharge.....	100,563	124,715	157,080	157,171	129,513
Tetraethyl lead.....	50,152	65,320	83,007	75,890	47,065
Chemicals and insecticides.....	8,298	8,172	10,703	8,557	8,169
Annealing.....	5,229	5,987	5,719	5,525	5,514
Galvanizing.....	484	819	1,073	988	1,132
Lead plating.....	(1)	941	494	1,130	1,182
Weights and ballast.....	(1)	9,269	22,954	9,539	3,089
Other.....	33,746	64,940	33,646	32,205	22,497
Total.....	607,111	675,405	722,820	637,490	530,688

¹ Included under "Other".

The following table shows the calculated apparent shipments of refined primary lead to domestic consumers. The apparent shipments of 477,686 tons in 1946 are probably more nearly correct than the actual receipts of 459,502 tons reported by consumers, because of incomplete coverage of the survey.

LEAD

Apparent shipments, of refined primary pig lead to domestic consumers, in short tons

	1942	1943
Supply:		
Stocks at primary refineries on Jan. 1.....	12,000	30,248
Government-owned stocks on Jan. 1 ¹	17,934	248,460
Production.....	566,839	466,244
Imports.....	366,497	244,000
Total available.....	963,270	1,008,952
Withdrawn:		
Stocks at primary refineries on Dec. 31.....	39,255	30,248
Government-owned stocks on Dec. 31 ¹	248,361	173,173
Exports ²	5,814	13,173
Total withdrawn.....	293,430	222,594
Apparent shipments to domestic consumers.....	669,840	786,358

¹ Estimate based upon American Bureau of Metal Statistics data.
² Revised figure.

³ According to reports submitted to the Tin-Lead-Zinc Division of the Bureau of Metal Statistics.

⁴ Includes 3,874 tons of foreign refined lead reexported in 1942, 11,253 tons in 1943, and 103 tons in 1946, according to records of the U. S. Bureau of Metal Statistics.

STOCKS

Producers' Stocks.—Lead stocks, as reported by the Bureau of Metal Statistics, are shown in the following table. Stocks of refined and antimonial lead include metal in the hands of refiners and by some of the refiners of secondary lead, plus foreign lead smelted and refined in the United States and entered for domestic consumption. Reports released by the American Bureau of Metal Statistics show that refined lead and antimonial lead declined from 51,929 tons in February to a low of 31,396 tons in March. Stocks advanced steadily to a year-end total of 11 percent from January 1.

Lead stocks at end of year at smelters and refineries in short tons

	1942	1943
Refined pig lead.....	28,815	28,815
Antimonial lead.....	6,122	4,122
Total.....	34,937	32,937
Lead in base bullion—		
At smelters and refineries.....	7,359	8,359
In transit to refineries.....	1,708	3,708
In process at refineries.....	13,925	16,925
Total.....	22,992	29,000
Lead in ore and matte and in process at smelters.....	59,247	68,247
Grand total.....	117,174	130,182

Consumers' Stocks.—Approximately 575 consumer plants reported stocks of 41,914 tons of domestic and foreign refined lead on hand December 31, 1946, a 59-percent decrease from the 102,937-ton inventory (revised figure) reported at the end of 1945.

	Domestic and foreign					Foreign (all grades)
	Corrod- ing	Chemical	Com- mon	Other	Total	
Dec. 31, 1945 ¹	33, 428	22, 040	46, 277	1, 192	102, 937	4, 264
Dec. 31, 1946.....	10, 693	9, 856	18, 777	2, 688	41, 914	2, 986

¹ Revised figures.

PRICES

Announcement by the Office of Price Administration of a higher ceiling price for lead, effective January 1, 1946. The established 6.50-cents-a-pound base price was increased to 7.50 cents. This new price level, although well below that necessary to effect a prompt reduction in shortage, was considered by industry spokesmen as below that necessary to effect a prompt reduction in shortage. A bill to extend the OPA in modified form was introduced by the President on June 29, and on July 2 the House passed it at 9.50 cents per pound, New York. With rapid legislative action on July 25, the former law was restored and prevailed until November 1, 1946. On the day the Price Administrator's decontrol order, which eliminated all of ceiling prices from all metals. The limitations and stimulated by brisk consumer demand. The inadequate supply, responded swiftly to the situation. On October 11 lead was quoted at 10.50 cents, New York. In response to lead import restrictions by the Civilian Control Administration on November 18, the price advanced to 11.80 cents. It raised the market price to the prevailing international price and duty charges. On December 16 domestic lead was priced at the price to 12.55 cents, New York, the highest previous record high, which prevailed for a period of time. It was 12.25 cents, New York.

The general policy of the Quota Com Premium Price Plan for overquota mine pr (copper and zinc were also included) pre collapsed with the expiration of OPA and Upon reestablishment of the OPA in late for retroactive premium payments to cover was in effect. The Premium Price Plan w 1947, under the same terms as in the past in the subsidy section of the bill extending that "adjustments shall be made to en development work and adequate allowan depletion." The bill further provided tha were noncancelable unless necessary in c adjustments of income to specific mines. metal price ceilings on November 9, subs aided by the Premium Price Plan were monthly market quotations as a base. A data showing production of lead under t 1943-46, at the various quota levels and th in the accompanying table.

The official London maximum price of £3 for Empire and foreign soft lead, fixed by Supply June 11, 1945, was advanced to £3 subsequent price advances during the year occurred when quotations rose to £45 and £55, respectively. The maximum price for soft lead remained unchanged the balance of the year per long ton beginning January 1, 1947. The Metal Exchange, discontinued at the outbreak of 1939, were not resumed during 1946.

LEAD

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¹ Production of Tri-State lead from Office of Metals Reserve, Joplin, Mo.; all other from Bureau of Mines monthly reports. These data are preliminary and do not exactly equal annual totals for the United States except for 1945.

¹ January-October. "A" and "B" quotas and premium payments for November and December are not separable by kinds and are shown with data footnoted 4.

⁴ Total "A" and "B" quotas and premium payments for November and December; separation by kinds not available.

¹ Data on premium payments and Metals Reserve mine-contract payments from Office of Metals Reserve. All payments shown are subject to correction due to additional payments as a result of retroactive quota adjustments, late reports by smelters and custom mills, etc.

* All average prices shown include OPA ceiling price.

Average monthly and yearly quoted prices of lead at St. Louis, New York, and London, 1944-46, in cents per pound¹

	1944			1945			1946		
	St. Louis	New York	London ²	St. Louis	New York	London ²	St. Louis	New York	London ²
January.....	6.35	6.50	4.49	6.35	6.50	4.49	6.35	6.50	6.28
February.....	6.35	6.50	4.49	6.35	6.50	4.49	6.35	6.50	7.01
March.....	6.35	6.50	4.49	6.35	6.50	4.49	6.35	6.50	7.01
April.....	6.35	6.50	4.49	6.35	6.50	4.49	6.35	6.50	7.84
May.....	6.35	6.50	4.49	6.35	6.50	4.40	6.35	6.50	8.09
June.....	6.35	6.50	4.49	6.35	6.50	5.13	8.03	8.18	8.09
July.....	6.35	6.50	4.49	6.35	6.50	5.39	9.10	9.25	9.88
August.....	6.35	6.50	4.49	6.35	6.50	5.39	8.10	8.25	9.88
September.....	6.35	6.50	4.49	6.35	6.50	5.39	8.10	8.25	9.88
October.....	6.35	6.50	4.49	6.35	6.50	5.39	10.29	10.44	9.88
November.....	6.35	6.50	4.49	6.35	6.50	5.39	12.02	12.19	9.88
December.....	6.35	6.50	4.49	6.35	6.50	5.39	12.02	12.19	9.88
Average.....	6.35	6.50	4.49	6.35	6.50	4.99	7.06	8.11	8.63

¹ St. Louis: Metal Statistics, 1947, p. 501. New York: Metal Statistics, 1947, p. 495. London: F.&M.J. Metal and Mineral Markets.
² Average price of foreign lead, converted to cents per pound with the pound sterling at \$4.02½. Official maximum price raised on June 11, 1945; Jan. 15, 1946; April 8, 1946; and July 1, 1946.

FOREIGN TRADE²

Imports.—During 1946 imports of lead dropped to the lowest level since 1939 and were 68 percent below the record total of 1942. As in previous years, the greater part of the lead imported was in the form of pigs and bars, 48 percent of which came from Mexico and virtually all the remainder from Canada, Peru, Japan, and Australia. Receipts of lead in ore and matte, which constituted 28 percent of the total imports, were 37 percent under 1945, due largely to a sharp decline in imports from Australia, Peru, and Canada, which more than offset a moderate increase from Newfoundland. Imports of lead in ore and matte were principally from Newfoundland, Australia, Peru, Canada, and Bolivia, which together supplied 89 percent of these receipts. Imports of lead in base bullion—all from Peru—increased to 125 tons. Five countries supplied 88 percent of the total lead in all forms imported in 1946: Mexico 34 percent, Canada 18, Peru 13, Newfoundland 12, and Australia 11, compared with 54, 10, 16, 5, and 11 percent, respectively, for a total of 96 percent in 1945.

¹ Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

LEAD

Total lead imported into the United States in ore, matte, base bullion, and reclaimed, 1942-46, by countries, in short tons

Country	1942	1943	1944	1945	1946
Ore and matte:					
Africa.....	3,879	16,438			
Argentina.....	4,582				
Australia.....	20,997	10,743			
Bolivia.....	1,382	6,934			
Canada.....	7,487	6,828			
Chile.....	3,166				
Mexico.....	2,358	2,931			
Newfoundland.....	23,951	13,473			
Peru.....	11,108	3,426			
Other countries.....	392	172			
Total.....	70,362	69,945			
Base bullion:					
Australia.....	42,900	3,846			
Mexico.....	56	639			
Peru.....	16	94			
Other countries.....	883	4			
Total.....	43,855	4,583			
Pigs and bars:					
Australia.....	83,362	8,994			
Canada.....	60,210	16			
Japan.....					
Mexico.....	192,044	214,865			
Peru.....	21,891	20,168			
Other countries.....					
Total.....	368,497	244,033			
Reclaimed scrap, etc.:					
Australia.....	1,396	348			
Canada.....	1,282	128			
Panama, Republic of.....	5				
Peru.....	57	1			
Other countries.....	7				
Total.....	2,767	477			
Grand total.....	492,471	319,038			

¹ Data include lead imported for immediate consumption plus material entering stock piles.

Lead imported for consumption in the United States, 1942-46

Year	Lead in ores, base bullion, and mattes, n. s. p. f.		Lead in base bullion		Pigs and bars		Sheets, and	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1942.....	87,377	\$5,715,251	48,589	\$4,285,425	387,693	\$32,328,330	20	\$28
1943.....	83,163	5,590,218	4,811	567,546	244,033	20,903,382	25	\$28
1944.....	100,846	6,755,269	73	7,046	223,379	22,793,430	40	\$28
1945.....	71,046	5,758,695	20	2,242	227,311	25,280,638	14	\$28
1946.....	28,377	3,056,111	20	2,302	100,820	14,205,962	24	\$28

¹ In addition to quantities shown (values included in total values), "reclaimed" follows—1942: 1,305 tons, \$137,393; 1943: 490 tons, \$56,158; 1944: 3,318 tons, \$298,196; 1945: 2,481 tons, \$194,913. Figures for 1942-46 include foreign lead received by stock piles.

Miscellaneous products, containing lead, imported for consumption in the United States, 1942-46

Year	Babbitt metal, solder, white metal, and other combinations containing lead			Type metal and antimonial lead		
	Gross weight (short tons)	Lead content (short tons)	Value	Gross weight (short tons)	Lead content (short tons)	Value
1942.....	971	274	\$86,096	245	210	\$10,631
1943.....	236	69	330,824	3,703	3,422	447,019
1944.....	60	43	15,368	7,562	7,174	954,265
1945.....	143	73	101,132	26,085	24,700	3,238,902
1946.....	187	72	211,122	1,740	1,494	220,046

Exports.—Total exports of pig lead in 1946 dropped to 42 percent of the 1945 total. Export restrictions imposed under the Export Control Act of 1940 remained in force throughout the year.

Lead exported from the United States, 1942-46

Year	Pigs and bars		Foreign lead exported in manufactures with benefit of draw-back (short tons)	Year	Pigs and bars		Foreign lead exported in manufactures with benefit of draw-back (short tons)
	Short tons	Value			Short tons	Value	
1942.....	1,940	\$285,354	26,258	1945.....	1,407	\$202,754	(¹)
1943.....	2,003	244,433	15,491	1946.....	597	105,457	(¹)
1944.....	16,523	2,073,145	20,237				

¹ Data not available.

Pig lead exported from the United States, 1942-46, by destinations, in short tons

Destination	1942	1943	1944	1945	1946
Countries:					
Brazil.....	51	779	450	406	281
Canada.....	2	0	5	8	40
Chile.....	18	7	23	215	2
China.....	5	51	34	25	49
Colombia.....	4	26	18	156	58
Cuba.....	15	9	9	14	11
Curaçao (N. W. I.).....					10
Czechoslovakia.....	7	5	8	32	17
Mexico.....	15	8	18	23	17
Panama, Republic of.....			642	267	10
Philippines, Republic of.....	224	6	14	14,314	96
Portugal.....	6	14	14,314	96	
Sweden.....	1,379	1,017	7	2	10
U. S. S. R.....	20	8	17	75	34
United Kingdom.....	194	70	77	128	44
Uruguay.....					
Venezuela.....					
Other countries.....					
Total.....	1,940	2,003	16,523	1,407	597
Continents:					
North America.....	135	80	80	273	170
South America.....	100	883	541	761	381
Europe.....	1,609	1,031	14,867	323	11
Asia.....	4	6	30	44	35
Africa and Oceania.....	2	3	5	6	(¹)

¹ In addition 3,874 tons of foreign lead were reexported in 1942, 11,258 tons in 1943, less than 1 ton in 1944, 377 tons in 1945, and 103 tons in 1946.

² Less than 1 ton.

LEAD

WORLD REVIEW

Foreign production of lead was a subject of during 1946 in the light of the world-wide shortage. Data on lead output for 1946 outside the United States is believed, however, that production was hampered by labor strikes, manpower shortages, and lack of output for 1946 to approximately 1,166,000 metric tons.

World production of lead, 1939-46, in metric tons

(Compiled by B. B. Mitchell)

Country	1939	1940	1941	1942	1943	1944	1945	1946
Argentina.....	13,978	12,864	18,021	20,700	22,700	22,700	22,700	22,700
Australia.....	238,298	256,129	239,052	255,409	255,409	255,409	255,409	255,409
Austria.....	10,187	8,202	8,879	8,787	8,787	8,787	8,787	8,787
Belgium.....	96,190	30,800	8,880	15,240	15,240	15,240	15,240	15,240
Burma.....	78,522	80,709	74,456	17,120	17,120	17,120	17,120	17,120
Canada.....	172,680	109,662	206,862	220,722	220,722	220,722	220,722	220,722
China.....	407	1,210	1,405	1,400	1,400	1,400	1,400	1,400
Czechoslovakia.....	5,000	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
France.....	42,881	25,577	23,220	12,462	12,462	12,462	12,462	12,462
Germany.....	175,500	167,100	163,000	140,100	140,100	140,100	140,100	140,100
Greece.....	4,926	1,250	800	2,300	2,300	2,300	2,300	2,300
Guatemala.....	16	(¹)	95	110	110	110	110	110
Hungary.....	90	110	4,540	4,810	4,810	4,810	4,810	4,810
Indochina, French.....	5	8	3	2	2	2	2	2
Italy.....	88,818	30,909	36,993	28,771	28,771	28,771	28,771	28,771
Japan.....	18,261	27,748	30,585	26,919	26,919	26,919	26,919	26,919
Korea (Chosen).....	7,957	7,630	10,000	11,900	11,900	11,900	11,900	11,900
Mexico.....	212,675	191,980	161,167	192,986	192,986	192,986	192,986	192,986
Northern Rhodesia.....	183	293	378	1,118	1,118	1,118	1,118	1,118
Norway.....	821	123	39					
Peru.....	24,310	31,131	32,871	37,916	37,916	37,916	37,916	37,916
Poland.....	25,000	23,000	25,000	(¹)	(¹)	(¹)	(¹)	(¹)
Romania.....	5,684	49	258	154	154	154	154	154
South West Africa.....	4,283	690	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Spain.....	25,991	45,991	46,865	41,149	41,149	41,149	41,149	41,149
Sweden.....				230	230	230	230	230
Tunisia.....	22,930	26,620	15,679	8,210	8,210	8,210	8,210	8,210
Union of South Africa.....	11	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
U. S. S. R.....	74,800	75,000	90,000	100,000	100,000	100,000	100,000	100,000
United Kingdom.....	16,888	13,813	8,097	5,483	5,483	5,483	5,483	5,483
United States (refined) ¹	404,257	468,675	494,125	497,908	497,908	497,908	497,908	497,908
Yugoslavia.....	10,552	32,949	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Total.....	1,733,000	1,766,000	1,722,000	1,708,000	1,708,000	1,708,000	1,708,000	1,708,000

¹ By countries where smelted but not necessarily refined. Data derived from the League of Nations and from the American Bureau of Metal Statistics.

² Approximate production.

³ Data not yet available; estimate by author of chapter included in this yearbook.

⁴ Exclusive of secondary material. Beginning in October 1939 in the Metallgesellschaft, Frankfurt on Main.

⁵ Includes Northern Territories and Sub-Carpathia; in addition to Hungary and Transylvania; and beginning in 1942 includes Southern Territories.

⁶ January to June, inclusive.

⁷ Preliminary data.

⁸ South Korea only.

⁹ Figures cover lead refined from domestic and foreign ores; refined lead not included.

¹⁰ Estimated by author of chapter.

Argentina.—Lead production in Argentina, considerable importance, as it supplies domestic and substantial surplus of lead concentrates for export. Smelting facilities in Argentina, several thousand tons of lead concentrates are imported each year from Bolivia. The Co. smelter at Puerto Vilelas, Bolivian ore, concentrates from the Aguilar district, Provincia Minera Aguilar, S. A., subsidiary of the

supplied virtually all the Argentine mine output of lead in 1946 from its property at Tres Cruces in the Aguilar district. The mine operated at approximately 60 percent capacity during most of the year owing to a persistent shortage of railroad rolling stock, which prevented adequate shipments of fuel oil, mine timber, and miscellaneous supplies to the mine and the movement of concentrates therefrom. The production of lead concentrates at the Aguilar mine in 1946 was 22,031 metric tons compared with 22,022 tons in 1945.

Australia.—During 1946 the Zinc Corp., Ltd., treated 448,037 tons of ore, from which 79,313 tons of lead concentrates were recovered, compared with 425,542 tons and 81,490 tons, respectively, in 1945. At the New Broken Hill Consolidated property, adjoining the Zinc Corp. on the south and managed by that company, ore output was increased from 3,468 tons in 1945 to 41,723 tons in 1946. Lead concentrate production increased tenfold to 3,851 tons.

The Lake George Mining Corp., Ltd., at Captain's Flat, New South Wales, produced 135,244 tons of ore in 1946, from which 12,599 tons of lead concentrates were recovered. Ore reserves at the year's end were estimated at 1,382,753 tons assaying 1.1 dwt. gold and 1.44 ounces of silver per ton, 7.24 percent lead, 12.35 percent zinc, and 0.68 percent copper.

A shortage of skilled labor and lagging development work were named by the Electrolytic Zinc Co. of Australasia as the principal factors limiting mine output in the year ended June 30, 1946. Mine production totaled 118,343 tons assaying 1.96 dwt. gold and 6.89 ounces of silver per ton, 18.92 percent zinc, 5.64 percent lead, and 0.53 percent copper, from which about 7,400 tons of lead concentrates containing 59 percent lead were recovered.

Austria.—Lead-zinc ore averaging 11 percent lead and 5 percent zinc was produced at the Bleiberg mine, 30 miles west of Klagenfurt in Carinthia. No ore was produced in 1945 following the German surrender in May, but 34,000 metric tons were mined in 1946. The production of lead and zinc concentrates was estimated at 1,400 and 1,500 tons, respectively. Refined lead is produced at Bleiberg in quantities sufficient to meet normal domestic requirements.

Bolivia.—Exports of lead concentrates totaled 9,297 short tons in 1946, a decline of 11 percent from the quantity shipped in 1945.

Burma.—No production was recorded from the Bawdwin mine of the Burma Corp., Ltd., in 1946. The company proceeded with salvage operations and rehabilitation of installations destroyed during the Japanese occupation. The mill at Namtu was completely wrecked by the Japanese; but the smelter, also at Namtu, was only slightly damaged. The hydroelectric plant at Mansam Falls, about 25 miles from Namtu, one of four originally operated by the company, was restored to provide power for unwatering operations at the mine. Officials of the Burma Corp., Ltd., indicated late in 1946 that the possibility of full-scale production at the Bawdwin mine before mid-1949 appeared unlikely. Factors delaying the resumption of mining and smelting operations were the uncertain political situation in Burma; the limited ore reserves remaining at the property; current high cost of operations; and the major construction necessary to restore railway communications with Rangoon.

Canada.—Although lead production increased in 1946, the level of output remained considerably below the peak in 1942. At Trail, British Columbia, the Consolidated Mining & Smelting Co., which operates the Trail lead smelter and electrolytic lead refinery, was the principal source of Canadian lead production. Production at the Trail smelter increased to 165,744 tons in 1945. Ore reserves at the end of the year showed about 3 million tons, 25 percent of which was new reserves derived from recalculations of existing reserves made as a result of new geological studies. The company reported that 1946 reserves were greater than in April 1940, when production of new reserves was estimated to be sufficient for continued operation at the then existing rate of extraction. Construction was begun on a new underground chamber near the center of the mine, a 4-mile haulage way (which will be used to return waste rock for backfilling to the mill for preliminary treatment of the ore) by the method. Completion of these projects, which will cost about \$3,000,000, is anticipated by the summer of 1947.

Other producing mines in British Columbia, during a portion of the year by labor strikes, included the Monarch and Kicking Horse mines at Field, operated by the Monarch and Kicking Horse Mines, Ltd.; and the Zintcon Mines, Ltd.

The New Calumet Mines, Ltd., at Calumet, Illinois, produced 208,860 tons of ore, from which 3,860 tons of lead concentrates were recovered. All the lead concentrates produced were sold to Belgian smelters. Ore reserves on September 30, 1946, were estimated at 944,964 tons, assaying 5.46 ounces of gold per ton, 2.7 percent lead, and 9.2 percent zinc.

France.—Although French lead output in 1946 was only about one-third of that in prewar 1938, production was far short of requirements. The lack of coal and—to a lesser extent—of manpower continued to limit output.

Hungary.—Lead production in Hungary dropped to a level as a result of a treaty signed in 1946 that required the country to supply lead to Rumania. The increased output of lead in 1946 was due to the annexation of Transylvania August 2, 1940.

Italy.—Zinc-lead mines in Italy in 1946, produced 22,315 tons of ore, from which 22,315 tons of lead concentrates, averaging 62 percent lead, were made. Production was, however, owing to inability of smelters to obtain sufficient quantities of ore to treat all ore produced.

Japan.—Since 1925 the Japanese lead industry has been unable to meet the domestic lead requirements, and to rely heavily on imports of lead concentrates. From the latter part of 1931 until the middle of 1945, the Japanese government concentrated every effort on becoming self-sufficient in lead supplies. Despite the urgency for expanded mining in 1941, when virtually all sources of imports were cut off, the mines were unable to produce more than 20 percent of the requirements.

requirements. Partly refined lead from Korea and Manchuria filled another 20 percent of the needs, and the remainder was met by heavy withdrawals from stocks accumulated since 1934. Proved and probable ore reserves at the seven major zinc-lead producing mines, plus those of five other mines whose reserves are relatively large, total 18,660,000 metric tons averaging 1.4 percent lead and 6.5 percent zinc.

Salient statistics of the lead industry in Japan, 1940-45, in metric tons¹

	1940	1941	1942	1943	1944	1945
Mine production of recoverable lead.....	16,640	16,409	18,334	20,058	16,100	4,660
Smelter production of refined lead.....	27,748	30,585	26,919	32,511	38,048	12,568
Imports:						
Crude lead and concentrates.....	10,593	14,182	7,031	10,831	21,092	4,426
Refined lead.....	92,091	78,532	950	4,303	2,686	182
Exports of refined lead.....	1,294					
Apparent domestic consumption.....	118,545	109,117	27,869	36,904	40,634	12,750

¹ Natural Resources Section Report 65, Zinc-Lead Resources of Japan. General Headquarters, Supreme Commander for the Allied Powers, Tokyo, 1947.

Mexico.—Labor strikes, poor railroad facilities, and high taxes were the principal factors limiting Mexican lead output in 1946. On December 31, 1945, a general strike of Mexican mine and smelter labor, originally scheduled for December 17, shut off lead output until the end of February 1946, when new wage scales were established and the workers returned to their jobs.

During the year an increasing proportion of Mexican lead production was shipped to destinations other than the United States. Because of the disruption of European markets during the war, large tonnages of Mexican production were exported to the United States. With the end of hostilities, however, European buyers were again bidding for Mexican lead at prices which, during most of 1946, were considerably higher than the ceiling price in the United States. Data on Mexican foreign lead trade for the first half of 1946 indicate that over 90 percent of the domestic production was exported, approximately 17 percent going to Europe, 5 percent to Brazil, and 78 percent to the United States.

Production at the Minas de Guerrero lead-zinc property in the Taxco Mining district owned and operated by Minas de Guerrero, S. A., a subsidiary of the Eagle-Picher Co., was virtually halted at the end of the year owing to depletion of ore reserves and shortage of labor. The company plans to dismantle the 800-ton selective flotation mill—erected in 1943—and move it together with all mining equipment to the Esmeralda mine in the Parral district, State of Chihuahua.

Exploration by the American Smelting & Refining Co. at the San Antonio mine in the Taxco district during mid-1946 reportedly disclosed a substantial tonnage of silver-lead-zinc ore. If certain contiguous claims can be acquired, the company will dismantle its flotation mill at Pedregal and rebuild it into a larger plant at San Antonio.

Newfoundland.—In Newfoundland about 384,000 short tons of ore were mined and milled during 1946, providing 39,727 tons of lead concentrates containing approximately 22,670 tons of lead.

LEAD

Peru.—A continued shortage of labor and mine were largely responsible for the decline in production from 53,664 metric tons in 1945 to 45,320 in 1946.

The 800-ton-per-day flotation plant of the Compania Minera de Oroya Corp. treated copper ores exclusively until 1945, when it was converted to approximately equal tonnages of copper and lead. Part of the lead concentrates produced in 1946 was smelted at Oroya.

The Compania Minero de Sayapullo, financed by foreign capital, reopened the old mines at Sayapullo and Cajamarca. Exploration disclosed a substantial tonnage of zinc-silver-cadmium ore sufficiently large to justify the construction of a 100-ton-a-day flotation mill, which was put in operation in 1946.

The Banco Minero de Peru constructed a new plant at Huachacolpa in the Department of Lima to treat on a custom basis lead-zinc ores from the district.

Exploration by the Picasso Bros. at the property in the Castrovirreyna district of the Department of Arequipa developed enough ore (including old workings) to justify the construction of a 150-ton-a-day flotation mill.

Spain.—The mine production of lead concentrated in 1939 through 1946, in metric tons was as follows:

	1939	1940	1941	1942
Lead concentrates.....	31,700	57,800	46,300	45,320
Lead content.....	23,300	42,400	33,700	32,670

United Kingdom.—Consumption of pig lead in the United Kingdom totaled 193,506 long tons in 1945. Over-all consumption was 223,591 tons in 1945. Over-all consumption recovered from scrap, was 317,195 tons (of which 27 percent was used in cable covering, 16 percent in pipe; 16 percent in batteries; 16 percent in other uses; and 15 percent for battery oxide; and 15 percent for other uses).

Stocks of refined lead in the United Kingdom in 1946, totaled 24,300 long tons. Government stocks (excluding quantities at port or in transit) were 1,000 tons.

U. S. S. R.—Virtually no official production of lead was reported from the Russian lead industry during the war. In 1946, however, presented in the announced new 5-year plan indicated that lead output had increased in recent years. Most of the lead smelted in the U. S. S. R. is produced in Kazakhstan.

By HELENA M. MEYER AND ALETHEA W. MITCHELL

THE lead and zinc pigments industry had to contend in 1946 with a continuation of the unbalanced supply-demand relationship that prevailed in 1945 and several earlier years, despite the fact that 1946 was a full peacetime year. Demand for pigments as a whole was at near record levels; but shortages of essential crude materials, again notably lead and linseed oil, made it impossible for producers to fill a large segment of requirements. Labor strikes prevented the disparity from being even greater than it was. Strikes in chief pigment-consuming industries, such as the automobile industry, reduced potential demand by such industries, and steel and coal strikes interfered with construction and other activity that would have increased pigments requirements materially. Presumably the prospective demand cut off by strikes in 1946 was merely deferred, so that total pigment needs appear headed for new records in the near future. Various pigments probably will share unequally in supplying the demand, however. White lead production gains, for example, depend chiefly on improvement in over-all supplies of pig lead, whereas the present capacity output of titanium pigments will rise with the completion of plant expansion now in progress.

The stringent pigment-supply situation, accompanied by the removal of price controls in November, led to the highest prices in many years for pigments covered by this report—for lead pigments the highest prices ever recorded.

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Despite Government controls on the consumption of production through Government assistance and supplies to producers, continued releases from Government inventories, and the premiums for overquota production, as well as the plan, the lead shortage became more severe. This was due chiefly to mine and smelter strikes, year, to labor shortages throughout the year, development work for several years. Receipt of lead from abroad also dropped sharply in 1941; the other hand, were abundant as compared with domestic production was less affected by strikes and refined zinc compared much more favorably. Producers of pigments, however, were not short of metal when needed.

Shipments of the competitive titanium-pig a new high record again in 1946 but were inadequate to meet demand. Plant capacity, in process of expansion, is the connection with this product.

	1941	1942	1943
Production (sales) ¹ of principal pigments:			
White lead (dry and in oil).....short tons	113,000	83,639	70,167
Litharge.....do	122,280	91,513	113,091
Red lead.....do	53,838	48,369	53,378
Zinc oxide.....do	148,833	99,677	143,402
Leaded zinc oxide.....do	68,920	48,128	43,828
Lithopone.....do	176,642	137,320	135,723
Value of products:			
All lead pigments.....	\$46,572,000	\$39,393,000	\$41,897,000
All zinc pigments.....	39,210,000	30,785,000	38,260,000
Total.....	85,782,000	70,178,000	78,157,000
Value per ton received by producers:			
White lead (dry).....	\$147	\$160	\$103
Litharge.....	134	150	162
Red lead.....	161	171	171
Zinc oxide.....	125	138	137
Leaded zinc oxide.....	118	129	132
Lithopone.....	71	79	79
Foreign trade:			
Lead pigments:			
Value of exports.....	\$1,228,000	\$957,000	\$1,439,000
Value of imports.....	12,000	4,000	3,000
Zinc pigments:			
Value of exports.....	3,525,000	2,741,000	2,737,000
Value of imports.....	22,000	8,000	5,000
Export balance.....	4,719,000	3,686,000	4,168,000

¹ Data for basic lead sulfate in 1946 included under white lead; Bure
separately.

Chief among the outlets for pigments are storage battery, and rubber industries. Sales of lacquer materials (figures for which are compi-

nevertheless, produced satisfactory paints, varnishes, and lacquers, despite wartime shortages in oils, natural resins, and certain pigments. In doing so they deviated considerably from American practices.

Great attention was given to the question of making paints and enamels without, or with minimum quantities of drying oils by a paint-making concern with factories in Belgium and France.⁴ Residual gums obtained from the distillation of crude benzol and of light tar oils were tried. Three types of tar-oil distillation residues are resinol, resigum, and resilin. The article claimed that paints can be made with resigum without the addition of any natural drying oil but stated that such paints do not give as good a finish as normal paints.

The serious effect of shortages of crude materials, linseed oil in particular, on British exports of paints was pointed out in a recent report.⁵ The report stated that the prewar value of Britain's export trade in paints, varnishes, and related products was about £4,000,000 a year. "Present" raw material restrictions were likely to cause a drop to £500,000 or less for 1946.

Devices practiced by the French paint industry during enemy occupation were outlined⁶ in 1946.

PRODUCTION

Figures on sales have been used in this series of reports for many years as a better guide to activity in the pigments industry than production. Data on lead and zinc pigments produced from ores now are compiled by the Bureau of Mines on questionnaires for lead and zinc. Because lead and zinc schedules ask for shipments rather than sales, for uniformity the pigments schedule was changed to cover shipments. Available data made it appear that sales and shipments in 1945, the year of change, were little different. In reporting tonnages of pigments an attempt is made to avoid all duplication. One of the chief problems is that finished pigments frequently are blended to make another product. Basic lead sulfate and zinc oxide, for example, are blended to make leaded zinc oxide, and in this instance the pigment weights appear in the total for the last-named class only. Pigments consumed by producing companies to make products beyond those covered by this report—that is, paints, storage batteries, and other articles—are considered as shipments.

The value of lead and zinc pigments in 1946 totaled \$87,790,000, a 16-percent increase over 1945. Lead and zinc pigments each represented 50 percent of the total compared with 55 and 45 percent, respectively, in 1939.

LEAD PIGMENTS

Total lead-pigments shipments declined 4 percent in quantity in 1946 despite the fact that white lead (carbonate and sulfate) showed substantial gains over the low tonnages shipped for 1945. Contrary to their war records, red lead and litharge dropped in 1946, the drops more than offsetting white-lead increases. All pigments were affected adversely by the inability of pigment manufacturers to obtain ade-

LEAD AND ZINC PIGMENTS AND

quate supplies of pig lead, and the demand from satisfied. The value of lead pigments owing to first the easing and then the removal of Government Controls; the value was above that for 1939. Average values of lead were substantially in 1946, and by the end of the year at high rates never before attained.

Lead pigments shipped by domestic manufacturers

Pigment	1945		
	Short tons	Value (at place of origin)	
		Total	Average
Basic lead sulfate or sublimed lead:			
White.....	2,235	\$318,900	
Blue.....	1,660	237,890	
Red lead.....	47,381	7,063,888	
Orange mineral.....	230	59,906	
Litharge.....	138,798	20,566,070	
White lead:			
Dry.....	27,382	4,346,124	
In oil.....	23,788	5,562,118	

¹ Basic lead sulfate included under white lead (dry) in 1946; Bureau of Mines.

² Value of orange mineral included under red lead in 1946; Bureau of Mines.

³ Weight of white lead only but value of paste.

Lead pigments sold¹ by domestic manufacturers in short tons

Year	White lead		Basic lead or sublimed
	Dry	In oil	
1942.....	35,865	47,774	7,229
1943.....	30,525	30,042	4,752
1944.....	46,400	30,200	5,253
1945.....	27,382	23,788	2,235
1946.....	41,892	24,009	(?)

¹ Reported as shipped in 1945 and 1946.

² Basic lead sulfate included under white lead (dry) in 1946; Bureau of Mines.

ZINC PIGMENTS AND

The more favorable supply-demand relationship compared with lead, pointed out in the chapter continued and was accentuated in 1946. Shipments of leaded zinc oxide were second only to those in 1928 and 1929. Lithopon made a record in 1946 but were at a relatively low total value, zinc pigments were 21 percent above 1939. Average values for all products were higher owing to the October increases and to the removal of ceilings by the Government effective November 10.

⁴ Digested in Chem. and Met. Eng., vol. 53, No. 6, June 1946, p. 208.

⁵ Chemical Age, British Paints for Abroad: Vol. 55, No. 1429, November 16, 1946, p. 604.

⁶ Oil, Paint and Drug Reporter, Paint Technology in France During the Enemy Occupation: Vol. 180, No. 20, November 11, 1946, pp. 87-89.

Shipments of zinc chloride totaled 57,316 tons (50° B.), continuing at the high levels of the preceding 2 years. Zinc sulfate sales established a new high record for the second successive year.

Zinc pigments and salts shipped by domestic manufacturers in the United States, 1945-46

Pigment or salt	1945			1946		
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)	
		Total	Average		Total	Average
Zinc oxide ¹	127,955	\$17,708,705	\$138	157,851	\$22,660,450	\$144
Leaded zinc oxide ¹	62,598	8,290,073	132	67,971	9,604,007	143
Lithopone.....	136,161	10,645,310	78	147,001	11,840,590	81
Zinc chloride, 50° B.....	56,230	2,828,474	50	57,316	3,133,891	55
Zinc sulfate.....	20,854	1,712,068	82	24,931	2,192,706	88

¹ Zinc oxide containing 5 percent or more lead is classed as leaded zinc oxide. In this table data for leaded zinc oxide include a small quantity containing less than 5 percent lead.

Zinc pigments and salts sold¹ by domestic manufacturers in the United States, 1942-46, in short tons

Year	Zinc oxide	Leaded zinc oxide ²	Lithopone	Zinc chloride (50° B.)	Zinc sulfate
1942.....	99,677	48,128	137,320	52,374	14,331
1943.....	143,402	43,828	135,723	53,707	15,649
1944.....	140,676	64,395	142,905	57,645	17,156
1945.....	127,955	62,598	136,161	56,230	20,854
1946.....	157,851	67,971	147,001	57,316	24,931

¹ Reported as shipped in 1945 and 1946.

² Includes a small quantity containing less than 5 percent lead, 1943-46.

CONSUMPTION BY INDUSTRIES

WHITE LEAD

As was to have been expected, shipments of white lead (dry and in oil) rebounded in 1946 from the low levels for 1945. Owing to the stringent provisions of War Production Board chemicals order M-384, through which white lead (carbonate and sulfate) was called upon to bear the brunt of curtailment in the use of lead in 1945 (discussed in the report of this series for 1945), shipments of white lead (dry) in 1945 were the smallest since 1934 and of white lead in oil the smallest since considerably before the beginning of the present century. In 1946, for the first time, the Bureau of Mines is not at liberty to show data on basic lead sulfate separately and must combine them with figures on white lead in order that lead pigments totals may be published. White lead and basic lead sulfate shipments gained more in 1946 than the other products covered by this report. The increased tonnages could not fill the large demand for white lead pigments, however, and inadequate pig-lead supplies interfered with greater production. Both white lead carbonate and sulfate are used chiefly in paints, and 92 percent of the combined tonnage was so used in 1946.

LEAD AND ZINC PIGMENTS AND

A better break-down of the "Other" class produced a quantity shown under the "Paint" class. Use in ceramics in 1946 followed the uptrend in this purpose.

The facilities of the International Smelting Chicago, Ind., for the production of white lead purchased by the Eagle-Picher Co. in 1946.

Production of white lead (dry, included) amounted to 42,597 tons and of white lead (white lead in oil) were produced.

Distribution of white lead (dry and in oil) sales short tons

Industry	1942	1943
Paint.....	76,837	66,441
Ceramics.....	1,812	1,444
Other.....	4,900	8,282
	83,630	76,167

¹ Reported as shipments in 1945 and 1946.

² Data for basic lead sulfate in 1946 included under white lead; but separately.

BASIC LEAD SULFATE

Basic lead sulfate, along with lead carbonate by the provisions of Order M-384, as pointed series for 1945. Figures for 1946 cannot be are included under White Lead (dry). The was merely a gain over the smallest tonnage figures were published in 1902. This pigment The figures for shipments in the accompanying substantial tonnages used as an intermediate product of leaded zinc oxide. The basic lead sulfate included in this report in the quantities shown and not in the figures for basic sulfate.

Distribution of basic lead sulfate sales,¹ 1942-46,

Industry	1942	1943
Paints.....	7,733	4,802
Rubber.....	80	131
Storage batteries.....		3
Other.....	588	661
	8,410	5,597

¹ Reported as shipments in 1945 and 1946.

² Data for basic lead sulfate in 1946 included under white lead; but separately.

RED LEAD

The stringent supply situation in pig lead is a factor in the 31 percent drop in shipments of this pigment was far from met by supplies in

pigment had stayed at high levels throughout the war. Storage batteries and paints, by far the chief uses, both took much less red lead than in 1945, dropping 28 and 43 percent, respectively. Use of red lead in ceramics virtually doubled in 1946 and was at the highest rate since 1941, accounting, however, for only 4 percent of total shipments.

Production of red lead amounted to 29,874 tons in 1946 compared with 48,185 tons in 1945.

The value of red lead as a structural paint was recently described.⁷

See the discussion under Litharge for a recent report on German red lead practice.

Distribution of red lead sales,¹ 1942-46, by industries, in short tons

Industry	1942	1943	1944	1945	1946
Storage batteries.....	23,545	26,616	30,211	26,725	19,115
Paints.....	21,017	22,271	18,074	10,438	9,318
Ceramics.....	639	622	878	626	1,228
Other.....	2,868	3,869	4,809	3,692	2,865
	48,309	53,378	53,972	47,381	32,526

¹ Reported as shipments in 1945 and 1946.

ORANGE MINERAL

Shipments of the small-tonnage orange mineral were cut almost in half in 1946. Ink manufacture took 63 percent of the total.

Distribution of orange mineral sales,¹ 1942-46, by industries, in short tons

Industry	1942	1943	1944	1945	1946
Ink manufacture.....	93	49	56	63	78
Color pigments.....	7	8	205	151	16
Other.....	28	22	23	16	27
	128	79	284	230	123

¹ Reported as shipments in 1945 and 1946.

LITHARGE

Shipments of litharge fell 4 percent in 1946 from the peak rate established in 1945 but exceeded all earlier years except 1945 and the slightly lower 1944. The serious shortage of lead in 1946 had an important bearing on the lowered rate of production and shipments of litharge in 1946, because manufacturers of litharge were unable to fill demand for their product. Storage batteries took 5 percent less litharge than in 1945, accounting for 57 percent of the total shipments; the quantity used for batteries was exceeded only by the previous year. In addition to the litharge used to make batteries, the storage-battery manufacturers themselves produce from pig lead a black or suboxide of lead which they use as a substitute for litharge. The quantity produced in 1946—46,000 tons—was 18 percent below 1945, marking a considerably greater drop than was registered by litharge. Black oxide figures are not included in the Bureau of

⁷ Dunn, E. J., Jr., *Physical and Chemical Phenomena That Account for Red Lead's Metal Protective Ability*: Paint Industry Mag., vol. 56, No. 10, October 1946, pp. 340, 342, 344-348.

LEAD AND ZINC PIGMENTS AND

Mines totals for litharge. Insecticides, w in the face of gains for other uses, fell 21 p siderably more than the average. Shipme gained 14 percent in 1946 and were the la oil refining and the manufacture of varnis upward against the trend for total lith which ranked as the fourth most importan percent from 1945. Methods of producing yellow in Germany were recently discussed.

Litharge production totaled 133,266 ton 141,258 tons in 1945.

Distribution of litharge sales,¹ 1942-46, by i

Industry	1942	1943
Storage batteries.....	43,630	54,98
Insecticides.....	14,830	20,23
Ceramics.....	9,625	9,86
Chrome pigments.....	7,344	9,35
Oil refining.....	4,771	5,22
Varnish.....	3,423	3,45
Rubber.....	3,450	4,30
Linoleum.....	3,343	9
Other.....	4,187	5,57
	91,513	113,09

¹ Reported as shipments in 1945 and 1946.

The manufacture of red lead and litharge in a recent report.⁹

ZINC OXIDE

Shipments of zinc oxide (lead-free) gained the largest since 1929, and had been exceed of 1929 and 1928. All classes of use, excep in the larger tonnage; as before the war, none warfare in 1946. Consumption in rubber percent and took 53 percent of the total, 1942, when it also took 53 percent. Pai 1946 and were the largest since 1930. St lead in the past 3 years, owing to inadequat lead, have increased the calls for zinc oxide. Floor coverings and textiles made the smal A further break-down of this class was ma rayon took 73 percent of it in that year. any other use, as in 1945, gaining 78 percent lishing a new record. This use made the p war but, following the sharp gains in 1945 the same percentage of the total as in the

Production of lead-free oxide amounted with 139,374 tons in 1945. Of the total for by the American process from ores and pri

⁹ Office of Military Government for Germany (US), *Chrome Yellow*: Flat Final Rept. 811, May 13, 1946, 10 pp.

¹⁰ Office of Military Government for Germany (US), *Litharge and Lead Oxide*: Flat Final Rept. 811, May 13, 1946, 18 pp.

by the French process from metal and scrap, and 6 percent by other processes, compared with 77, 17 (revised), and 6 (revised) percent, respectively, in 1945.

The facilities of the International Smelting & Refining Co. at East Chicago, Ind., for the production of white lead and zinc oxide, were purchased by the Eagle-Picher Co. in 1946.

According to a recent statement,¹⁰ zinc pigments are now the most widely used of all white pigments and their use is increasing. The statement apparently refers to the United Kingdom or to some particular region, because titanium pigments rank first in the United States.

Distribution of zinc oxide sales,¹ 1942-46, by industries, in short tons

Industry	1942	1943	1944	1945	1946
Rubber.....	52,717	67,898	59,518	63,447	83,776
Paints.....	25,122	29,862	24,999	28,014	84,786
Coated fabrics and textiles.....	5,224	6,033	9,503	12,177	10,022
Floor coverings.....					2,848
Ceramics.....	2,034	3,203	3,653	5,086	9,050
Chemical warfare.....		21,801	27,686	2,053	
Other.....	13,680	14,016	15,256	17,178	17,364
	99,677	143,402	140,675	127,955	157,861

¹ Reported as shipments in 1945 and 1946.

² Of which 9,303 tons were for rayon.

LEADED ZINC OXIDE

Leaded zinc oxide shipments in 1946 were second only to those in 1941, being 1 percent below the peak year. It has been pointed out previously that this pigment's advantageous position during the war stemmed from the fact that it is made almost exclusively from ore rather than scarcer metal or scrap. Shipments of leaded zinc oxide for paint have been at high levels for several years, partly because of the diversion of business from other white pigments in smaller supply. This pigment continued to be used almost exclusively for paint. The figures for leaded zinc oxide include basic lead sulfate used in blending, as indicated under Basic Lead Sulfate.

Leaded zinc oxide production totaled 71,016 tons in 1946 compared with 62,519 tons in 1945. The totals can be broken down as follows (comparison with 1945 in parentheses): Over 5-35 percent lead, 59,564 (48,678) tons; over 35-50 percent, 7,150 (10,091) and a revised total of 10,057 for 1944) tons; and most of the remainder in 1946 was over 50 percent lead and in 1945 was 5 percent or less.

Distribution of leaded zinc oxide sales,¹ 1942-46, by industries, in short tons

Industry	1942	1943	1944	1945	1946
Paints.....	47,052	42,303	62,223	58,852	64,810
Rubber.....		42	119	200	100
Other.....	1,070	1,483	2,063	3,540	2,989
	48,122	43,828	64,306	62,598	67,971

¹ Reported as shipments in 1945 and 1946.

¹⁰ Metal Bulletin (London), No. 3142, November 8, 1946, p. 17.

LITHOPONE

The lithopone statistics in this report are ordinary lithopone sold as such plus the ordinary of the high-strength product. This method of conceal the operations of one company, which output of the high-strength product and has in some years. In 1946, as in 1945, two companies, produced high-strength lithopone. Sales increased 8 percent in 1946 and were the largest insufficient to supply total demand. Sales to rubber manufacturers took 64 percent more than for only 1 percent of the total. Separation of for floor coverings and textiles shows that 7,615 fabrics and textiles and 7,541 for floor coverings 5,150 and 10,671 tons respectively, in 1945. In down of statistics on floor coverings and textiles the actual break-down for 1945, therefore, more that for 1946 than is apparent. The use of manufacturers, which had been rising prior to 1945 the 1945 rate in 1946; it amounted to 3,011 tons in 1945 and contrasted with 6,488 tons reported for use in ink manufacture likewise continued relatively unchanged in 1946. The in 1944, 864 in 1945, and 830 in 1946. A ton making ink is regularly shown by one manufacturer from that sold for paint, but the tonnages given companies. Exports are included mainly under one company classifies part of its exports according to Plant capacity for the manufacture of lithopone total 157,000 tons in 1946.

Production of lithopone amounted to 148,900 tons in 1946, compared with 136,460 tons in 1945.

Distribution of lithopone sales,¹ 1942-46, by industries, in short tons

Industry	1942	1943
Paints, varnishes, and lacquers.....	109,216	103,860
Floor coverings and textiles.....	15,776	15,999
Rubber.....	1,047	1,078
Other.....	11,282	14,786
	137,320	135,723

¹ Reported as shipments in 1945 and 1946.

² Includes a quantity, not separable, used for printing ink.

Consumption of ordinary lithopone in the United States has trended downward almost continually since 1940. In 1940, 19,400 tons, was used in 1937. In 1946, 6,350 tons, was used for one purpose or slightly below one-third of the all-

lithopone figures in the following table are included in the totals for ordinary lithopone in the preceding table.

Titanated lithopone produced in the United States and ordinary lithopone used in its manufacture, 1942-46, in short tons

Year	Titanated lithopone produced	Ordinary lithopone used	Year	Titanated lithopone produced	Ordinary lithopone used
1942.....	11,700	9,900	1945.....	9,200	7,800
1943.....	9,800	8,400	1946.....	7,500	6,350
1944.....	9,800	8,300			

ZINC SULFIDE

In 1946, as in several earlier years, only one company produced zinc sulfide, and the Bureau of Mines is not at liberty, therefore, to publish figures for this pigment.

ZINC CHLORIDE

Shipments of zinc chloride, in terms of 50° B. solution, totaled 57,316 tons in 1946 compared with 56,230 tons in 1945. These figures include the zinc chloride equivalent of zinc ammonium and chromated zinc chloride produced. Complete figures covering distribution of zinc chloride shipments by uses are not available.

Production amounted to 57,088 tons in 1946 and 56,793 tons in 1945.

ZINC SULFATE

Zinc sulfate shipments established a new high record in 1946, for the second successive year, rising 20 percent above 1945. The curve of zinc sulfate shipments has increased sharply during the past 10 years or more, the total for 1946 being 171 percent above the average for the 5-year period, 1935-39. Agriculture led other uses by a substantial margin in 1946, taking 43 percent of the total, and displaced rayon, with 31 percent, which stood first in 1945. Both uses established new peak records in 1946, the former gaining 63 percent over 1945 and the latter, 13 percent. Chemicals, flotation reagent, and paints all dropped in 1946, the last being only 7 percent of the quantity reported in 1943. If a more complete break-down of the chemicals classification were practicable, some of the other classifications probably would be increased. Electrogalvanizing and the manufacture of glue showed substantial gains in 1946, the former taking the largest tonnage since 1941.

The dry weight of zinc sulfate shipments, by uses, was reported for the first time in 1945. In compiling data for 1946, the 1945 figures were found to require revision and necessary changes are covered in the accompanying table.

In 1946, 25,004 tons of zinc sulfate were produced, compared with 21,362 tons in 1945.

LEAD AND ZINC PIGMENTS AND ZINC SULFATE

Distribution of zinc sulfate sales,¹ 1942-46, by industry

Industry	1942	1943	1944	1945
	Gross weight	Gross weight	Gross weight	Gross weight
Agriculture.....	4,123	3,329	4,974	6,641
Rayon.....	3,149	4,537	5,954	6,721
Chemicals.....	2,595	1,642	1,459	2,811
Flotation reagent.....	355	1,282	1,131	1,231
Textile dyeing and printing.....	60	213	293	53
Glue.....	750	635	293	29
Electrogalvanizing.....	219	187	275	25
Paints and varnish processing.....	1,917	2,439	1,330	58
Other.....	1,163	1,385	1,737	1,991
	14,331	15,649	17,156	20,851

¹ Reported as shipments in 1945 and 1946.

² Revised figures.

PRODUCERS AND PLANTS

The report of this series for 1945 contained lead and zinc pigments and zinc salts of their classes of product. Since this list was prepared, zinc oxide facilities of the International Smelting and Refining Co., East Chicago, Ind., have been taken over by the

RAW MATERIALS USED IN MANUFACTURE OF LEAD AND ZINC PIGMENTS AND ZINC SULFATE

Figures covering the raw materials used in the manufacture of lead and zinc pigments and zinc sulfate were not available when the report of this series for 1945 was prepared. Data for 1945 are given below, and will appear in the next annual issue of this volume.

Lead pigments and zinc pigments and salts are made from a variety of materials, including ore, refined metal, and scrap. In 1945, 92 percent of the lead pigments were derived from pig lead and 8 percent from ore. Zinc pigments were derived from pig lead and 8 percent from ore. Lead pigments were used to make leaded zinc oxide, about 9 percent from ore and concentrates, 9 percent from slab zinc, and 2 percent from secondary materials; about 20 percent foreign.

The following tables give the source of the raw materials used in the manufacture of each pigment and salt. Pig lead is either directly or indirectly, in the manufacture of red lead, and orange mineral and is used also in the manufacture of basic lead sulfate. The lead content of leaded zinc oxide, which in turn was made from pig lead in the table. Zinc oxide is the most important raw material in the manufacture of considerable slab zinc is used. Ore is employed in the manufacture of zinc oxide, leaded zinc oxide, lithopone, zinc sulfide, and basic lead sulfate. A substantial proportion

pone (46 percent in 1945) and most of that in zinc chloride made in the United States are derived from secondary material. For a number of years before the United States entered World War II, there had been a large increase in the quantity of secondary zinc used in the manufacture of zinc oxide. The scarcity of supplies of both metal and scrap caused the proportion of the total oxide made by the French process, which uses only metal and scrap, to drop sharply in 1942 and to continue low in 1943-45, despite the fact that the percentage from metal and scrap rose in 1943 and continued upward in 1944 and 1945. The production of zinc oxide from metal and scrap accounted for the following percentages in relation to total production: 41 percent in 1939, 16 percent in 1942, 19 percent in 1943, 22 percent in 1944, and 25 percent in 1945.

Lead content of lead and zinc pigments produced by domestic manufacturers, 1944-45, by sources, in short tons

Pigment	1944					1945				
	Lead in pigments produced from—				Total lead in pigments	Lead in pigments produced from—				Total lead in pigments
	Ore		Pig-lead	Secondary material		Ore		Pig-lead	Secondary material	
	Domestic	Foreign				Domestic	Foreign			
White lead...			61,143		61,143			39,742		39,742
Red lead.....			48,411		48,411			43,685		43,685
Litharge.....			130,353		130,353			131,110		131,110
Orange mineral.....			254		254			106		106
Basic lead sulfate.....	2,709		710		3,419	2,807		327		3,134
Leaded zinc oxide..	14,975	2,063	354		17,392	14,435	1,453	529	1	16,419
	17,684	2,063	247,225		266,972	17,243	1,453	215,595	1	234,292

Zinc content of zinc pigments and salts produced by domestic manufacturers, 1944-45, by sources, in short tons

Pigment or salt	1944					1945				
	Zinc in pigments and salts produced from—				Total zinc in pigments and salts	Zinc in pigments and salts produced from—				Total zinc in pigments and salts
	Ore		Slab zinc	Secondary material		Ore		Slab zinc	Secondary material	
	Domestic	Foreign				Domestic	Foreign			
Zinc oxide.....	55,075	10,180	15,108	11,376	121,835	65,505	18,240	15,462	12,181	111,388
Leaded zinc oxide.....	28,803	5,141	.....	620	32,654	25,395	4,197	.....	700	30,208
Lithopone.....	9,427	2,929	.....	13,079	20,335	11,474	2,908	.....	12,207	28,679
Total pigments ¹	121,305	18,256	15,108	25,075	180,824	102,374	25,435	15,462	25,074	168,345
Zinc chloride.....	.....	13	12,680	12,673	.....	.....	.....	22	12,472	12,494
Zinc sulfate.....	1,607	998	36	2,410	5,051	2,383	898	34	3,289	6,514

¹ These figures are higher than those shown in the report on Secondary Metals—Nonferrous because they include zinc recovered from byproduct sludges, residues, etc., not classified as purchased scrap material.

² Excludes zinc sulfide, data for which Bureau of Mines not at liberty to publish.

LEAD AND ZINC PIGMENTS AND Z

PRICES

Total and average values received by producers for pigments and zinc salts are given in the tables in this report. Average values for all pigments gained in 1946. Following the raising of the ceiling price on pigments and pastes with a high lead content effective June 7, 1946—the first advance since maximum prices were established by the General Maximum Price Regulations—changes represented an average increase of prices of 20 percent, or about 1½ cents a pound.

Producers raised prices for zinc oxide (lead-free) ceilings in June 1946 during the almost month-long operation of the OPA. Ceiling prices at March were reestablished at the end of July and were in effect for the first time on October 14.

All price controls on the products covered by the OPA were moved by general order of the President, effective June 7, 1946. Immediate gains were 2½ cents a pound for lithopone, 1 cent a pound for zinc oxide (lead-free) for the leaded grades of zinc oxide (depending on the lead content) less than ½ cent for lithopone. Further gains were at the end of the year, when prices for pigments were at the highest rates for many years and the highest ever recorded.

Range of quotations on lead pigments and zinc pigments (or delivered in the East), 1943-46, in cents per pound

(Oil, Paint and Drug Reporter)

Product	1943	1944	1945
Basic lead sulfate, or sublimed lead, less than 10 percent lead, carlots, barrels.....	7.50-7.75	7.50-	7.50-
White lead, or basic lead carbonate, dry, carlots, barrels.....	8.00-8.25	8.00-	8.00-
Litharge, commercial, powdered, barrels.....	8.00-9.00	8.00-	8.00-
Red lead, dry, 95 percent or less, less than carlots, barrels.....	9.50-10.00	9.50-	9.50-
Orange mineral, American, small lots, barrels.....	12.00-12.50	12.00-	12.00-
Zinc oxide:			
American process, lead-free, bags, carlots.....	7.25	7.25-	7.25-
American process, 5 to 35 percent lead, barrels, carlots.....	7.25-7.38	7.25-	7.25-
French process, red seal, bags, carlots.....	8.50	8.50-	8.50-
French process, green seal, bags, carlots.....	9.00	9.00-	9.00-
French process, white seal, barrels, carlots.....	9.75	9.75-	9.75-
Lithopone, ordinary, small lots, bags.....	4.50	4.50-	4.50-
Zinc sulfide, less than carlots, bags, barrels.....	8.50-8.75	8.50-	8.50-
Zinc chloride, works:			
Solution, tanks.....	2.50	2.50-	2.50-
Fused, drums.....	5.00-6.50	5.00-	5.00-
Zinc sulfate, crystals, barrels.....	3.85-4.60	3.85-	3.85-

¹ Quotation was reduced to 3.65-4.40 cents per pound in Sept. 11, 1944. Reporter, which added "works, freight allowed," to the description.

FOREIGN TRADE¹¹

The total value of exports of lead and zinc in 1946 was 13 percent below 1945, accounted for in part by several small items from that classification.

¹¹ Figures on imports and exports compiled by M. B. Price, of the Bureau of Economic Warfare, U. S. Department of Commerce.

was well in advance of any year in the 1929-41 period and also exceeded 1942 and 1944. The tonnages of zinc oxide and lithopone each exceeded any lead class several times, and the value of zinc pigments exported was 3.4 times that for the lead group. Zinc pigments exported rose 28 percent in value, while lead pigments declined 40 percent.

Value of foreign trade of the United States in lead and zinc pigments and salts, 1945-46

	1945		1946	
	Imports	Exports	Imports	Exports
Lead pigments:				
White lead	54	\$611,688	\$339	\$183,867
Red lead		385,683	3,800	292,461
Litharge	1,566	414,167	4,576	374,583
Orange mineral		920		(¹)
Other lead pigments	5,997	8,831	4,312	(¹)
	7,617	1,421,169	13,033	850,801
Zinc pigments:				
Zinc oxide	24	1,203,361	8,420	2,022,902
Lithopone	7	1,049,061	58	888,555
Zinc sulfide		25,399	324	(¹)
	31	2,278,721	8,808	2,911,457
Lead and zinc salts:				
Lead arsenate		735,005	5	333,981
Other lead compounds	18	(²)		(¹)
Zinc chloride		93,590	405	(¹)
Zinc sulfate	16,775	62,119	17,225	(¹)
Other zinc salts and compounds	(²)	119,747	(¹)	(¹)
	16,793	1,010,521	17,725	333,981
Grand total	24,441	4,710,411	39,566	4,066,329

¹ Beginning Jan. 1, 1946, not separately classified.

² Data not available.

Lead Pigments and Salts.—Imports of lead pigments are of little consequence, red lead, amounting to 54 tons, being the chief item in 1946. All classes shown separately in the export group were shipped from the United States in smaller quantity in 1946 than in 1945; white lead, the chief class in 1945, with 4,079 tons, dropped to only 910 tons in 1946 or to the lowest level in many years. Litharge, lead arsenate, and red lead ranked above white lead in tonnage in 1946. Red lead exports amounted to 4 percent of total domestic shipments in 1946, or the highest proportion attained by any lead pigment.

Lead pigments and salts imported for consumption in the United States, 1942-46

Year	Short tons					Total value
	Basic carbonate white lead	Red lead	Litharge	Suboxide of lead	Other lead compounds	
1942		2	2	7	11	\$5,841
1943		4	1	3		3,349
1944	(¹)		1	10		5,982
1945	1	8	10		(¹)	7,635
1946	1	54	15	11		13,038

¹ Less than 1 ton.

² Includes also lead pigments, n. s. p. f., \$97 (522 pounds); lead arsenate, \$5 (552 pounds).

LEAD AND ZINC PIGMENTS AND

Lead pigments and salts exported from the U

Year	Short tons			
	White lead	Red lead	Litharge	Orange mineral
1942	2,249	1,391	1,999	7
1943	4,692	1,535	1,610	7
1944	3,052	2,117	2,391	13
1945	4,079	1,922	2,512	3
1946	910	1,355	2,180	(¹)

¹ Beginning Jan. 1, 1946, not separately classified.

Zinc Pigments and Salts.—Zinc sulfate continued to be the chief item in the import class but amounted to only 1 percent of total zinc oxide gained 54 percent in 1946 and was exceeded by shipments of lithopone from the United States for the first time since 1937, when exports of these pigments were 13 tons, respectively. Lithopone exports were 13 tons in 1946, a record tonnage for 1941, having dropped almost 90 percent after; the 1946 tonnage was the smallest since 1937. Lithopone exports each amounted to 7 percent of total domestic producers.

Zinc sulfate had been the chief zinc chemical imported until 1945, when it was surpassed in quantity by zinc chloride. Separate data on these compounds are available from January 1, 1946.

Zinc pigments and salts imported for consumption in

Year	Short tons			
	Zinc oxide		Lithopone	Zinc sulfide
	Dry	In oil		
1942	13	1		1
1943	10	11		(¹)
1944	(¹)	6		(¹)
1945	(¹)		(¹)	(¹)
1946	41		(¹)	(¹)

¹ Less than 1 ton.

Zinc pigments and salts exported from the U

Year	Short tons		Total value ¹	Year
	Zinc oxide	Lithopone		
1942	6,013	17,036	\$2,913,595	1945
1943	6,019	17,320	2,898,253	1946
1944	5,511	11,551	2,194,203	

¹ Includes also—1942: Zinc sulfide \$6,328 (37,691 pounds); zinc chloride \$53,624 (1,025,564 pounds); other zinc salts and compounds, \$76,022 (\$29,523 (78,387 pounds); zinc chloride \$57,300 (761,861 pounds); zinc sulfate \$22,087 (139,940 pounds); 1944: Zinc sulfide, \$47,133 (711,953 pounds); zinc sulfate, \$83,555 (2,029,801 pounds); other zinc salts and compounds, \$23,399 (173,475 pounds); zinc chloride \$22,199 (1,243,826 pounds); other zinc salts and compounds, \$119,119. January 1 none of the foregoing classes separately recorded.

to 6,646 tons; alloys, 16 percent to 14,055 tons; and collapsible tubes and foil, 342 percent to 2,126 tons. The several increases were at the expense of accumulated Government and consumer stocks that in tin content at the beginning of the year were closely 33,300 tons and at the end 20,400 tons.

Tin-plate output (including terneplate) rose sharply from 311,100 tons in 1945 to 439,000 in 1946 and exports (excluding terneplate of about 5,000 tons in each year) moved upward from 27,174 tons to 112,545. The controlled price of coke tin plate for home use was increased in August from 32s. 6d. to 34s. 3d. per base box, f. o. b. makers' works. The export prices were increased several times from 35s. at the beginning of the year to 47s. 6d. f. o. b. port in the last 3 months and averaged 41s. 9.45d. for the year. There was considerable range in the actual prices, which varied with country of destination.

A 5-year plan for the modernization of the British iron and steel industry, estimated to cost £200,000,000 had been approved by the Iron and Steel Federation but had not been agreed to by the Board of Trade up to February 1947. The plan envisaged the expenditure of about £50,000,000 in south Wales, where output is predominantly plate and sheet. A hot-strip and three cold-rolling mills and modern tin-plate mills are to be built. There appeared to be reluctance to provide electrolytic facilities beyond the plant now under construction at Ebbw Vale.

Mine production has declined uninterruptedly from 1,999 tons in 1938 to 793 in 1946. The East Pool and Agar mine that had been worked for more than a century closed in 1945 leaving only the South Crofty and Geevor mines in operation. In the year ended March 31, 1946, the latter crushed 44,943 tons and recovered 552.6 tons of concentrate or 27.54 pounds of black tin a ton. The Ministry of Supply purchased all Cornish tin on a cost-plus basis. An interrogation in the House of Commons brought out that the cost was about £456 (82 cents a pound) a ton in 1945.

Titanium

By HELENA M. MEYER AND R. LO

GENERAL SUMMARY

RECORD consumption of ilmenite by major pigments featured the titanium industry. Makers of titanium dioxide operated at a loss but were unable to supply the unprecedented demand for their product. The rising use of titanium in the past few years has made increasing inroads into markets formerly held by other white pigments. Titanium dioxide demand in 1946, however, as in 1945, by the inability of domestic producers to meet their market demand, caused material shortages. A lower rate of domestic production, 8 percent less than in 1945—was due principally to a shorter work week at the world's largest titanium plant in N. Y.; but the gain of 15 percent in imports offset the domestic drop, and stocks were augmented by the end of the year. Inventories of ilmenite on hand could fill consumption requirements at the end of almost a year.

Labor strikes at coal mines and steel plants retarded the use of structural materials, heavy machinery, and expansion by three domestic titanium dioxide producers. The expansion in progress early in 1947 will be completed by the end of the year.

Rutile production was at a new record rate in 1946, over 1945. Because of this high rate and increased consumption, domestic producers could supply only a small part of the demand for the first time since the mineral has become a commodity. Imports dropped 45 percent to the lowest level in years. Inventories at the close of 1946 were sufficient to meet demand at the 1946 rate.

Increased possibilities for use of titanium in the construction field and for other engineering uses were pointed out in a recent report, discussed below.

The decision of the District Court of the United States for the Southern District of New York that certain factors in the titanium industry were guilty of monopolistic practices, mentioned in the report for 1945, was appealed. The case was argued before the Court on February 3 and 4, 1947, but a decision was not reached at the time this report was written.

Ilmenite prices were reduced from \$28-\$30 a ton on the Atlantic seaboard, quoted nominally at that level in 1941, to \$19-\$20 in December 1946, with the

reduced from 60 percent to 57-60 percent. Prices for rutile have been unchanged at 8-10 cents a pound, 94 percent TiO_2 , for several years.

DOMESTIC PRODUCTION

Ilmenite output fell 8 percent in 1946 but was second only to the production for 1945. On the other hand, rutile production rose 4 percent to a new high record in 1946. Shipments of ilmenite concentrates in 1946 ranged from 44 to 60 percent TiO_2 and shipments of rutile concentrates from 93 to 94 percent TiO_2 .

Production and mine shipments of titanium concentrates from domestic ores in the United States, 1942-46

Year	Ilmenite				Rutile			
	Production (short tons)	Shipments			Production (short tons)	Shipments		
		Gross weight (short tons)	TiO_2 content (short tons)	Value		Gross weight (short tons)	TiO_2 content (short tons)	Value
1942.....	77,208	93,397	41,328	\$1,805,823	2,048	2,649	2,400	\$410,956
1943.....	203,551	211,715	94,283	3,738,970	3,987	3,941	3,039	610,879
1944.....	278,610	280,701	128,095	7,371,279	6,022	6,770	6,312	1,088,112
1945.....	308,516	308,518	141,852	7,359,170	7,179	6,837	6,414	869,920
1946.....	282,447	282,708	130,624	4,878,917	7,453	7,514	7,046	998,989

Florida.—Humphreys Gold Corp., operating under lease from Rutile Mining Co., and its parent company, the Titanium Alloy Manufacturing Co., near Jacksonville, has increased the capacity of its sand-washing plant (for recovery of rutile, ilmenite, and zircon) to 7,500 tons daily. There are 316 spirals in all at this plant.¹ Riz Mineral Co., producer of ilmenite, rutile, and zircon near Vero Beach, ceased operations the latter part of October 1946.

New York.—Production of ilmenite at Tahawus, Essex County, by the National Lead Co., dropped in 1946 compared with 1945 as a result of the labor shortage and reduced work week.

New Jersey.—The Calco Chemical Division, American Cyanamid Co., placed its revamped titanium-pigment facilities in operation at Gloucester City at the end of 1946. The plant was acquired from the Sherwin-Williams Co. in 1945.

North Carolina.—The Yadkin Valley Ilmenite Co., subsidiary of the Glidden Co., produced 17,102 short tons of ilmenite (averaging 52.4 percent TiO_2) at Finley, Caldwell County.

Virginia.—Rutile and ilmenite were produced near Roseland, Nelson County, by the American Rutile Corp., subsidiary of the Metal & Thermit Corp. The Calco Chemical Division of American Cyanamid Co. produced ilmenite at Piney River, Nelson County. A study of the ore body at Piney River indicates that most of the ilmenite is primary and occurs in an igneous dike formation suggesting greater continuity of the ore body.²

Wyoming.—The Iron Mountain deposits were examined³ in 1943 by the Bureau of Mines and a diamond-drilling project was set

¹ Engineering and Mining Journal, vol. 147, No. 10, October 1946, p. 104.

² Davidson, D. M., Grout, F. F., and Swartz, G. M., Notes on the Ilmenite Deposit at Piney River, Va.: Econ. Geol., vol. 41, No. 7, November 1946, pp. 739-748.

³ Frey, Eugene, Exploration of Iron Mountain Titaniferous Magnetite Deposits, Albany County, Wyo.: Bureau of Mines Rept. of Investigations 3908, 1946, 37 pp.

up under the strategic minerals program; drill completed November 1, 1944. Samples combining deposit were submitted to Bureau of Mines metal. The chemical composition of a typical specimen of tite ore was: TiO_2 , 10.5 percent; Fe, 36.05 percent; SiO_2 , 16.6 percent.

CONSUMPTION AND USES

Consumption of ilmenite gained 6 percent in a new high record; but titanium pigments, the were in insufficient supply to meet demand, none. The manufacture of titanium dioxide took 99 percent of the uses took less ilmenite than in 1945. The use of percent to the smallest total since 1941. Rutile is welding-rod coatings, which took 84 percent, and which took 15 percent.

Consumption of ilmenite and rutile in the United States in short tons

Product	Ilmenite	
	Gross weight	Estimated TiO_2 ton
1945		
Pigments (manufactured titanium dioxide) ¹	371,691	18
Welding-rod coatings ¹	115	
Alloys and carbide.....	8,611	
Ceramics.....		
Miscellaneous ²	761	
Total consumption.....	381,178	18
1946		
Pigments (manufactured titanium dioxide) ¹	399,042	20
Welding-rod coatings ¹	105	
Alloys and carbide.....	4,086	
Ceramics.....		
Miscellaneous ²	451	
Total consumption.....	404,283	20

¹ "Pigments" include all manufactured titanium dioxide, consumption of was 2,258 tons in 1945 and 938 tons in 1946.

² Consists of ilmenite used as a steel flux and rutile used in lamp-electrode oxidizer.

Titanium Pigments.—Production and sales of established new high records again in 1946, but production rate was inadequate by a substantial margin and still growing demand for the product. As pointed out in statement of this report, the continuing pinching materials for the manufacture of competitive white for white lead carbonate and white lead sulfate, and lithopone, and zinc sulfide) accentuated the stringency in regard to titanium dioxide. Since 1939 titanium utilized in greater quantity than any other white. Bureau of Mines is not at liberty to publish figures. According to information received from

turer, the use pattern was unchanged in 1946 from 1945, when he estimated that 75 percent was used for paint, varnish, and lacquer, 10 percent for paper, 2 percent each for floor coverings and rubber, 1½ percent each for welding-rod coatings and textiles, and 8 percent for other uses.

Testimony in the United States Department of Justice antitrust suit against factors in the titanium-pigments industry brought out that production of titanium pigments in the United States had risen from 100 tons (TiO₂ content) in 1920 to about 128,000 tons in 1941 and was 110,000 tons in 1943. Estimated foreign production was about 1,000 tons in 1920 and 23,000 in 1938.

Welding-Rod Coatings.—Production of titanium-coated welding rods was 133,000 short tons in 1946, marking a continuation of the decline since 1943 and the smallest total since before 1941; 267,000 tons were produced in 1945, 382,000 in 1944 and 481,000 in 1943. Of these rods in 1946, 53 percent were coated with natural rutile, 33 percent with manufactured titanium dioxide (extracted from ilmenite), 8 percent with both varieties of dioxide, and 6 percent with ilmenite. The drop in welding-rod output was due to termination of war demand.

Titanium Alloys.—Titanium alloys are discussed in a report described under Technology.

Other Uses.—Titanium in the form of metal had been available in only very small quantities prior to recent experimental work by the Bureau of Mines (see section on Technology). The Bureau's report stated that the large-scale use of ductile metallic titanium would appear to depend only on its availability in suitable form and at a price no longer marking it a rare and precious metal.

STOCKS

Ilmenite and rutile stocks increased 40 and 46 percent, respectively, during 1946.

Stocks of titanium concentrates in the United States at end of year, 1945-46, in short tons

Stocks	1945				1946			
	Ilmenite		Rutile		Ilmenite		Rutile	
	Gross weight	Estimated TiO ₂ content	Gross weight	Estimated TiO ₂ content	Gross weight	Estimated TiO ₂ content	Gross weight	Estimated TiO ₂ content
Producers	1,570	774	594	558	1,309	613	533	501
Distributors	6,780	3,254	4,064	3,739	3,919	2,155	8,488	7,979
Consumers	264,248	131,732	1,581	1,464	375,998	105,541	1,896	1,521
Government			3,891	3,668			3,891	3,658
Total stocks	272,598	135,760	10,130	9,419	381,236	198,309	14,808	13,659

Includes ilmenite and rutile content of mixed zirconium-titanium concentrates.

PRICES

Ilmenite, 60 percent TiO₂, continued to be nominally quoted at \$8-\$30 a long ton, f. o. b. Atlantic seaboard, until June 1946, when 60 percent TiO₂ was quoted at \$24-\$26; in November it dropped

to \$22-\$24 and in December to \$19-\$20 a long ton. Rutile, 90 percent TiO₂, remained at 8-10 cents a pound, ton lots, at \$1.23 per pound of content, 20- to 25-percent grade and \$1.35 for 20- to 25-percent carbontitanium, 15-20 percent Ti at \$142.50 per ton of metal, 96-98 percent, was listed at \$5-\$5.50 per ton of metal. Manufactured titanium dioxide remained at 14-16 cents a pound.

FOREIGN TRADE

Imports.—Ilmenite imports in 1946 increased 90 percent over 1945. India furnished 90 percent of the total, except for a small quantity in October, therefrom that country in the last 7 months of the year. Imports of rutile increased during the year. Imports of rutile were at the lowest level since 1940. Titanium is imported only in the form of mixed zircon-rutile-ilmenite concentrates. These are separated into their component minerals by the American Titanium Corp. (subsidiary of the American Titanium Ventures, Ltd.), Carteret, N. J.; Orefraction Co., and Titanium Alloy Manufacturing Co., Niagara Falls, N. Y. In 1946, 12 tons of ferrotitanium and 12 tons of titanium were imported in 1946.

Titanium concentrates¹ imported for consumption in the United States, by countries, in short tons

Country of origin	1942	1943
ILMENITE		
Australia ²	235	390
Brazil	1,287	
Canada	4,540	65,437
Ceylon		
India and Dependencies	1,165	8,960
Norway		
Portugal		
Total as reported	7,227	74,787
Australia: In "zirconium ore" ³	3,180	3,300
Grand total	10,407	78,083
Value of "As reported"	\$60,490	\$380,161
RUTILE		
Australia ²	1,311	2,802
Brazil	4,966	4,920
Cameroon (French) ⁴	146	1,095
India and Dependencies		818
Total as reported	6,423	9,635
Australia: In "zirconium ore" ³	4,102	4,703
Grand total	10,525	14,338
Value of "As reported"	\$623,917	\$823,624

¹ Classified as "ore" by the U. S. Department of Commerce.

² All imports of titanium from Australia in 1942-46 were in mixed concentrates. Totals of mixed concentrates are derived by addition of the U. S. Department of Mines (on the basis of surveys of importers) into the three component minerals and rutile over the quantities reported by the U. S. Department of Commerce.

³ Includes 309 tons not recovered from mixed concentrates.

⁴ Includes quantities reported by the U. S. Department of Commerce from Africa, from which no rutile production has been recorded.

⁵ Figures on imports and exports compiled by M. B. Price, of the U. S. Department of Commerce.

Exports.—Of the concentrates exported in 1946, 32 percent went to Canada, 22 percent to Sweden, 22 percent to the United Kingdom, 7 percent to Netherlands, and 7 percent to Switzerland. Of the pigments, 74 percent went to Canada and 13 percent to Latin America (largely Brazil, Cuba, Mexico, and Argentina). Practically all of the ferro-alloys went to Canada. Total titanium products exported in 1946 were valued at \$3,400,000.

Exports of titanium products from the United States, 1942-46, by classes

Year	Concentrates		Ferro-alloys ¹		Dioxide and pigments		Tetrachloride and other compounds	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1942.....	618	\$117,886	422	\$60,938	8,870	\$1,707,433	24	\$13,660
1943.....	576	103,947	760	117,402	9,765	1,830,344	728	442,591
1944.....	291	51,828	793	127,145	10,925	1,851,467	375	215,606
1945.....	609	121,961	744	122,887	12,524	2,315,552	75	46,718
1946.....	1,386	220,866	550	63,723	16,314	3,062,607	(²)	(²)

¹ Includes metal and nonferrous alloys, 1942-44.

² Beginning Jan. 1, 1946, not separately classified.

TECHNOLOGY

Historical data on the technology of metallic titanium and its alloys and original research work of the Bureau of Mines in this connection were recently summarized by Dean and Silkes.⁴ In a press notice announcing the report the Bureau said:

Still considered expensive to produce even under the improved method employed at the Bureau's Intermountain Experiment Station at Salt Lake City, Utah, pure titanium is a light corrosion-resistant metal that combines the properties of stainless steel with those of the strong aluminum alloys. * * *

Until about 1900, efforts to produce pure titanium were unsuccessful, but subsequently a number of methods were developed, one of which was modified by Bureau metallurgists and now attains a production of 100 pounds of metal a week at the Bureau's Boulder City, Nev., pilot plant. In the modified process, titanium is obtained by reducing titanium tetrachloride with pure molten magnesium in the presence of helium under slight pressure.

Ranking ninth in abundance among the elements, titanium places fourth among metallic elements suitable for engineering purposes, and is exceeded only by aluminum, iron, and magnesium. The metal is about twice as heavy as magnesium, which is slightly lighter than aluminum.

One of the outstanding properties which gives pure titanium an advantage over certain other metals is its relatively high proportional limit, a measure of the metal's elasticity. Bureau metallurgists have determined that the proportional limit of cold-worked titanium is as high as 75,000 pounds per square inch, compared with the unusually low proportional limit of stainless steel, which is reported to be not more than 25,000 pounds even when fully cold worked.

Because titanium thus offers a minimum weight where continued high stress is concerned, its use has been suggested in many parts of aircraft design and in a variety of diaphragms that are maintained under tension, particularly microphone diaphragms where weight is important. A considerable saving in power is predicted in the use of the light metal in textile machinery for high-speed spindles, spools, warp beams, and other working parts.

The fact that titanium can be surface hardened is important in the construction of parts subject to frictional wear and its lightness and strength, coupled with an expansion property a little less than that of cast iron, make titanium an ideal material for automotive pistons. Other metals, however, possess better

⁴ Deau, R. S., and Silkes, B., *Metallic Titanium and Its Alloys*; Bureau of Mines Inf. Circ. 7381, 1946, 38 pp.

TITANIUM

qualities for piston heads than titanium because of its low ductivity.

Among other experimental uses for titanium, not fully scarcity of the pure metal, are in sports goods such as tennis rods; for spring balances and springs where a considerable low loads is desired; for marking glass; for tool mounting of pen points and styluses.

WORLD REVIEW

Available data on world production of ilmenite years are shown in the accompanying table. Britain is an important producing and consuming countries follow.

World production of titanium concentrates (ilmenite and rutile) in metric tons

[Compiled by B. B. Mitchell]

Country	1940	1941	1942	1943
ILMENITE				
Australia:				
New South Wales.....	1,538	3,521	3,651	3,100
Queensland.....	12	258	937	1,000
Brazil (exports).....	4,114	11,477	9,100	62,000
Canada.....	465	2	691	600
Egypt.....	2,596	(¹)	(¹)	(¹)
Federated Malay States (exports).....	267,376	131,111	49,977	38,000
India, British.....	61,700	61,086	60,713	60,000
Norway.....	809	798		
Portugal.....	7,082	1,000	4,840	
Senegal.....	150	71	86	
Spain.....	18,780	21,135	70,042	184,000
United States.....				
Total ilmenite.....	354,532	236,930	200,036	268,000
RUTILE				
Australia:				
New South Wales.....	1,641	3,549	4,496	4,000
Queensland.....		267	1,007	1,000
South Australia.....	2			
Brazil (exports).....	499	2,369	4,615	4,000
Cameroon, French (exports).....	503	1,399	2,153	2,000
India.....	934	1,891	2,295	2,000
Norway.....	150	172	77	
United States.....	2,620	2,839	2,402	3,000
Total rutile.....	6,365	12,486	17,045	19,000

¹ Data not available. Estimates for individual countries included in world total.

² Includes 26 tons of garnet-ilmenite.

³ Approximately 20 percent of ilmenite concentrates is zircon.

⁴ Less than 1 ton.

Australia.—A recent report⁵ indicated that the mineral sands containing rutile, zircon, and ilmenite occur at intervals along 300 miles of the Coff's Harbour, New South Wales, and Tin Can Bay. According to the report, the main output has come from the 50-mile stretch from Byron Bay, New South Wales, to Queensland. Preliminary investigations on a large scale, with a view to improvement of plant practice, have been carried out at the metallurgical laboratory, University of Queensland, and the Council for Scientific and Industrial Research.⁶

⁵ Chemical Engineering and Mining Review, Recovery of Rutile and Zircon from Mineral Sands, No. 456, Sept. 10, 1946, pp. 451-454.

⁶ Queensland Government Mining Journal, vol. 47, No. 541, November 1946.

Egypt.—Egypt has deposits of hundreds of thousands of tons of ilmenite. Black sands at the mouth of the Nile contain monazite and zircon.⁸

Germany.—The titanium industry in Germany was summarized in a recent report.⁹ The report is quoted in part as follows:

The surprisingly extensive wartime research and patent applications of Titanengesellschaft G. m. b. H., the only German manufacturers of titanium dioxide, represent thought-provoking viewpoints in this field. The comprehensive development of vitreous enamels based on titanium in place of boron is claimed not to provide merely a substitute for borax but, rather, products permitting better enamels and the use of fewer coats, with corresponding production economies. Titanium dielectrics and resistors as developed, or under investigation in Germany, seem to offer unusual possibilities in the fields of radio and electrical and electronic circuits and apparatus. Titanium carbide as a constituent of cemented carbide cutting tool tips seems to have made a place for itself beyond that of a mere substitute in high speed finishing cuts where minimum wear is important.

Titanengesellschaft G. m. b. H. was the sole producer of titanium dioxide and titanium tetrachloride in Germany, and the output of titanium dioxide at the Leverkusen plant, near Cologne, for 1940-42, in metric tons, was as follows:

	Ore consumed (dry basis)	Titanium dioxide produced (equivalent TiO ₂)
1940.....	30, 234	11, 730
1941.....	34, 927	13, 153
1942.....	39, 235	15, 323

A representative wartime distribution of an output of 1,200 tons a month of titanium dioxide was as follows:

	Metric tons
Paints and similar materials.....	300
Welding rods and metallurgy.....	300
Vitreous enameling, mainly flux.....	100
Paper manufacture.....	100
Silk delustering.....	100
Electrical ceramics.....	50
Titanium tetrachloride (manufactured).....	50
Export to European countries.....	200
	1, 200

Except for a few experimental batches the pigment-grade TiO₂ was exclusively of the anatase crystal modification, whereas the rutile type was desired for welding-rod coatings and electrical ceramic purposes.

Titanium tetrachloride was produced in 1943-44 at a rate of 100 tons a month, presumably primarily for producing fogs for screening military movements.

Another report¹⁰ stated that production ceased completely on October 26, 1944, owing to major damage sustained in a daylight bombing raid. Production was resumed on a limited scale in December 1945. The plant equipment did not sustain as much damage as the plant structure.

⁸ Herlitz, Matin, *Egypt's Minerals*; Min. Jour., vol. 226, No. 5776, May 4, 1946, p. 345.

⁹ McBerly, Ford H., *Titanium Products in Germany*; Office of Military Government for Germany (United States) Final Report 773, May 3, 1946, 61 pp.

¹⁰ British Intelligence Objectives Sub-Committee Final Report, *Titanium Pigments*, Titanengesellschaft, Leverkusen; No. 451, p. 2.

India.—A pilot plant to produce titanium dioxide sludge has been established in the laboratories of the Scientific and Industrial Research, Delhi, India.¹¹

Malaya.—There are about 300,000 tons of ilmenite pigment factory in Travancore, South India, has been established. The government of Travancore will have sole ownership of mining, exporting, and processing of all minerals.

Norway.—Deposits located south of Stavanger, all of the ilmenite required for titanium production, according to a recent report.¹² The reserves were said to exceed 30 million tons, with a content of 25 to 40 percent. A representative analysis of the ore was as follows following export to Germany was as follows following analysis: 34.00 percent TiO₂, 34.00 percent FeO, 12.44 percent FeS, 2.79 percent SiO₂, 3.55 percent MgO, 0.37 percent V₂O₅, 0.085 percent NiO, 0.015 percent P₂O₅, and less than 0.01 percent Cr₂O₃.

United Kingdom.—Paint shortage and increased demand for paint distribution plan effective August 1945. Projects are afoot for new titanium pigment factories to 4,000 tons of rutile are consumed annually.¹³

¹¹ Foreign Commerce Weekly, vol. 24, No. 7, Aug. 17, 1946, p. 55.

¹² The Mining Journal (London), vol. 227, No. 5802, Nov. 2, 1946, p. 868.

¹³ Willbourn, E. S., *The Relationship of the Geological Survey to the Mining Industry*, vol. 44, No. 2, April-June 1946, p. 131.

¹⁴ McBerly, Ford H., work cited in footnote 9, p. 1.

¹⁵ Chemical and Process Industries, vol. 30, No. 7, July 1946, p. 50.

¹⁶ Metal Bulletin, No. 3085, Apr. 9, 1946, p. 16.

Zinc

By RICHARD H. MOTE AND ESTHER B. MILLER

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GENERAL SUMMARY

WORK stoppages due to strikes, higher operating costs, and price uncertainty when Government subsidies lapsed temporarily at midyear were major obstacles that restricted domestic zinc output in 1946. However, despite a drop in production and imports, the over-all available supply of slab zinc was sufficient to meet requirements and permit expansion of consumers' stocks.

Domestic mine production was 6 percent less than in 1945, and the outputs of primary and redistilled secondary slab zinc were 5 and 10 percent lower, respectively. The drop in domestic smelter output was partly offset, however, by an 8-percent gain in slab zinc imports, the quantity of which was the greatest in the history of the zinc industry in 1946. Imports of zinc in ores and concentrates dropped 29 percent from 1945. Year-end inventories at domestic smelters were 31 percent less than at the beginning, whereas consumers' stocks gained 28 percent over the quantity on hand at the beginning of the year.

The St. Louis quotation for Prime Western zinc averaged 8.73 cents per pound in 1946 compared with 8.25 cents in 1945.

¹ This report deals primarily with the smelting branch of the industry. Full details of zinc mining are given in the various State reports of this volume. As some zinc ore is used directly in the manufacture of zinc pigments, see also the chapter on Lead and Zinc Pigments and Zinc Salts.

ZINC

Salient statistics of the zinc industry in the United States, 1942-46

	1925-29 (average)	1942	1943
Production of primary slab zinc:			
By sources:			
From domestic ores..... short tons..	589, 048	629, 957	594, 250
From foreign ores..... do.....	12, 734	281, 915	348, 050
	602, 382	891, 872	942, 300
By methods:			
Electrolytic..... percent of total..	21	28	35
Distilled..... do.....	79	72	65
Production of redistilled secondary slab zinc..... short tons..	43, 756	53, 195	48, 215
Stocks on hand at primary smelters Dec. 31..... short tons..	45, 575	82, 498	168, 777
Primary zinc available for consumption..... short tons..	548, 472	739, 938	806, 285
Prices:			
Prime Western at St. Louis:			
Average for year..... cents per pound..	6. 76	8. 25	8. 25
Highest quotation..... do.....	8. 90	8. 25	8. 25
Lowest quotation..... do.....	5. 40	8. 25	8. 25
Yearly average at London..... do.....	6. 46	4. 63	4. 63
Mine production of recoverable zinc..... short tons..	724, 720	768, 025	744, 196
Tri-State district (Joplin)..... percent of total..	49	31	27
Western States..... do.....	30	40	43
Other..... do.....	21	29	30
World smelter production of zinc..... short tons..	1, 435, 000	1, 084, 200	2, 017, 500

LABOR PROBLEMS

Most significant among the many labor problems during 1946 were the widespread strikes at primary smelters, and refineries that paralyzed the industry half of the year. Work stoppages in 1946 began in March 21, when approximately 1,300 workers at the American Refining Co. Murray lead smelter and the United Refining & Mining Co. West Mountain (Bingham) mine and Midvale concentrator struck when negotiating wages collapsed. Workers at certain Colorado and mining and milling operations of the American Smelting and the Phelps Dodge Corp. joined the strike on March 20, respectively. Lead smelters operated Smelting & Refining Co. in California, Colorado, New Jersey, and Texas also became strike-bound, although these closures did not restrict the output of zinc alone, many zinc-lead operations were forced to use limited storage facilities for ore and concentrate and had to cover operating expenses without prompt sale of zinc. Strikes continued to hamper zinc mining in the West in June, when new labor contracts were signed. Zinc mining in the Eastern States was impeded by labor strikes at the American Zinc Co. of Tennessee in Knoxville and Jeffersonville from February 2 through May 4 and at mines of the American Zinc Co. in New Jersey from mid-June to August 17.

Labor strikes at zinc smelters at East St. Louis and at a restricted production in January, and a complete stoppage at a smelter at Danville, Ill., in March stopped production.

der of the year. The Henryetta, Okla., smelter closed in early April owing to strike conditions and did not resume operations until the latter part of September. In Pennsylvania, a strike stopped production at the Langeloth smelter from June to October, and a shortage of electrical power due to a labor strike curtailed output at the Josephstown smelter in October.

The shortage of mine and mill labor continued to be a potent factor limiting domestic mine output during 1946. The predicted return to the mines of former employees who migrated to the cities for high-paying wartime jobs fell far short of expectations. Likewise, a large percentage of the labor supply that entered the armed services during the war did not return upon demobilization; however, most operators considered that the manpower supply problem had improved somewhat by the end of 1946.

GOVERNMENT REGULATIONS

Except for a few minor regulations, the zinc industry operated throughout 1946 free of Government controls. At the end of the year Priorities Regulation 32 limiting manufacturers' inventories of all grades of slab zinc and die-cast alloy to 30 days' requirements or a practicable working inventory, whichever is less, remained operative. Regulations requiring a license for exporting slab zinc and zinc semi-manufactures to certain countries also remained operative during the year. Consumers requesting zinc supplies from the Reconstruction Finance Corporation reserve stocks were required to file proof of necessity.

Subsidy payments under the Premium Price Plan for over-quota production were continued through June but collapsed with expiration of Office of Price Administration and ceiling prices June 30. Upon reestablishment of the OPA, provisions were made for retroactive premium payments to cover the period when no plan was in effect.

The establishment of a Federal Government stock pile of strategic minerals and metals for national defense was authorized on July 23 when President Truman signed the Strategic and Critical Materials Stock-piling Act (Public Law 520, 79th Congress). The act authorizes and directs the Secretary of War, the Secretary of the Navy, and the Secretary of the Interior, acting jointly through the agency of the Army and Navy Munitions Board, to determine from time to time what materials are strategic, and to establish quantities and dates for stock piling. The act further provides that purchases for stock piling shall be made from supplies in excess of current industrial demand and at a price not to exceed current open market price. Except to provide for the rotation of any stock-piled material where necessary to prevent deterioration, no disposition of stock-piled material shall be made without 6 months' public notice and congressional approval. The President, however, may order the release of stock-piled materials when required for purposes of the common defense or in time of war or national emergency.

Figure 1 shows trends in the domestic zinc industry in the United States since 1900.

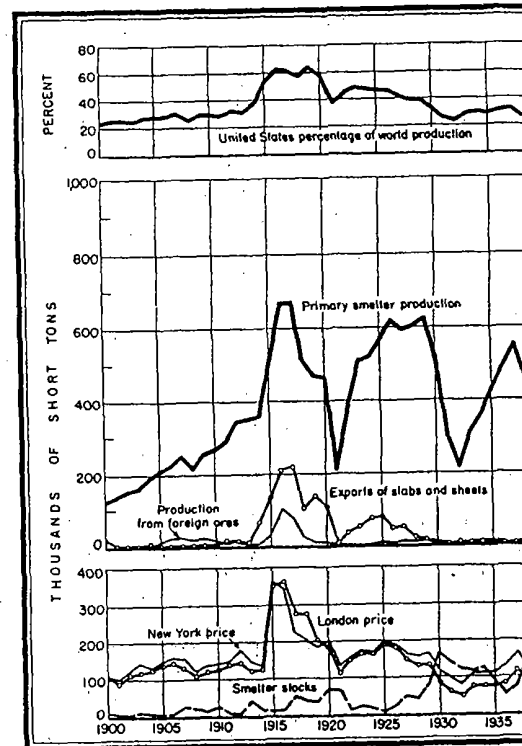


FIGURE 1.—Trends in the zinc industry in the United States 1900-46. Imports of sheet zinc are not shown. Before 1936 they seldom exceeded 500 tons a year. Exports of slabs and sheets have increased, amounting to 36,402 tons in 1942, 56,155 tons in 1943, 63,800 tons in 1944, and 104,015 tons in 1946.

TARIFF

The import tariff on zinc-bearing ores remains unchanged (zinc content) and on zinc in blocks, pigs or slabs at 1 cent per pound during 1946.

DOMESTIC PRODUCTION

Zinc-production statistics may be prepared on two bases. The mine-production data compiled on the basis of tons in ores and concentrates and adjusted to account for losses in smelting are the most accurate measure of output. The slab-zinc production, as reported by smelter companies, is a close figure of actual zinc recovery but generally understates the figure owing to overlap or lag between mine and smelter production.

receipts of ores and concentrates. Over a period of years, however, these variations tend to balance within the limits of statistical error.

MINE PRODUCTION

The mine production of recoverable zinc (including that recovered as zinc pigments and salts directly from ore) in the United States decreased 6 percent in 1946 to the lowest level since 1938. The uninterrupted drop in output from the wartime peak in 1942 was essentially due to prolonged strikes at mines and smelters, especially in western United States, and a continued shortage of labor. Zinc mining is centered largely in five areas—the Tri-State area of southeastern Kansas, southwestern Missouri, and northeastern Oklahoma; Tennessee-Virginia; Sussex County, N. J.; St. Lawrence County, N. Y.; and the Western States (principally Idaho, Arizona, Colorado, New Mexico, Utah, Nevada, and Montana, in descending order of productivity in 1946).

The Western States contributed 48 percent of the total domestic output of zinc in 1946 despite a 7-percent decline to the lowest level of production since 1940. Idaho continued to be the largest producer of zinc in the United States, although 1946 output was 14 percent below the 1945 production. More than 94 percent of the Idaho zinc output in 1946 came from the Coeur d'Alene region; zinc-lead ores and old tailings concentrated yielded 85 percent of the total zinc. Among the Western States, Arizona took second place over New Mexico by a substantial margin as zinc production increased 9 percent over the record output of 1945. About 51 percent of the Arizona total zinc came from a mine at Bisbee, Cochise County; zinc-lead ore accounted for 87 percent of the total production. Zinc production in Colorado increased 1 percent in 1946; zinc ore yielded 53 percent of the State total zinc and zinc-lead ore, 38 percent. New Mexico output, the lowest since 1940, decreased 10 percent in 1946 compared with 1945. Over 89 percent of the total output came from mines in the Central district, Grant County; zinc ore yielded 91 percent of the total zinc produced. Utah zinc output slumped 16 percent to the lowest level since 1934. Owing to a 5-month labor strike at the United States and Lark group, production of zinc in the West Mountain (Bingham) district—for years the leading source of zinc in Utah—declined to about half that in 1945, permitting the Park City region to advance to first place. Zinc-lead ore concentrated supplied 79 percent of the total zinc in 1946, and zinc slag fumed most of the remainder. Production of zinc in Nevada in 1946 was the greatest in the history of the State. About 70 percent of the total was mined in the Pioche district, Lincoln County; nearly 92 percent of the zinc recovered was from zinc-lead ore. The mine output of zinc in Montana declined 4 percent in 1946; zinc-lead ore accounted for 65 percent of Montana's zinc in 1946, and 34 percent was from zinc ore and old slag.

Zinc production in the Central States, smallest since 1933, decreased 1 percent from the 1945 output. The Tri-State (Joplin) region maintained its position as the principal zinc-producing district, with 24 percent (23 percent in 1945) of the total United States output.

ZINC

Mine production of recoverable zinc in the United States, 1942-46, by States, in short tons

State	1925-29 (average)	1942
Western States:		
Arizona.....	2,628	18,522
California.....	3,999	613
Colorado.....	32,888	32,215
Idaho.....	29,123	87,250
Montana.....	72,519	64,715
Nevada.....	5,570	10,197
New Mexico.....	23,351	40,461
Oregon.....		115
South Dakota.....		
Texas.....	44,385	45,543
Utah.....	675	14,398
Washington.....		
	215,023	310,035
Central States:		
Arkansas.....	71	181
Illinois.....	1,174	9,389
Kansas.....	114,323	55,874
Kentucky.....	644	407
Missouri.....	10,708	36,394
Oklahoma.....	228,989	146,510
Wisconsin.....	23,058	9,426
	382,944	258,181
Eastern States:		
New Jersey.....	93,839	94,040
New York.....	7,091	45,807
Tennessee.....	14,631	43,971
Virginia.....	11,192	15,991
	126,753	199,809
	724,720	768,025

Despite a decline of 11 percent in zinc production, New Jersey experienced a sharp drop in the output from New Jersey, which contributed 24 percent of the total domestic output.

Mine production¹ of recoverable zinc in the United States, 1941-46, by Month, in short tons

Month	1941	1942	1943
January.....	60,833	67,289	58,000
February.....	55,627	63,684	55,000
March.....	61,184	69,415	62,000
April.....	62,555	68,521	66,000
May.....	61,852	68,871	59,000
June.....	64,030	64,540	60,000
July.....	60,950	63,253	60,000
August.....	63,973	61,671	61,000
September.....	63,453	57,702	63,000
October.....	65,284	61,164	64,000
November.....	62,038	58,892	65,000
December.....	67,346	63,023	64,000
	749,125	768,025	744,000

¹ Monthly data for 1941-44 were based largely on smelter receipts, which are not necessarily the actual mine output. All monthly figures have been adjusted to final figures.

The 25 leading zinc-producing mines in the United States, listed in the following table, yielded 49 percent of the total zinc output.

Rank Mine District State Operator Type of ore

Rank	Mine	District	State	Operator	Type of ore
1	Franklin & Sterling Hill	New Jersey	New Jersey	New Jersey Zinc Co.	Zinc
2	Copper Queen	Warren (Bisbee)	Arizona	Empire Zinc Corp.	Zinc-lead
3	St. Lawrence County	St. Lawrence County	New York	St. Joseph Lead Co.	Do.
4	Austinville	Austinville	Virginia	Empire Zinc Division	Do.
5	Red Cliff	Red Cliff	Colorado	Empire Zinc Division	Zinc
6	Bayard Mine group	Bayard	New Mexico	U. S. Smelting, Refining & Mining Co.	Do.
7	Star	Star	Idaho	Sullivan Mining Co.	Zinc-lead
8	Bunker Hill Smelter Slag Dump	Yreka	Calif.	Bunker Hill & Sullivan Mining & Concentrating Co.	Zinc-slag
9	Edwards	St. Lawrence County	N. York	St. Joseph Lead Co.	Zinc-slag
10	Churn Tailings	Evolution	Idaho	Hecla Mining Co.	Zinc-lead
11	Combined Metals group	Pioche	Nevada	Combined Metals Reduction Co., & R. E. West Mining Co.	Do.
12	Page	Yreka	Idaho	Federal Mining & Smelting Co.	Do.
13	Davis-Bible group	Eastern Tennessee	Tennessee	Universal Exploration Co.	Do.
14	United States & Lark	West Mountain	Utah	U. S. Smelting, Refining & Mining Co.	Zinc-lead
15	Masot No. 2 and Masot Graves	Eastern Tennessee	Tennessee	American Zinc Co. of Tennessee	Zinc-lead
16	Elk Valley	Pioche	New Mexico	Elk Valley Mine	Zinc-lead
17	Elk Valley Mine group	Central	Kansas	Empire Zinc Division, New Jersey Zinc Co.	Zinc
18	Paxon-Skapti Swalley "D" group	Tri-State	Tennessee	Empire Zinc Division & Smelting Co.	Zinc-lead
19	Grasselli	Eastern Tennessee	Tennessee	American Zinc Co. of Tennessee	Zinc
20	Iron Ring	Big Bug	Arizona	Shastuck Denn Mining Co.	Zinc-lead
21	Smelter slag dump	Big Bug	Arizona	American Smelting & Refining Co.	Zinc-slag
22	Poele Zinc Fume Plant	Smelter	Utah	International Smelting & Refining Co.	Do.
23	Pez Glana & Mayflower	Blue Ledge	N. Mexico	New Park Mining Co.	Zinc-lead
24	Crado	Central	Idaho	Nemacott Copper Corp.	Zinc-lead
25	Morning	Hunter	Idaho	Federal Mining & Smelting Co.	Zinc-lead

ZINC

Detailed information on the production of mines in the United States may be found in the chapters of this yearbook with the mine production of gold, silver, lead, and zinc in the States.

Mine production of recoverable zinc in the United States, by district, 1,000 tons or more during any year, 1942-46, in thousands of tons

District	State	1942	1943
Tri-State (Joplin region)	Kansas, southwestern Missouri, Oklahoma	237,936	200,511
Coeur d'Alene region	Idaho	78,313	79,633
New Jersey	New Jersey	94,040	92,866
St. Lawrence County	New York	45,807	45,000
Central	New Mexico	42,374	52,211
Eastern Tennessee	Tennessee	43,971	41,768
Warren (Bisbee)	Arizona	1,449	1,028
Upper Mississippi Valley	Iowa, northern Illinois, Wisconsin	11,128	10,539
Austinville	Virginia	15,793	17,131
Red Cliff	Colorado	22,880	28,855
Pioche	Nevada	8,957	11,900
Park City region	Utah	13,028	11,488
Metalline	Washington	13,620	9,298
West Mountain (Bingham)	Utah	22,834	23,400
Summit Valley (Butte)	Montana	29,313	7,877
California (Leadville)	Colorado	3,344	5,611
Big Bug	Arizona	2,660	3,000
Kentucky-Southern Illinois Smelter (Lewis and Clark County)	Kentucky, southern Illinois	8,096	5,633
Smelter (Tooele County)	Utah	(1)	(1)
Old Hat (Oracle)	Arizona	579	2,455
Pima (Sierritas, Papago, Twin Buttes)	do.		1,399
Tintic	Utah	1,708	2,333
Eureka	Nevada		4
Magdalena	New Mexico	3,185	5,298
Pioneer (Rico)	California	2,764	3,683
Campo Basso	California		284
Cochise	Arizona		284
Ten Mile	Colorado	643	97
Warm Springs	Idaho	6,280	4,744
Upper San Miguel	Colorado	390	1,211
Flat Creek	California		22
Northport	Washington	685	91
Chelan Lake	do.		1,633
Animas	Colorado	379	47
Hedderston	Montana	1,266	98
Rush Valley	Utah	(1)	(1)
Harshaw	Arizona	4,825	3,398
Breckenridge	Colorado		23
Palagonia	Arizona		1,913
Sheridan	Montana	139	61
Wallapai	Arizona	2,244	1,544
Hunter Valley	California		4,071
Pioneer (Superior)	Arizona	3,884	4,071
Yankee Hill	California		40
South Mountain	Idaho	1,486	63
Packer Creek	Montana		1,000
Livingston	Virginia	198	1,455

¹ Includes very small quantity produced elsewhere in State.

² Bureau of Mines not at liberty to publish.

SMELTER PRODUCTION

During 1946, 21 primary zinc-reduction plants were in operation, of which 12 operated with horizontal retorts exclusively, 3 with horizontal and vertical retorts, 3 with vertical retorts exclusively (electrothermic), and 5 with electrolytic methods.

The St. Joseph Lead Co. continued experiments with a slag-fuming plant at Herculaneum, Mo., in 1946 for

slab zinc as a direct product of the operation that treats lead blast-furnace slag containing 12 to 16 percent zinc.

Horizontal-Retort Plants.—The total number of retorts reported at active horizontal-retort primary plants in 1946 was 73,240, a 1-percent decrease from the 74,120 retorts on December 31, 1945, at plants which operated during that year. Of the total retorts reported, 54,272 (74 percent) were in use at the close of 1946, compared with 54,932 (74 percent) in operation at the end of 1945.

Vertical-Retort Plants.—Four vertical-retort continuous distilling plants operated during 1946. The St. Joseph Lead Co. operated its 9 electrothermic units at Josephtown, Pa., at about 90 percent capacity throughout the year. Of the 66 vertical retorts at the remaining 3 plants, 62 were in operation on December 31, 1946.

Electrolytic Plants.—Five electrolytic plants were in operation during 1946, as in 1945. There were 3,670 cells at the plants on December 31, 1946, of which 3,128 (85 percent) were in operation compared with 3,184 (99 percent) at the end of 1945. No new installations were reported under construction or planned.

Smelting Capacity.—Irrespective of additions or subtractions of smelter recovery units, statistics on domestic smelting capacity vary from year to year owing to changes in metallurgical practices among the various plants. According to reports to the Bureau of Mines, the zinc-reduction plants in the United States on December 31, 1946, had a stated annual capacity to produce 1,067,800 tons of slab zinc under normal operating conditions, allowing for necessary shut-downs for repairs. This figure, which compares with a 1,054,000-ton reported capacity at the end of 1945, indicates that the 1946 output was 72 percent of the capacity as compared with 77 percent in 1945. Horizontal- and vertical-retort plants operated at 73 percent of a stated 41,000-ton capacity (77 percent of a 672,000-ton capacity in 1945), electrolytic plants at 74 percent of a 382,400-ton capacity (80 percent in 1945), and secondary smelters at 59 percent of a 44,400-ton capacity (64 percent of a 44,000-ton capacity in 1945).

No additional smelting capacity was planned at the end of 1946, and only a small increase of four graphite retorts was under construction at one smelter.

Waelz Kilns.—Waelz plants have been installed in recent years at several midwestern and eastern smelters to facilitate recovery of additional metals from the ore and to reduce over-all smelting losses. The following companies operated Waelz kilns in 1946:

- Arkansas:
 - Fort Smith—The Residue Co.
- Illinois:
 - Fairmont City—American zinc Co. of Illinois.
 - Danville—The Hegeler Zinc Co.
 - La Salle—Matthiessen & Hegeler Zinc Co.
- Kansas:
 - Cherryvale—National Zinc Co., Inc.
- Oklahoma:
 - Henryetta—Eagle-Picher Mining & Smelting Co.
- Pennsylvania:
 - Donora—American Steel & Wire Co.
 - Langeloth—American Zinc & Chemical Co.
 - Palmerton—New Jersey Zinc Co.

ZINC

Slag-Fuming Plants.—The recovery of zinc from slag has become an increasingly important source of zinc in the United States in recent years. In the slag-fuming process, zinc is recovered in the form of oxidized zinc fume from hot slags and reclaimed dump slags from old lead smelters. The oxidized zinc fume is further treated at electrolytic retort zinc smelters for recovery of metallic zinc. The following companies operated slag-fuming plants in 1946:

- Idaho:
 - Bradley—Bunker Hill & Sullivan Mining & Concentration Co.
- Montana:
 - East Helena—Anaconda Copper Mining Co.
- Utah:
 - Tooele—International Smelting & Refining Co.

In 1946, the three plants in the United States which operated hot and cold slag, which yielded 75,385 tons of zinc fume and 41,566 tons of recoverable zinc.

The American Smelting & Refining Co. completed the construction of a slag-fuming plant to recover zinc from the company El Paso (Texas) smelter. Construction of the plant began early in 1947.

Active Zinc-Reduction Plants.—A list of the zinc-reduction plants operating in the United States in 1946 follows:

Horizontal-retort plants

- Arkansas:
 - Fort Smith—Athletic Mining & Smelting Co.
 - Van Buren—Arkansas Smelting Co.¹
- Illinois:
 - Fairmont City—American Zinc Co. of Illinois.
 - Danville—The Hegeler Zinc Co.
 - La Salle—Matthiessen & Hegeler Zinc Co.
- Oklahoma:
 - Blackwell—Blackwell Zinc Co.
 - Henryetta—Eagle-Picher Mining & Smelting Co.
 - Bartlesville—National Zinc Co., Inc.
- Pennsylvania:
 - Langeloth—American Zinc & Chemical Co.
 - Donora—American Steel & Wire Co.
 - Palmerton—The New Jersey Zinc Co. of Pennsylvania
- Texas:
 - Amarillo—American Smelting & Refining Co.
 - Dumas—American Zinc Co. of Illinois.

Vertical-retort plants

- Illinois:
 - Dupue—The New Jersey Zinc Co.
- Pennsylvania:
 - Palmerton—The New Jersey Zinc Co. of Pennsylvania
 - Josephtown—St. Joseph Lead Co.
- West Virginia:
 - Meadowbrook—E. I. du Pont de Nemours & Co.

Electrolytic plants

- Idaho:
 - Kellogg—Sullivan Mining Co.
- Illinois:
 - East St. Louis—American Zinc Co. of Illinois.
- Montana:
 - Anaconda—Anaconda Copper Mining Co.
 - Great Falls—Anaconda Copper Mining Co.
- Texas:
 - Corpus Christi—American Smelting & Refining Co.

¹ Operations suspended January 1946.

PRIMARY AND REDISTILLED SECONDARY SLAB ZINC

The output of primary slab zinc in 1946, the smallest since 1940, dropped 5 percent below the 1945 production. Although the use of foreign ore declined and the slab zinc produced from this source dropped 10 percent, the quantity of zinc recovered from foreign ore continued high in comparison with prewar years. Production from domestic ore, lowest since 1938, declined 2 percent to continue the downward trend in evidence since 1941.

Production of redistilled slab zinc from zinc scrap declined 10 percent in 1946. Of the 44,516 short tons of redistilled secondary slab zinc produced, 18,408 tons (41 percent) were derived from primary smelters, and 26,108 tons (59 percent) were produced at secondary plants. Data on the output of remelted secondary slab zinc are not included with those for redistilled metal. In 1946 the production of slab zinc recovered by remelting purchased scrap amounted to 8,212 tons (8,090 tons in 1945). Zinc rolling mills and other consumers of slab zinc recover large quantities of zinc from their own plant scrap; but such metal is not measured statistically, for it normally does not enter the market as scrap.

Primary and redistilled secondary slab zinc produced in the United States, 1942-46, in short tons

Year	Primary			Redistilled secondary	Total (excludes zinc recovered by remelting)
	Domestic	Foreign	Total		
1942.....	620,957	1 281,015	891,872	53,195	945,067
1943.....	594,250	1 348,089	942,309	48,215	990,524
1944.....	574,453	1 294,849	869,302	40,037	918,339
1945.....	457,084	1 287,477	764,561	49,242	813,803
1946.....	459,205	269,057	728,262	44,516	772,778

¹ Includes a small tonnage of foreign slab zinc further refined into high-grade metal in the United States.

DISTILLED AND ELECTROLYTIC ZINC

Of the 1946 output of primary zinc, 61 percent was distilled and 39 percent was produced electrolytically compared with 65 and 35 percent, respectively, in 1945.

An increased demand for zinc for alloy die-casting was largely the cause for the gain in output of Special High Grade zinc, the only grade of slab zinc in which production increased in 1946. In contrast to a 7-percent rise in output of Special High Grade, Regular (Ordinary) High Grade decreased 6 percent, Intermediate 34 percent, Selected 21 percent, and Prime Western 10 percent. Production of Brass Special remained virtually unchanged. The original first-stage smelter production of Prime Western zinc was somewhat higher than is indicated in the following table, but to avoid duplication the quantity consumed in redistilling was omitted because the resultant Special High Grade slab zinc thus produced is reported. Of the total 1946 production (comparable 1945 figures in parentheses), 30 percent (32 percent) was Prime Western, 31 percent (27 percent) Special High Grade, 23 percent (24 percent) Regular High Grade, 10 percent (9 percent) Brass Special, 4 percent (6 percent) Intermediate, and 2 percent (2 percent) Selected.

ZINC

Distilled and electrolytic zinc, primary and secondary, States, 1942-46, in short tons

CLASSIFIED ACCORDING TO METHOD OF REFINING

Year	Electrolytic primary	Distilled	Redistilled
1942.....	252,087	638,885	
1943.....	329,902	612,407	
1944.....	317,388	551,914	
1945.....	280,924	494,637	
1946.....	281,295	446,967	

CLASSIFIED ACCORDING TO GRADE

Year	Grade A		Grade B (Intermediate)	Grades C and D	
	Special High Grade (99.99% Zn)	Regular High Grade (Ordinary)		Brass Special	Selected
1942.....	231,422	250,501	77,527	86,176	
1943.....	233,158	303,743	62,700	82,072	
1944.....	251,210	251,595	55,928	54,396	
1945.....	220,241	191,639	49,106	75,749	
1946.....	236,184	180,366	32,294	75,296	

¹ For total production of secondary zinc see chapter on Secondary Metal.

PRIMARY SLAB ZINC, BY STATE

Montana was the leading producer of primary slab zinc for the first time in 1946, which displaced Pennsylvania for first second in 1946 and was followed by Oklahoma. Which production figures may be released, Illinois, which occupied the next three positions, in order of decreasing production, was followed by Montana and Idaho, as usual, produced electrolytic and Texas made both electrolytic and distilled. States confined their operations to distillation alone.

Some indication of the movement of foreign zinc within the United States is revealed when a breakdown of primary slab zinc from this source is considered. In 1946, 10 percent of primary slab zinc of foreign origin recovered in Montana accounted for 29 percent, Pennsylvania 17 percent, Illinois 13 percent, Texas 11 percent, Arkansas, and Idaho combined 9 percent. Zinc produced from foreign ores and concentrated recovered by electrolytic methods and 54 percent.

Primary slab zinc produced in the United States, by State, 1942-46, in short tons

Year	Arkansas	Idaho	Illinois	Montana	Oklahoma	Pennsylvania
1942.....	41,049	39,916	175,455	103,486	102,422	231,302
1943.....	35,704	41,129	221,080	237,585	72,043	218,058
1944.....	31,350	38,562	165,362	224,321	107,364	206,215
1945.....	29,391	23,110	124,904	175,251	106,115	200,709
1946.....	18,720	34,532	104,002	186,662	104,125	178,611

¹ Texas and West Virginia; also Missouri in 1942 and 1943.

SECONDARY ZINC

In addition to the redistilled secondary slab zinc (unalloyed) already reported herein, some remelted slab zinc is produced, and a large quantity of secondary zinc is recovered each year in the form of alloys, zinc dust, zinc pigments, and zinc salts. Additional information on secondary zinc is given in the Secondary Metals—Nonferrous chapter of this volume.

BYPRODUCT SULFURIC ACID

Sulfuric acid made from the sulfur dioxide gases produced in roasting zinc blende (sphalerite) is an important byproduct of zinc smelting. To utilize a larger proportion of their acid-producing capacity, some plants also consume large quantities of native sulfur. The production of sulfuric acid at zinc-blende roasting plants decreased 17 percent in 1946.

Sulfuric acid (60° B. basis) made at zinc-blende roasting plants in the United States, 1942-46

Year	Made from zinc blende ¹		Made from native sulfur		Total ²		
	Short tons	Value ³	Short tons	Value ³	Short tons	Value ³	
						Total	Average per ton
1942.....	695,242	\$6,470,037	147,513	\$1,393,998	842,755	\$7,864,035	\$9.45
1943.....	879,366	8,687,146	155,210	1,533,475	1,034,576	10,220,623	9.88
1944.....	839,451	8,344,143	258,927	2,673,734	1,098,378	10,917,877	9.94
1945.....	786,682	7,944,478	303,327	3,063,603	1,089,909	11,008,081	10.10
1946.....	701,080	6,842,541	207,141	2,021,696	908,221	8,864,237	9.76

¹ Includes acid from foreign blende.

² At average of sales of 60° acid.

ZINC DUST

All previous records for production of zinc dust were broken in 1946, the total output being 10 percent greater than in 1945 and 8 percent above the former high point reached in 1944. Zinc powder and blue powder are not included in the total produced; the zinc dust statistically reported is restricted to commercial grades that comply with severe specifications as to percentage of unoxidized metal, evenness of grading, and fineness of particles. The zinc content of the dust produced in 1946 ranged from 94.97 to 99.69 percent and averaged 97.91 percent. Shipments of zinc dust totaled 27,257 tons, of which 1 percent went to foreign countries. Shipments of zinc dust were slightly lower than production, and as the quantity consumed at manufacturers' plants was small (3 percent of output), producers' stocks increased from 1,622 tons (corrected figure) at the beginning to 2,148 tons at the close of the year.

The average price of zinc dust shipped to domestic consumers in 1946 was 10.6 cents a pound compared with 10.1 cents in 1945. The raw materials used to manufacture zinc dust are reviewed in the Secondary Metals—Nonferrous chapter of this volume. Most of the production is from zinc scrap (principally galvanizers' dross), but some is recovered from zinc ore, slab zinc, and as a byproduct of zinc refining.

ZINC

Zinc dust¹ produced in the United States, 1942-46

Year	Short tons	Value		Year	Short tons
		Total	Average per pound		
1942.....	22,805	\$4,789,050	\$0.105	1945.....	25,877
1943.....	25,990	5,249,980	.101	1946.....	28,577
1944.....	26,511	5,408,244	.102		

¹ All produced by distillation.

ZINC PIGMENTS AND SALTS

The principal zinc pigments are zinc oxide and litharge. The principal salts are the chloride and sulfate. These products are manufactured from various zinc-bearing materials, including zinc scrap, and residues. Details of the production of zinc pigments and salts are given in the Lead and Zinc Pigments and Salts chapter of this volume.

DOMESTIC CONSUMPTION

NEW SUPPLY

The following table shows the 5-year record of primary slab zinc available for consumption in the United States. This quantity, in effect, is equivalent to primary slab zinc available each year for shipment to domestic consumers.

In addition to primary slab zinc, 45,213 tons of red metal slab zinc were made available to consumers in 1946. This was for a decrease in stocks at secondary smelters. A remelt spelter were produced from purchased scrap.

Primary slab zinc available for consumption in the United States, 1942-46

	1942	1943	1944
Supply:			
Stocks at smelters Jan. 1.....	24,212	82,498	168,777
Production.....	886,810	933,828	867,222
Imports.....	36,362	66,155	63,624
Total available.....	947,374	1,072,481	1,099,623
Withdrawn:			
Exports.....	133,938	97,439	21,577
Shipments for Government account.....	82,498	168,777	233,044
Stocks at smelters Dec. 31.....	216,436	266,216	264,022
Total withdrawn.....	432,972	472,432	518,643
Available for consumption.....	514,402	599,049	580,980

¹ Adjusted to exclude imported slab zinc further refined into high-grade metal.

CONSUMPTION¹

According to reports from plants representing an estimated 99 percent of the consuming industry in the United States (670 plants in 1946), 801,242 tons of slab zinc (including 3,912 tons of purchased remelt spelter) were put in process in 1946, a 6-percent decline from the 1945 total of 852,311 tons and 10 percent below the record level of 888,626 tons in 1944. Receipts at consumers' plants during 1946 were 821,930 tons. The apparent discrepancy between this figure and the calculated 866,171 tons of primary and secondary slab zinc and remelt spelter shipped to domestic consumers in 1946 can be attributed to incomplete coverage of the survey, variations in the quantity of metal in transit from producer to consumer at the beginning and the end of the year, and unaccounted-for slab zinc stored in bonded warehouses.

Galvanizing continued as the principal use of slab zinc, although the quantity consumed for this purpose in 1946 declined 5 percent. The use of slab zinc fell sharply, owing largely to labor strikes at the brass mills and the increasing use of brass scrap in lieu of virgin metal. The quantity of zinc used for zinc-base alloys reached an all-time high of 212,211 tons, a gain of 62 percent over 1945.

Consumption of slab zinc in the United States, 1942-46, by industries, in short tons¹

Industry and product	1942	1943	1944	1945	1946
Galvanizing: ²					
Sheet and strip.....	76,106	72,233	119,381	135,383	113,816
Wire and wire rope.....	35,216	37,391	44,850	46,083	43,667
Tubes and pipe.....	47,685	51,023	50,472	63,163	62,460
Wire cloth.....	7,320	(³)	(³)	(³)	(³)
Fittings.....	(³)	14,549	14,113	10,014	10,593
Other.....	81,764	78,005	87,876	82,638	89,223
	247,491	253,201	316,991	337,181	319,759
Brass products:					
Sheet, strip, and plate.....		287,962	246,402	148,375	66,125
Rod and wire.....	292,820	60,638	70,970	67,299	53,387
Tube.....		24,466	27,725	21,507	19,173
Castings and billets.....		16,851	16,703	12,942	4,776
Copper-base ingots.....	27,126	20,384	17,174	9,893	4,379
Other copper-base products.....		2,868	2,953	1,361	1,262
	319,946	419,079	381,927	250,377	149,102
Zinc-base alloy:					
Die castings.....	58,918	60,115	76,201	121,966	206,237
Alloy dies and rod.....	21,227	10,067	8,245	8,286	5,313
Slush and sand castings.....	(³)	143	75	684	661
	80,145	70,325	84,521	130,836	212,211
Rolled zinc:					
Zinc oxide.....	66,045	48,529	70,524	97,889	92,397
Other uses:	7,977	11,496	20,198	18,113	19,170
Slush castings.....	552	(³)	(³)	(³)	(³)
Wet batteries.....	1,667	1,807	2,174	1,790	1,635
Desilverizing lead.....	1,261	2,178	2,051	2,095	1,781
Light-metal alloys.....	(³)	1,074	2,047	1,469	545
Other.....	3,095	3,088	3,193	3,861	4,642
	6,565	8,147	9,465	9,215	8,603
Total consumption	728,169	816,777	888,626	852,311	801,242

¹ Based on a canvass of 600 plants in 1942 and a somewhat larger coverage in 1943-46 mostly from small consumers.

² Includes zinc used in electrogalvanizing, but excludes sherardizing.

³ Separate figures not available but included in "Other."

⁴ Includes miscellaneous articles not given elsewhere.

⁵ Included under "Other uses."

⁶ Included under "Zinc-base alloy" in 1943-46.

⁷ Includes zinc used in making zinc dust, bronze powder, alloys, chemicals, castings, and miscellaneous uses not elsewhere mentioned.

⁸ Includes 6,982 tons of remelt zinc in 1944, 5,111 tons in 1945, and 3,912 tons in 1946.

⁹ See also, Ransome, Alfred L., Consumption of Slab Zinc in the United States, 1900-45, by Industries, Grades and Geographic Divisions; Bureau of Mines Inf. Circ. 7450, February 1948, 31 pp.

ZINC

The volume of slab zinc consumed for rolled products was short of equaling the 1945 figure. In addition to the mills remelt and reroll the metallic scrap produced in casting operations. The scrap so treated in 1946 totaled 3,313 tons—a 42-percent decrease from the comparable 1945. Purchased zinc scrap in the form of zinc scrap, and engravers' plates totaling 3,313 tons was in 1946 (3,652 tons in 1945). Production of rolled zinc and purchased scrap was 92,648 tons, a decrease from 1945. Inventories of rolled zinc were 2,531, 1946, compared with 2,498 tons (revised figure) in 1945. In addition to the actual shipments of zinc in 1946, the rolling mills processed 50,133 tons (including that which was remelted and rerolled) 32,429 tons of semifabricated and finished products.

Rolled zinc produced and quantity available for consumption, 1945-46

	1945		
	Short tons	Total Value	Average per pound
Production:			
Sheet zinc not over 0.1 inch thick.....	16,746	\$4,624,274	\$0.138
Boiler plate and sheets over 0.1 inch thick.....	3,057	717,301	.117
Strip and ribbon zinc.....	77,176	18,817,191	.122
Foil, rod, and wire.....	1,406	559,213	.199
Total rolled zinc.....	98,384	24,717,979	.126
Imports.....	(¹)		
Exports.....	5,418	1,484,826	.137
Available for consumption.....	92,966		
Value of slab zinc (all grades).....			.086
Value added by rolling.....			.040

¹ Figures represent net production. In addition, 31,968 tons of strip and in 1946 were rerolled from scrap originating in fabricating plants in connection with the production of rolled zinc.

² Less than 1 ton.

³ Allowances made for change in producers' stocks of rolled zinc.

⁴ Revised figure.

The following table shows the six commercial grades of zinc and purchased remelt spelter consumed by the industry in 1946. Of the 801,242 tons of domestic and foreign zinc consumed in 1946, 37 percent was Prime Western, 32 percent Special, 17 percent Regular High Grade, compared with 37 percent Prime Western, 32 percent Special, 17 percent Regular High Grade, respectively, in 1945. All grades of zinc were used in the manufacture of brass and rolled zinc products. The principal grade used in the hot-dip process was the principal grade used in the hot-dip process. The higher grades being used chiefly for electrogalvanizing. The use of higher grades in brass manufacture necessitates the use of higher grades. 66 percent of the total used in this industry being of the higher grades.

Consumption of slab zinc in the United States in 1946, by grades, according to industry, in short tons

	Special High Grade	Regular High Grade	Intermediate	Brass Special	Selected	Prime Western	Remelt	Total
Galvanizing.....	11,514	14,610	10,985	12,870	973	266,270	2,537	319,759
Brass products.....	33,975	64,239	11,193	14,046	201	24,613	776	149,102
Zinc-base alloy.....	207,063	3,905	888	-----	-----	229	326	212,211
Rolls zinc.....	3,864	36,778	11,545	36,498	1,160	3,662	-----	92,397
Zinc oxide.....	1,870	17,300	-----	-----	-----	-----	-----	19,170
Other uses.....	1,381	3,469	1,281	669	-----	1,529	274	8,603
Total.....	259,667	139,301	35,692	64,083	2,394	290,203	3,912	801,242

STOCKS

Producers' Stocks.—Inventories of slab zinc at producers' plants dropped 31 percent in 1946 and were the lowest recorded since 1943. Of the 176,342 tons on hand at the end of the year, 123,231 tons were Special High Grade and Regular High Grade and the remainder (53,111 tons) of lower grades, compared with 169,679 tons and 86,537 tons, respectively, at the end of 1945. Nearly the entire decline can be accounted for by reduced inventories of Prime Western (75 percent) and Special High Grade and Regular High Grade (27 percent).

Stocks of zinc ore (60 percent concentrates) in the Tri-State district (as reported by the Tri-State Zinc and Lead Ore Producers' Association) were 3,677 tons, lowest for the year, at the beginning of 1946. Inventories increased to 6,930 tons on March 23 but declined thereafter to 3,988 tons on July 13. High point of the year was reached on November 2, with a total of 10,614 tons, followed by a general downward trend to 8,328 tons on December 28.

Stocks of zinc on hand at zinc-reduction plants in the United States at end of year, 1942-46, in short tons

	1942	1943	1944	1945	1946
At primary reduction plants.....	82,498	108,777	233,044	254,765	175,586
At secondary distilling plants.....	1,942	1,829	652	1,461	756
	84,440	170,606	233,696	256,216	176,342

Consumers' Stocks.—Stocks of slab zinc at consumers' plants increased markedly in 1946, the total on December 31 being 28 percent over the quantity on hand at the beginning of the year. Inventories increased abruptly at the first of the year to a high of about 116,300 tons on May 31, followed by a general downward trend during the remainder of the year. At the average monthly rate of consumption in 1946, consumers' stocks on hand at the end of 1946 were slightly more than 1 month's requirements.

Consumers' stocks of slab zinc at plants at the beginning of the year, 1946, in short tons

	Galvanizers	Die casters ¹	Brass mills ²	Zinc rolling mills
Dec. 31, 1945.....	33,086	12,791	18,185	6,317
Dec. 31, 1946.....	42,678	22,271	20,041	6,648

¹ Includes producers of zinc-base die castings, zinc-alloy dies, and zinc-alloy dies.

² Includes brass mills, brass ingot makers, and brass products.

³ Revised figure.

⁴ Stocks on December 31, 1945 and 1946, exclude 416 tons and 497 tons, respectively.

PRICES

The base ceiling price established by the Office of War Relocation of 8.25 cents a pound for Prime Western grade zinc at St. Louis remained unchanged through June 30. A bill for the OPA was vetoed by the President on June 29, and the price of zinc advanced to 9.50 cents, St. Louis. With the OPA by legislative action on July 25, the former price of 8.25 cents became effective and prevailed until October 1. The OPA announced an upward revision of 1 cent per pound, establishing the market at 9.25 cents, St. Louis, by order of November 12, retroactive to November 1. The prices from all metals and opened the way for a further advance on November 12 to 10.50 cents, St. Louis, the highest for Prime Western zinc since March 1917. The weight received by the producers for all grades of zinc was 8.6 cents a pound, f. o. b. plants, compared with 8.6 cents in 1946 price of 12.2 cents for zinc, which appears in the volume of this volume, represents the weighted average price of grades of slab zinc (8.9 cents) plus the increment of 1 cent per pound based upon the total mine output of 1946. The \$37,954,842 in subsidies for overquota production and smelter contracts paid by the Office of Metals.

The general policy of the Quota Committee for the Premium Price Plan for overquota mine products (copper and lead were also included) prevailed until it collapsed with expiration of the OPA and ceiling prices. Upon reestablishment of the OPA in late July 1947, for retroactive premium payments to cover the price increase was in effect. The Premium Price Plan was extended in 1947, under the same terms as in the past, except that in the subsidy section of the bill extending the OPA that "adjustments shall be made to encourage exportation and adequate allowances for depreciation." The bill further provided that all classes of premium contracts be cancelable unless necessary to make individual adjustments to specific mines. With the abandonment of the Premium Price Plan on November 10, subsidies to mines financially aided by the Premium Price Plan were computed with average monthly prices as a base. A compilation of important data showing zinc under the Premium Price Plan, 1943-46, at various levels and the payments made, is given in the following table.

Salient statistics on zinc with regard to operation of Premium Price Plan, 1943-46¹

	1943			1944			1945			1946		
	Tri-State district	U. S. exclusive of Tri-State	U. S. total	Tri-State district	U. S. exclusive of Tri-State	U. S. total	Tri-State district	U. S. exclusive of Tri-State	U. S. total	Tri-State district	U. S. exclusive of Tri-State	U. S. total
Total production of recoverable zinc ² short tons.....	200,103	540,565	740,668	200,311	515,465	715,806	140,181	474,177	614,358	137,858	427,929	565,787
Ceiling production at 8.25 cents a pound.....do.....	11,930	326,251	338,181	20,911	251,105	272,016	6,672	204,633	210,305	2,253	165,896	168,149
Ceiling production, proportion of total.....percent.....	5.96	60.35	45.66	10.44	48.71	38.00	4.05	43.10	34.23	1.63	38.77	29.72
Overceiling production under Premium Price Plan:												
"A" quota only (11.00 cents a pound) short tons.....	92,650	146,639	239,289	65,714	171,328	237,042	41,388	191,328	232,716	15,594	132,861	148,455
"B" quota (13.75 cents a pound).....do.....	58,243	40,045	98,288	65,779	56,015	121,794	82,135	39,444	91,579	35,082	36,152	71,234
"C" quota (16.50 cents a pound).....do.....	34,893	22,778	57,671	42,080	31,421	73,501	35,192	36,009	71,201	56,956	44,861	101,817
.....percent.....										22.262	47.136	69.398
Total premium production.....do.....	185,696	209,462	395,158	173,573	258,764	432,337	128,715	266,781	395,496	129,894	261,010	390,904
Metals Reserve mine contracts.....do.....	2,477	4,852	7,329	5,857	5,596	11,453	5,794	2,763	8,557	5,711	1,023	6,734
Total overceiling production.....do.....	188,173	214,314	402,487	179,430	264,360	443,790	134,509	269,544	404,053	135,605	262,033	397,638
Overceiling production, proportion of total:												
Production under Premium Price Plan:												
"A" quota only.....percent.....	46.30	27.13	32.31	32.80	33.24	33.12	29.53	40.35	37.88	11.31	31.05	26.24
"B" quota (also received "A").....do.....	29.11	7.41	13.27	32.83	10.87	17.01	37.19	8.32	14.91	25.45	8.45	12.59
"C" quota (also received "A" and "B") percent.....	17.39	4.21	7.77	21.01	6.09	10.27	25.10	7.59	11.59	41.31	10.48	17.99
.....percent.....										16.15	11.01	12.27
Total premium production.....do.....	92.80	38.75	53.35	86.64	50.20	60.40	91.82	56.26	64.38	94.22	60.90	69.09
Metals Reserve mine contracts.....do.....	1.24	.90	.99	2.92	1.09	1.60	4.13	.58	1.39	4.15	.24	1.19
Total overceiling production.....do.....	94.04	39.65	54.34	89.56	51.29	62.00	95.95	56.84	65.77	98.37	61.23	70.28
Payments under Premium Price Plan: ³												
"A" premium.....dollars.....	10,213,269	11,520,444	21,733,713	9,546,487	14,283,080	23,829,567	7,079,337	14,672,969	21,752,306	5,802,964	11,490,232	17,293,196
"B" premium.....do.....	5,117,544	3,455,281	8,572,825	5,932,208	4,809,086	10,741,294	4,802,986	4,140,882	8,952,868	4,081,379	4,296,471	8,377,850
"C" premium.....do.....	1,914,183	1,252,814	3,166,997	2,314,401	1,728,271	4,042,672	1,935,543	1,980,489	3,916,032	3,153,057	2,383,854	5,536,911
.....percent.....										2,411,697	2,576,074	4,987,671
Total premium production.....do.....	17,244,996	16,228,539	33,473,535	17,793,096	20,820,437	38,613,533	13,817,866	20,803,340	34,621,206	16,448,907	20,746,631	37,165,628
Metals Reserve payments to smelters ⁴ do.....				402,680		402,680	875,247		875,247			

Metals Reserve mine contracts ⁵ dollars.....	225,005	280,353	505,358	578,737	313,792	892,529	550,979	157,745	708,724	698,862	60,352	759,214
Total overceiling payments.....do.....	17,470,001	16,508,892	33,978,893	18,774,413	21,134,229	39,908,642	15,244,092	20,961,085	36,205,177	17,147,859	20,805,983	37,954,842
Average prices per pound of zinc: ⁶												
Average premium production.....cents.....	12.893	12.124	12.485	13.376	12.273	12.716	13.618	12.150	12.627	15.218	12.861	13.645
Metals Reserve mine contracts.....do.....	12.791	11.139	11.698	13.190	11.054	12.146	13.005	11.105	12.391	15.005	11.837	14.524
Total overceiling production.....do.....	12.892	12.102	12.471	13.482	12.247	12.746	13.917	12.138	12.730	15.210	12.857	13.660
Total production.....do.....	12.615	9.777	10.544	12.936	10.300	11.038	13.687	10.460	11.197	15.106	11.318	12.241

¹ From published and unpublished reports of the Office of Price Administration and the Office of Premium Price Plan for Copper, Lead, Zinc, and Manganese.

² Production of Tri-State zinc from Office of Metals Reserve agency, Joplin, Mo.; all other from Bureau of Mines monthly reports. These data are preliminary and do not exactly equal final annual totals for the United States except for 1945.

³ January-October. "A", "B", and "C" quotas and premium payments for November and December are not separable and are shown with footnote 4.

⁴ Total "A", "B", and "C" quotas and premium payments for November and December; separation by kinds not available.

⁵ Data on premium payments, payments to smelters, and Metals Reserve mine-contract payments from Office of Metals Reserve. All payments shown are subject to correction due to additional payments as a result of retroactive quota adjustments, late reports by smelters and custom mills, etc.

⁶ All average prices shown include OPA ceiling price.

Price of zinc and zinc concentrates, 1942-46

average price for foreign zinc, converted to cents per pound with the pound sterling at \$4.02½.
based upon price indexes of U. S. Department of Labor.

Metal Statistics, 1947, p. 662. St. Louis: Metal Statistics, 1947, p. 659. London: E&MJ Metal
 and Markets.
 of include Government premium of \$29.70 a ton on zinc concentrates payable for overquota pro-
 duce price for foreign zinc converted to cents per pound with the pound sterling at \$4.02½. Official
 price raised on June 11, 1945, and Apr. 8, July 1, and Nov. 13, 1946.
 market due to uncertainty of Premium Price Plan subsidies.

² American Metal Market quotes average prices (delivered) of High Grade and High Grade (f. o. b. New York)—1942-45, 9.25 cents; 1946, 9.73 cents. Brass Spéc 1942-45, 8.50 cents; 1946, 8.98 cents.

¹ Figures on imports and exports compiled by M. B. Price, of the Bureau of U. S. Department of Commerce.

Zinc imported for consumption in the United States, 1942-46, by classes

Year	Ores (zinc content)		Blocks, pigs, slabs		Sheets		Old, dross and skimmings ¹		Zinc dust		Total value ²
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	
1942.....	283,167	\$10,723,983	36,352	\$2,924,438	50	\$10,066	3,357	\$158,929	702	\$43,464	\$13,860,900
1943.....	516,646	20,476,688	56,155	5,826,874	(³) 15	56	5,146	226,754	106	17,585	26,545,937
1944.....	418,004	18,678,957	63,626	6,132,877	(³) 15	2,540	5,603	306,188	.....	.....	25,114,562
1945.....	330,397	14,902,057	96,710	12,186,873	(³) 15	2	7,831	477,893	362	39,789	27,648,614
1946.....	166,885	8,122,471	104,016	10,474,850	(³) 15	10	4,137	300,429	77	4,942	24,902,702

¹ Includes dross and skimmings as follows—1942: 3,214 tons, \$160,913; 1943: 5,032 tons, \$216,425; 1944: 4,694 tons, \$224,995; 1945: 4,323 tons, \$231,946; and 1946: 2,851 tons, \$185,972.

² In addition, manufactures of zinc imported as follows—1942: \$10; 1943: \$35,355; 1944: \$14,223; 1945: \$8,077; and 1946: \$1,929.

³ Less than 1 ton.

Exports.—The value of export of zinc ores (and concentrates) and manufactured articles containing zinc of foreign and domestic origin (excluding galvanized products, alloys, and pigments) amounted to \$11,199,007 in 1946, compared with \$2,956,222 in 1945. In addition to the items shown in the accompanying tables, considerable zinc is exported each year in brass, pigments, chemicals, and galvanized iron and steel. Export data on zinc pigments and chemicals are given in the Lead and Zinc Pigments and Zinc Salts chapter of this volume. Much of the zinc used in the manufacture of such products is of foreign origin, and when they are exported a draw-back of 99 percent of the import duty is refunded upon the basis of zinc contained in the finished product. Data covering draw-back in 1945 and 1946 are not yet available. Draw-back refunds were made on 7,274 tons in 1943 and on 29,738 tons in 1944.

Zinc ore and manufactures of zinc, exported from the United States, 1942-46

Year	Zinc ore, concentrates, and dross (zinc content)		Slabs, plates, or blocks		Sheets, strips, or other forms, n. e. s.		Zinc dust	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1942.....	(¹)	\$18	133,938	\$22,828,929	4,767	\$1,289,889	1,772	\$417,957
1943.....	(¹)	806	97,439	17,167,729	3,167	891,132	5,859	1,263,296
1944.....	(¹)	38	21,576	3,717,643	4,020	1,065,206	295	74,478
1945.....	(¹)	67	7,782	1,126,910	6,235	1,747,937	330	81,308
1946.....	80	15,440	87,431	6,626,800	13,846	4,468,328	366	89,439

¹ Less than 1 ton.

ZINC

Slab and sheet zinc exported from the United States, 1943-46, in short tons

Destination	Slabs, plates, and block				Sheet
	1943	1944	1945	1946	1943
Country:					
Argentina.....	(¹)	(¹)	110	3,705	91
Australia.....	(¹)	(¹)	2,060	4,133	48
Belgium and Luxembourg.....	1,828	1,069	441	1,301	79
Brass.....	13,347	4,132	24	1	2,160
Canada.....	107	17	687	643	24
Chile.....	2,170	(¹)	141	417	5
Cuba.....	(¹)	(¹)	(¹)	67	68
Czechoslovakia.....	(¹)	(¹)	(¹)	1,118	(¹)
Finland.....	(¹)	(¹)	(¹)	950	(¹)
France.....	(¹)	(¹)	2,204	4,080	(¹)
India.....	5,818	(¹)	(¹)	54	196
Mexico.....	181	473	113	64	(¹)
Netherlands.....	(¹)	(¹)	(¹)	2,491	(¹)
Portugal.....	(¹)	(¹)	(¹)	17	2
Sweden.....	(¹)	(¹)	(¹)	470	1,181
Switzerland.....	(¹)	(¹)	(¹)	1,338	4,205
Turkey.....	(¹)	(¹)	(¹)	3	179
Union of South Africa.....	1,329	(¹)	(¹)	(¹)	144
U. S. S. R.....	23,477	1,151	(¹)	(¹)	(¹)
United Kingdom.....	48,540	14,689	(¹)	12,760	2
Other countries.....	962	64	276	124	361
Continent:	97,439	21,576	7,782	37,431	3,167
North America.....	13,509	4,621	300	136	2,288
South America.....	1,652	1,112	1,391	5,753	317
Europe.....	72,017	15,820	6,087	26,863	74
Asia.....	7,991	23	3	4,679	15
Africa.....	2,269	1	1	(¹)	32
Oceania.....	1	(¹)	(¹)	(¹)	5

¹ Less than 1 ton.

WORLD REVIEW

World production of zinc in recent years, insofar as is shown in the accompanying table.

World smelter production of zinc, 1940-46, by countries where produced

(Compiled by B. B. Mitchell)

Country	1940	1941	1942	1943	1944	1945	1946
Argentina.....	(¹)	(¹)	410	728	(¹)	(¹)	(¹)
Australia.....	77,176	78,945	78,474	78,972	(¹)	(¹)	(¹)
Belgium.....	70,419	38,690	28,620	27,770	(¹)	(¹)	(¹)
Canada.....	168,495	193,784	198,769	187,342	187,342	187,342	187,342
China.....	(¹)	214	(¹)	(¹)	(¹)	(¹)	(¹)
Czechoslovakia.....	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
France.....	37,843	25,918	22,829	21,490	(¹)	(¹)	(¹)
Germany.....	317,600	317,600	314,100	312,000	(¹)	(¹)	(¹)
Indochina, French.....	6,104	6,261	6,462	6,438	(¹)	(¹)	(¹)
Italy.....	39,338	38,900	33,846	15,460	(¹)	(¹)	(¹)
Japan.....	69,214	62,177	64,730	60,948	(¹)	(¹)	(¹)
Mexico.....	33,388	38,678	51,743	64,449	(¹)	(¹)	(¹)
Netherlands.....	5,049	3,718	6,133	4,565	(¹)	(¹)	(¹)
Northern Rhodesia.....	13,402	13,762	13,046	13,620	(¹)	(¹)	(¹)
Norway.....	17,229	6,404	7,693	15,376	(¹)	(¹)	(¹)
Peru.....	178	752	941	1,225	(¹)	(¹)	(¹)
Poland.....	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Spain.....	12,322	19,143	19,150	19,200	(¹)	(¹)	(¹)
Sweden.....	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
U. S. S. R.....	85,000	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
United Kingdom.....	60,025	68,677	72,437	70,345	(¹)	(¹)	(¹)
United States.....	612,596	745,720	809,088	854,844	(¹)	(¹)	(¹)
Yugoslavia.....	4,989	(¹)	(¹)	(¹)	(¹)	(¹)	(¹)
Total.....	1,620,600	1,749,200	1,800,000	1,830,800	1,830,800	1,830,800	1,830,800

¹ Included with Germany.

² Data not available; estimate by senior author of chapter included in total.

³ Includes Austria, Czechoslovakia, and Poland in 1940-44.

⁴ Estimated.

⁵ Preliminary data for fiscal year ended March 31 of year following that stated.

⁶ Some secondary metal included.

Argentina.—The Aguilar mine of the Compania Minera Aguilar, A., subsidiary of the St. Joseph Lead Co., continued to be the leading producer in 1946, although the property operated at about 60 percent capacity owing to shortage of mine timber, fuel oil, and inability of the road to provide enough cars for shipping concentrates from the mine. The zinc-concentrates production at the Aguilar mine in 1946 was 29,601 metric tons compared with 25,862 tons in 1945.

Australia.—Labor shortages and the difficulty in obtaining new mining machinery continued to restrict zinc production at Australian mines and smelters in 1946.

The production of crude ore at the Broken Hill South, Ltd., for the year ended June 30, 1946, was 293,130 long tons compared with 1,605 tons for the previous year.

The Lake George Mining Corp., Ltd., at Captain's Flat, New South Wales, produced 135,244 tons of ore for the fiscal year ended June 30, 1946, compared with 164,549 tons for the previous year. The total estimated ore reserves remaining at the property on June 30 were 82,753 tons assaying 1.1 dwt. gold and 1.4 ounces of silver per ton, 17.2 percent lead, 12.4 percent zinc, and 0.7 percent copper.

The electrolytic plant of the Electrolytic Zinc Co. of Australasia, Ltd., at Risdon, Tasmania, which treats zinc concentrates from Broken Hill, New South Wales, as well as from the company-owned Manian mines, produced 77,299 long tons of slab zinc during 1946.

Canada.—At Trail, British Columbia, the Consolidated Mining & Smelting Co. continued to be the principal source of Canadian zinc production. According to the company's annual report to stockholders, slab zinc produced at the electrolytic plant at Trail was 139,337 tons compared with 134,873 tons in 1945. Ore reserves at the end of the year showed a net increase of about 3.3 million tons.

The Hudson Bay Mining & Smelting Co., Ltd., at Flin Flon, Manitoba, according to the company's annual report to stockholders, produced 1,837,472 short tons of ore in 1946. About 145,900 tons of concentrates averaging 45.4 percent zinc were produced at the company flotation mill. Slab-zinc production at the company electrolytic plant was 51,328 tons compared with 47,468 tons in 1945. At Sherridon, Manitoba, the Sherritt Gordon Mines, Ltd., milled 1,336 tons of ore in 1946, from which 17,291 tons of zinc concentrates were recovered. Ore reserves in the West mine at the end of 1946 were 1,368,000 tons averaging 2.12 percent zinc and 2.60 percent copper; known ore at the East mine was completely mined out during the year.

The Normetal Mining Corp., Ltd., at Normetal, Quebec, during the year milled 186,634 tons of ore averaging 3.64 percent copper and 3.68 percent zinc, which yielded 20,508 short tons of zinc concentrate (3.68 percent zinc), in addition to copper concentrate. Ore reserves at the end were 1,716,000 tons averaging 7.28 percent zinc and 3.68 percent copper. Ore reserves at the Waite Amulet Mines, Ltd., were reduced from 2,517,538 tons in 1945 to 1,997,739 tons at the end of the year.

Mexico.—Labor strikes, poor railroad facilities, and high taxes were the principal factors limiting Mexican zinc output in 1946. On November 31, 1945, a general strike of Mexican mine and smelter

labor, originally scheduled for December 17, shut off zinc production at the end of February 1946, when new wage scales were agreed upon and the workers returned to their jobs.

Newfoundland.—The mine production of zinc, in content of concentrates produced, totaled 87,673 short tons in 1946 compared with 49,350 tons in 1945.

United Kingdom.—Consumption of zinc in the United Kingdom totaled 289,364 long tons in 1946, of which 216,089 tons were primary and 73,275 tons secondary (including remelted). Zinc figures for 1945 were 250,383 tons consumed, of which 199,000 tons were primary and 77,060 tons secondary. Of the total zinc consumed in 1946, 33 percent was used in brass products, 25 percent in zinc oxide, 19 percent in zinc dust and miscellaneous, 7 percent for die castings, and 7 percent for zinc dust and miscellaneous.

U. S. S. R.—Virtually no official production figures are available on the Russian zinc industry during the last year, however, presented in the announcement March 1946. The Year Plan indicates that zinc output has been declining.