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Mineral and Metal Production in 1908

Statistics of the Output of the More Important Substances. Commercial Movements. Market Conditions. Mining and Metallurgy

SOME INCREASES, MANY DECREASES

In the accompanying table we summarize the production of the more important minerals and metals in the United States in 1908 so far as it has been possible to collect the statistics at so early a date. The figures for copper, lead and spelter are based on reports received directly from the producers, who have communicated their actual output during the first 11 months of the year, together with their estimates of probable production in December; in many cases the estimates are for only the last few days of December. The other statistics are based chiefly on the reports of pro-

ducers, State mine inspectors, and special correspondents. The statistics for the production of gold and silver in the United States are the preliminary estimates of the Director of the Mint. Even under these conditions, it is impossible to insure accuracy. Among other difficulties, there are always likely to be duplications or omissions in the reports of the producers, which can be corrected only by careful investigation involving considerable time. However, we are confident that the statistics which we are able to present at this early date are close approximations to the truth. It will be observed that in some cases there are differences between the statistics

given by the various contributors to this number and our editorial statistics. This is because the articles of our outside contributors were necessarily written and put into type before our own statistics were available, which in some cases was not until Jan. 6, 1909, and consequently the statistics of our contributors are generally estimates. This explanation will account for discrepancies, though the reason will be so obvious to our readers that an explanation is hardly required.

We thank the producers of metals and minerals for their courteous coöperation

was punctured. During the first two months of 1907 prices continued to rise, but as early as March it was manifest that industrial activity was on the downward grade. A stock of unsold copper began to accumulate in May, but it was not until after the middle of July that many prominent industrialists, who should have been better informed, awoke to the fact that a general recession in business was not merely impending, but had actually proceeded far.

The year 1908 began with the panic conditions a matter of history, but with

MINERAL AND METAL PRODUCTION OF THE UNITED STATES.
PRELIMINARY STATISTICS, SUBJECT TO REVISION.

Product.	Customary Measure.	1907.			1908.			Changes In Quantity.
		Quantity.	VALUE.		Quantity.	VALUE.		
			Total.	Per Unit.		Total.	Per Unit.	
NON-METALLIC:								
Coal, bituminous	Short ton	388,222,868	\$463,654,776	\$1.20	338,688,000	\$390,103,984	\$1.15	D. 49,534,868
Coal, anthracite	Short ton	86,341,832	198,653,218	2.30	80,280,000	184,682,317	2.30	D. 6,061,832
Iron ore	Long ton	52,955,070	117,560,255	2.22	34,202,000	61,563,100	1.80	D. 19,339,030
Limestone flux	Long ton	15,722,801	7,480,121	0.475	9,650,000	3,860,000	0.40	D. 6,072,801
Petroleum	Barrel	164,347,930	123,260,948	0.75	184,734,678	131,779,288	0.71	I. 20,386,748
MANUFACTURED:								
Coke	Short ton	36,993,622	99,055,150	2.687	22,697,000	53,926,887	2.376	D. 14,296,622
Copper sulphate	Pound	44,867,650	2,804,228	0.0625	45,144,000	2,198,513	0.0487	I. 276,350
Lead, sublimed white	Short ton	8,700	1,026,600	118.00	9,100	973,700	107.00	I. 400
Zinc oxide (a)	Short ton	85,390	7,731,100	90.54	65,100	5,876,040	90.28	D. 20,290
METALLIC:								
Copper	Pound	879,241,766	181,660,142	0.20661	952,395,477	127,849,569	0.13424	I. 73,153,711
Gold	Oz. fine	4,375,215	90,435,700	20.67	4,659,562	96,313,256	20.67	I. 284,347
Iron, pig	Long ton	25,442,013	580,077,896	22.80	15,828,000	268,284,600	16.95	D. 9,953,327
Lead	Short ton	350,130	37,288,845	106.50	323,841	27,202,644	84.00	D. 26,291
Quicksilver	Flasks	20,932	780,506	37.29	20,000	840,000	42.00	D. 932
Silver	Oz. fine	56,514,700	36,919,358	0.65327	51,798,053	27,382,523	0.52864	D. 4,716,647
Zinc	Short ton	249,612	29,763,735	119.24	207,735	19,635,112	94.52	D. 41,877

(a) Includes zinc-lead pigment.

ducers, State mine inspectors, and special correspondents. The statistics for the production of gold and silver in the United States are the preliminary estimates of the Director of the Mint.

Even under these conditions, it is impossible to insure accuracy. Among other difficulties, there are always likely to be duplications or omissions in the reports of the producers, which can be corrected only by careful investigation involving considerable time. However, we are confident that the statistics which we are able to present at this early date are close approximations to the truth.

It will be observed that in some cases there are differences between the statistics

by promptly and fully furnishing us with statements of their production in 1908 and we thank many other persons who have aided in the preparation of this number.

The metal industries suffered in 1908 from the general commercial depression that began in 1907. This has proved to be more far-reaching than was at first supposed. Indeed, the setback began earlier than people in general were aware. Probably the threatening of adverse conditions was apparent to the great international banking houses before the end of 1906—perhaps before the Cobalt boom

demand for the metals at low ebb, as was naturally to be expected, and the accumulation of large unsold stocks, the latter being unequally distributed among the producers, although there was scarcely one who did not have something on hand. During the falling market in the last quarter of 1907, some producers sold steadily for what could be realized; others held aloof, expecting all the time a recovery, only to be obliged finally to sell at a sacrifice when necessity compelled; others who missed the market on the decline, but were able to finance their accumulations, were carrying large stocks at the beginning of 1908.

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Metal Markets

New York, Jan. 6.—The metal markets generally show some revival of activity at the opening of the year, but no marked changes from the previous week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Nov. 1908..	\$ 2,967,795	\$ 2,892,225	Exp. \$ 75,570
" 1907..	615,169	63,574,871	Imp. 62,959,702
Year 1908..	73,857,749	45,105,998	Exp. 28,750,846
" 1907..	54,211,240	98,949,657	Imp. 44,738,317
Silver:			
Nov. 1908..	3,951,987	3,275,609	Exp. 676,378
" 1907..	4,187,378	3,602,405	" 584,973
Year 1908..	47,111,352	37,814,676	" 9,296,706
" 1907..	57,212,168	41,690,324	" 15,521,844

Exports of specie from New York, week ended Jan. 2: Gold, \$31,250, to the West Indies and Panama; silver, \$723,796, chiefly to London. Imports: Gold, \$77,612; silver, \$90,761, both from Central and South America.

Gold—The London price of gold in the open market is about the same as last week, 77s. 9¼d. per oz. for bars, and 76s. 5d. for American eagles.

Platinum—Prices are strong. Dealers quote \$24.25 per oz. for ordinary metal, \$26.25 for hard, \$20@21 for good scrap.

SILVER AND STERLING EXCHANGE.

Dec.-Jan.	31	1	2	4	5	6
New York....	50 ¼	.....	50 ¼	50 ¼	50 ¼	50 ¼
London.....	23 ¾	23 ¾	23 ¾	23 ¾	23 ¾	23 ¾
Sterling Ex..	4.8700	.....	4.8710	4.8705	4.8680	4.8690

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Silver—Owing to a variety of causes the tone of silver has improved, and price has advanced to 23¾d. Chief among these causes are a better feeling in India owing to the uptake of silver for the interior; buying on China account; covering by speculators, and some purchases on long account by those who are hopeful of business this coming year.

Copper, Tin, Lead and Zinc

Dec.-Jan.	Copper.			Tin.	Lead.	Spelter.	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.	Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
31	14 ¼ @14 ¼	14 ¼ @14 ¼	63 ¾	29	4.15 @4.20	5.12½ @5.15	4.97½ @5.00
1	.....	.....	.....	.....	.....	.....	.....
2	14 ¼ @14 ¼	14 ¼ @14 ¼	.....	29	4.17 @4.22	5.15 @5.17½	5.00 @5.02½
4	14 ¼ @14 ¼	14 ¼ @14 ¼	63 ¾	29	4.17 @4.22	5.15 @5.20	5.00 @5.05
5	14 ¼ @14 ¼	14 ¼ @14 ¼	63 ¾	29	4.17 @4.22	5.15 @5.20	5.00 @5.05
6	14 ¼ @14 ¼	14 ¼ @14 ¼	63 ¾	28 ¾	4.17 @4.22	5.15 @5.20	5.00 @5.05

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The demand to which reference was made last week continued up to the close of the year, and round quantities of both electrolytic and Lake copper were sold to foreign and domestic consumers. Since the beginning of this week a much quieter tone prevails. The market closes higher and steady at 14½@14¾c. for Lake copper; 14¼@14¾c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper is 14@14½ cents.

Copper sheets, cold-rolled, 20c.; hot-rolled, 19c. per lb. Wire, 15¾c. base.

The London Standard market fluctuated within narrow limits and closes a fraction lower than last week, quotations being cabled at £63 15s. for spot, £64 10s. for three months.

Statistics for the second half of December show an increase in the visible supplies of 2000 tons.

Refined and manufactured sorts we quote: English tough, £67; best selected, £66@67; strong sheets, £78@79.

Tin—Transactions in the London market have been of small volume, but at rather steady prices. The close is somewhat softer at £131 for spot, £132 5s. for three months.

The domestic market displayed no special features. Interest among consumers is still lacking. At the close tin is offered at 28.75 cents.

Statistics for the month of December show a decrease in the visible supplies of 1200 tons.

Lead—Demand has been somewhat better, absorbing the lots offered from Missouri and by dealers, which had been hanging over the market. The close is firm and higher at 4.17½@4.22½c., New York.

Some life was infused into the London market, due to cables from Australia that a strike had broken out in the mines of the Broken Hill Proprietary Company. This news started an advance, the market reaching £13 7s. 6d. for Spanish lead on Monday last, but since then an easier tendency prevails and the close is lower at £13 3s. 9d. for Spanish lead, £13 6s. 3d. for English lead.

Spelter—Demand on the part of speculators and consumers brought about considerable activity, under the influence of which a good business was transacted at advancing prices. The close is firm at 5.15@5.20c. New York, 5@5.05c. St. Louis.

Reports from Europe are also more encouraging and the close is cabled at £21 5s. for good ordinaries, £21 10s. for specials.

Gold, Silver and Platinum in 1908

Review of the Influences and the Commercial Conditions Which Governed the Production and Price of the Three Precious Metals

WORLD'S GOLD PRODUCTION \$436,222,000

The gold mines of the world in 1908 not only kept up the great production of recent years, but increased it by a considerable amount. In the accompanying table is given the approximate production for the year, comparison being made with the ascertained figures for 1907. Some corrections will, of course, be required when the final returns are received; but the necessary estimates have been made on a conservative basis, and it is not believed that any important changes will have to be made in the total.

	1907.	1908.
United States.....	\$90,435,700	\$96,313,000
Transvaal.....	133,352,381	145,500,000
Australasia.....	75,849,349	74,296,000
Russia.....	26,578,253	27,500,000
Mexico.....	17,820,000	18,750,000
Canada.....	8,264,765	9,350,000
Rhodesia.....	11,266,845	13,288,000
British India.....	10,857,648	10,925,000
West Africa.....	5,627,970	5,800,000
China, Japan and Korea.....	10,403,378	10,500,000
Other countries.....	23,336,836	24,000,000
Total.....	\$413,793,125	\$436,222,000

The figures given in the table above for the United States are the preliminary statement of the director of the Mint. For nearly all the important producing countries—the Transvaal, Australia, Rhodesia, India and others—we have reports covering 11 months of the year, from which it is possible to estimate the December returns very closely. For Russia we are dependent, owing to the slowness of official action in that country, upon incomplete and partial returns, which indicate a considerable gain. Mexico, also, is estimated from partial returns.

The total increase in 1908, as compared with 1907, was \$22,428,125, or 5.4 per cent. The total gold production for 10 years past has been as follows, showing continuous gains, except in the years of the Boer war:

1899.....	\$311,505,497	1904.....	\$349,088,293
1900.....	258,829,703	1905.....	378,411,754
1901.....	260,877,429	1906.....	405,060,969
1902.....	298,812,493	1907.....	413,793,125
1903.....	329,475,401	1908.....	436,222,000

The gains in 1908, in the order of their importance, were from the Transvaal, the United States, Canada, Russia, Rhodesia and Mexico. Australasia alone of the large producers showed a decrease,

Gold and Silver Production in the United States

BY FREDERICK HOBART.

There was a marked contrast in 1908 between the course of gold production and that of silver in the United States, the chief causes of which are briefly explained in the following pages.

GOLD PRODUCTION

Gold production in 1908 exceeded that of 1907 by 6.5 per cent., and was the greatest ever reported in a single year, notwithstanding decreases in some of the leading States. The increase over 1906, heretofore the year of greatest production, was \$1,939,455, or 2.1 per cent. In the following table is given the production by States, as estimated by Frank A. Leach, director of the United States Mint, from the returns of the various branch mints and assay offices. These figures will approximate closely the final returns, though there may be a slight readjustment as among the different States. The figures give the value of the output in dollars:

GOLD PRODUCTION OF THE UNITED STATES.

	1907.	1908.	Changes.
Alabama.....	\$27,400	\$43,686 I.	\$16,286
Alaska.....	18,489,400	20,930,784 I.	2,441,384
Arizona.....	2,664,000	2,345,308 D.	318,692
California.....	16,853,500	19,581,570 I.	2,728,070
Colorado.....	20,897,600	22,811,784 I.	1,914,184
Georgia.....	64,800	48,918 D.	15,882
Idaho.....	1,255,900	1,450,830 I.	194,930
Maine.....		198 I.	198
Michigan.....		20 I.	20
Minnesota.....		1,265 I.	1,265
Montana.....	3,472,600	3,322,551 D.	150,049
Nevada.....	15,411,000	12,090,218 D.	3,320,782
New Hampshire.....		2,306 I.	2,306
New Mexico.....	330,000	240,756 D.	89,244
North Carolina.....	78,700	85,314 I.	6,614
Oregon.....	1,122,200	1,119,528 D.	102,672
South Carolina.....	58,100	58,336 I.	236
South Dakota.....	4,138,200	7,690,294 I.	3,552,094
Tennessee.....	3,800	3,186 D.	614
Texas.....	1,000	545 D.	455
Utah.....	5,121,600	3,930,290 D.	1,191,310
Virginia.....	8,300	4,321 D.	3,979
Washington.....	262,300	222,189 D.	40,111
Wyoming.....	9,400	1,773 D.	7,627
Other States.....		19,936 I.	19,936
Total	\$90,435,700	\$96,313,256 I.	\$5,877,556

U. S.....	\$90,435,700	\$96,005,906 I.	\$5,636,106
Porto Rico.....	1,200	642 D.	558
Philippines.....	64,700	306,708 I.	242,008
Total.....	\$90,435,700	\$96,313,256 I.	\$5,877,556

The lowest point touched in gold production, since the California discoveries began to have their effect, was \$30,800,000 in 1884. For eight years after that time there were fluctuations from year to year, but no great increases until 1893, when

the upward movement began which has culminated in the present large production. The total output of the United States for 16 years past has been reported as follows:

GOLD PRODUCTION FOR 16 YEARS.

1893.....	\$35,955,000	1901.....	\$78,666,700
1894.....	39,500,000	1902.....	80,000,000
1895.....	46,610,000	1903.....	73,591,700
1896.....	53,088,000	1904.....	80,723,200
1897.....	57,363,000	1905.....	88,180,700
1898.....	64,463,000	1906.....	94,373,800
1899.....	71,053,000	1907.....	90,435,700
1900.....	79,171,000	1908.....	96,313,300

The main factors in the growth of the production here shown have been the new discoveries in Alaska and Nevada; the exploitation of the Cripple Creek and other camps in Colorado; the improvements in metallurgy which have resulted in closer saving and the extended working of lower grade ores; and the improvements in handling material which have made possible the working on a large scale of low-grade placer ground, as in the dredge-worked fields of California. It is difficult to say which of these factors is the most important; all of them have contributed materially to the gain in the output of gold, which is now more than three times as great as it was 20 years ago.

If we examine the table of 1908 production we find that six States produced over \$5,000,000 each in 1907 or 1908, and from these there came in the latter year 90.4 per cent. of the total production. These States, classed in their order as producers in 1908, were:

	1907.	1908.
Colorado.....	\$20,897,600	\$22,811,784
Alaska.....	18,489,400	20,930,784
California.....	16,853,500	19,581,570
Nevada.....	15,411,000	12,090,218
South Dakota.....	4,138,200	7,690,294
Utah.....	5,121,600	3,930,290
Total.....	\$80,911,300	\$87,034,940

Four other States—Montana, Arizona, Idaho and Oregon—produced over \$1,000,000 each in 1908; no other State reached a total as high as \$250,000. In all 98.9 per cent. of the gold production was from 10 States, or Territories, all of them, in the Rocky Mountain region or on the Pacific Coast. The Southern States, our oldest gold producers, made a very small showing, notwithstanding efforts made to revive some of the old mines in Alabama and North Carolina. In our foreign possessions Porto Rico reports only a trifling output; that of the Philippines showed a large increase, though the total is still small. That it is increasing proves that attention paid to the mineral resources of the Islands is beginning to produce substantial results.

SILVER PRODUCTION

Silver production in the United States in 1908 was the smallest reported in nearly 20 years, and was less than that of 1907 by 8.3 per cent. in quantity. The decrease in values is much greater—25.8 per cent.—as the average market price of silver in New York, on which the commercial values are calculated, fell from 65.327 cents per ounce in 1907 to 52.864 cents in 1908. As usual, the production of silver was affected by that of lead and copper, in connection with which metals most of the silver is won. The production for two years, as estimated by the director of the mint, is shown in the following table in ounces of fine silver:

SILVER PRODUCTION IN THE UNITED STATES. |			
(FINE OUNCES.)			
	1907.	1908.	Changes.
Alaska...	179,250	201,988	I. 22,738
Arizona...	2,903,050	3,046,137	I. 143,087
California...	1,590,000	1,823,588	I. 233,588
Colorado...	11,495,500	10,161,318	D. 1,334,182
Idaho...	7,888,350	6,289,585	D. 1,598,765
Michigan...	331,350	232,184	D. 99,166
Missouri...	25,300	25,000	D. 300
Montana...	11,129,550	11,518,913	I. 389,363
Nevada...	8,280,450	19,322,828	I. 1,042,378
New Mexico...	599,550	372,950	D. 226,600
North Carolina...	25,150	16,090	D. 9,060
Oregon...	96,050	109,640	I. 13,590
South Dakota...	106,600	197,996	I. 91,396
Tennessee...	58,350	59,876	I. 1,326
Texas...	305,300	461,715	I. 156,415
Utah...	11,406,800	7,718,872	D. 3,687,928
Washington...	83,950	68,175	D. 15,775
Other States...	10,000	167,495	I. 157,495
Total U. S.	56,514,550	51,794,350	D. 4,720,200
Porto Rico...		3	I. 3
Philippines...	150	3,700	I. 3,550
Total...	56,514,700	51,798,053	D. 4,716,647
Commercial value.	\$36,919,358	\$27,382,523	D. \$9,536,835

Three of the important silver producers—Montana, Nevada and Arizona—show gains, only that of Nevada being large. These increases were due to the greater output of copper carrying some silver. On the other hand there were heavy decreases in three important States—Colorado, Idaho and Utah. Idaho and Colorado are the largest silver-lead producers; in Utah the loss resulted largely from the smelter troubles, to which reference was made under gold production.

As above noted, the silver output of 1908 was the smallest reported for 20 years, with the single exception of the year 1894. The production for 20 years past has been, in fine ounces:

SILVER PRODUCTION FOR 20 YEARS.			
1889.....	50,000,773	1899.....	54,764,000
1890.....	54,516,300	1900.....	57,647,000
1891.....	58,330,000	1901.....	55,214,000
1892.....	64,900,000	1902.....	55,500,000
1893.....	60,000,000	1903.....	54,300,000
1894.....	49,500,000	1904.....	57,786,100
1895.....	55,727,000	1905.....	56,101,600
1896.....	58,835,000	1906.....	56,517,900
1897.....	53,860,000	1907.....	56,514,700
1898.....	54,438,000	1908.....	51,798,053

It is not possible to analyze the underlying causes directly affecting the variations in the production of silver.

The Commercial Movement of Gold and Silver

BY FREDERICK HOBART

The great production of gold as shown in the preceding columns, still continued in 1908. Its movement exercises a most important influence upon the commerce of the world; but in its turn is directed and influenced by the currents of that commerce. That the production of gold was not only maintained, but increased, did not prevent the occurrence of a year of general depression; though it served in some degree to mitigate the effects of that depression. The supply of gold, however, is one of the complexity of causes which affect and direct the commerce of the world, any discussion of which is impossible here.

The movement of silver, while far less important than that of gold, still has its place in commerce of sufficient importance to be carefully recorded.

COMMERCIAL MOVEMENT OF GOLD

The additions made to the world's visible stock of gold during 1908 amount in round figures to about \$340,000,000, or about 75 per cent. of the total production during the year. This is, in all probability, the largest proportion of the production which has ever taken form and become a part of the world's circulating medium. That it did not prevent a depression which extended, in a greater or less degree, to all the commercial nations of the world is a remarkable fact. It was not sufficient to make up for the great absorption of capital which had been going on for several years previously.

GOLD MOVEMENT IN THE UNITED STATES

The gold movement in the United States for 11 months ended Nov. 31 was as follows:

	1907.	1908.
Exports.....	\$54,211,240	\$73,857,749
Imports.....	98,949,557	45,105,963
Excess.....	Imp. \$44,738,317	Exp. \$28,751,786

The statement for the full year, 1907, showed a total of imports amounting to \$88,182,385. The movement for December, so far as reported, indicates that for 1908 there was a total of about \$36,000,000 excess of exports. The imports in 1907 were swelled by the large amounts borrowed from European bankers in November and December to tide over the panic period; in 1908, toward the latter part of the year, it became necessary to repay in gold a part of these advances which had not been met by shipments of merchandise or transfers of securities. So far as can be estimated, the debt is not yet fully settled.

GOLD MOVEMENT IN GREAT BRITAIN

The movement of gold in Great Britain for 11 months ended Nov. 30 is reported as follows:

	1907.	1908.
Imports.....	£49,306,609	£41,539,849
Exports.....	45,986,743	45,197,929
Excess.....	Imp. £ 3,319,866	Exp. £ 3,658,080

Great Britain has, therefore, been placed in the very unusual position of showing an excess of gold exports. This was largely due to the extraordinary demands from France, which appears just now to be the universal creditor. A decrease in the export trade in many staple products also had its influence.

GOLD MOVEMENT IN FRANCE

The gold movement in France is reported up to date for only 10 months of the year, the figures being as follows:

	1907.	1908.
Imports.....	Fr. 389,243,000	Fr. 789,825,000
Exports.....	94,004,000	18,347,000
Excess, imports....	Fr. 295,239,000	Fr. 771,478,000

France has been steadily accumulating gold throughout the year, the policy of its leading bankers having been, apparently, to draw gold from every possible source in order to secure their reserves against all possible financial and political contingencies.

BANK GOLD HOLDINGS

The gold holdings of the great European banks in the closing weeks of 1907 and 1908 compare as follows, the amounts being reduced to dollars:

	1907.	1908.	Changes.
England...\$	165,388,645	\$ 165,087,430	D. \$ 296,215
France....	538,787,750	689,929,615	I. 151,141,865
Germany...	137,140,000	192,155,000	I. 55,015,000
Aust.-Hun.	228,795,000	244,860,000	I. 16,065,000
Russia....	607,125,000	606,805,000	D. 320,000
Netherl'ds.	38,239,100	41,935,000	I. 3,695,900
Belgium..	17,510,000	20,103,335	I. 2,593,335
Italy.....	193,320,000	187,000,000	D. 6,320,000
Spain.....	78,210,000	78,965,000	I. 755,000
Sweden...	20,325,000	21,215,000	I. 890,000
Norway....	8,255,000	8,200,000	D. 55,000
Switzerl'nd	13,735,000	23,495,000	I. 9,760,000
Total....	\$2,046,925,595	\$2,279,748,380	I. \$232,822,785

The specie held by the associated New York banks in the last week of 1907 was \$181,503,100; in the last week of 1908 it was \$272,248,200, showing a large increase. This surplus includes silver coin as well as gold. The banks have materially strengthened their reserves as compared to a year ago; but these specie holdings were diminished by some \$35,000,000 during the month of December.

The United States Treasury held on Dec. 1 a total of \$188,480,313 available gold coin and bullion; besides this it held \$850,817,869 deposited to secure gold notes outstanding and the so-called circulation reserve of \$150,000,000; making a total accumulation of \$1,189,298,182 in gold—the largest quantity ever gathered in one place. The amount of gold in circulation in the United States—including gold reserves held by banks—is estimated by the Treasury Department at \$610,060,000; but it is believed that this estimate is too high, and that insufficient deductions have been made for losses, destruction by fire and other accidents, gold sent

out of the country and not reported, and other causes.

Deducting the excess of exports from the production of the year, the increase of the gold supply of the United States in 1908 was approximately \$67,560,000. From this is again to be deducted the quantity used in the arts and otherwise absorbed or lost. Assuming the same ratio as for the world's general supply, the gold monetized or made available for the uses of commerce and trade in 1908 was approximately \$50,500,000, an amount not much more than one-fourth of that which this country absorbed in 1907. At the present time it appears probable that the same conditions will extend through at least the earlier part of the new year.

It is probable that, as usual in time of depression, the quantity of gold absorbed and used in the arts decreased considerably during the year, not only in the United States, but also in Europe. The definite determination of this quantity is impossible at all times, even when accounts are summed up over a series of years, and it has always been more or less a matter of conjecture.

COMMERCIAL MOVEMENT OF SILVER

The movement of silver, while almost as great in quantity as in the previous year, was represented by lower values, owing to the steady decrease in prices. The exports and imports of silver in the United States for the 11 months ended Nov. 30 were as follows in value:

SILVER MOVEMENT IN THE UNITED STATES.			
	1907.	1908.	Changes.
Exports	\$57,212,168	\$47,111,382	D. \$10,100,786
Imports	41,690,324	37,814,676	D. 3,875,648
Net import.	\$15,521,844	\$ 9,296,706	D. \$ 6,225,138

At the average values of the year the net exports in 1907 were approximately 23,760,000 oz., and 17,586,000 oz. in 1908; the decrease in quantity being 6,174,000 oz., or 26 per cent., while the decrease in values was 40.1 per cent.

Only a small proportion of the total exports—about \$4,500,000 in 1908—went directly to the East, being shipped from San Francisco to Hongkong. The balance went chiefly to Europe, the greater part of it to the central market in London.

SILVER MOVEMENT IN GREAT BRITAIN

The silver movement in Great Britain for 11 months ended Nov. 30 was as follows, in values:

SILVER MOVEMENT IN GREAT BRITAIN.			
	1907.	1908.	Changes.
Exports	£15,813,329	£11,804,119	D. £4,009,210
Imports	14,667,024	9,588,812	D. 5,078,212
Excess, exp.	£ 1,146,305	£ 2,215,307	D. £1,069,002

Here again the decrease in values was much greater than that in quantities, owing to the lower prices. A special statement of the exports to the Far East from Great Britain is as follows, complete to Dec. 17, or within two weeks of the end of the year:

SILVER EXPORTS FROM LONDON TO THE EAST.

	1907.	1908.	Changes.
India.....	£10,631,354	£8,412,390	D. £2,218,964
China.....	417,360	641,400	I. 224,040
Straits.....	691,160	164,885	D. 526,265
Total.....	£11,699,854	£9,218,675	D. £2,421,179

The decrease in values here shown was 20.8 per cent. Owing to the lower prices, however, the fall in quantities was small, the total value above representing approximately 92,538,000 oz. in 1907, and 90,668,000 oz. in 1908, a decrease of only 1,970,000 oz., or 2.1 per cent.

From this table it appears that India has taken at least the same quantity of silver as in 1907, but there has been a large decrease in other Eastern countries. The Straits are practically out of the market, and have been so since the currency changes made in that British dependency two years ago. China took some quantities early in the year, but since then has been a seller, not a buyer, disposing of the surplus metal taken two years ago, chiefly in India, but occasionally in London.

PRICE OF SILVER

The price of silver showed a steady decline, almost uninterrupted, during the year. The following table shows the monthly averages of the quotations in London and New York for two years:

Month.	AVERAGE PRICES OF SILVER.			
	New York.		London.	
	1907.	1908.	1907.	1908.
January	68.673	55.678	81.769	25.738
February.....	68.835	56.000	81.852	25.865
March.....	67.519	55.365	81.325	25.570
April.....	65.462	54.506	80.263	25.138
May.....	65.971	52.796	80.471	24.377
June.....	67.090	53.663	80.893	24.760
July.....	68.144	53.115	81.366	24.514
August.....	68.745	51.683	81.637	23.863
September.....	67.792	51.720	81.313	23.877
October.....	62.436	51.431	78.863	23.726
November.....	58.677	49.647	27.154	22.933
December.....	54.566	48.769	25.362	22.493
Year.....	65.927	52.864	80.186	24.402

New York, cents per fine ounce; London, pence per standard ounce.

The average yearly quotation of silver in New York for 10 years past has been as follows in cents per fine ounce:

1899.....	59.580	1904.....	57.221
1900.....	61.330	1905.....	60.352
1901.....	58.950	1906.....	66.791
1902.....	52.160	1907.....	65.327
1903.....	52.570	1908.....	52.864

The average for 1908 was lower than in seven out of the 10 years included in the table.

The fall in prices, which reached the lowest point since 1902, was due, apparently, in part only to the lower demand from the East. The increase in supplies from Canada and Australia was another cause. There were also minor contributing factors. The demand for silver for use in the arts has been small, in consequence of the general condition of business. The United States Mint was not a buyer from early in the year till late in December. European mints, except the French mint, took less than the usual

quantities. While of less importance than the trade with the East, these factors have had their effect.

Another point to be considered was the existence for several months of an extensive bear operation in London, ably directed by some large Chinese and Indian houses. Any movement for an advance was checked by offers of silver on Chinese account, by statements of large shipments from China direct to India, and by reports of large accumulations of unsold metal in India. This bear movement, it is believed, is almost at an end.

UNITED STATES MINT PURCHASES

Purchase of silver by the United States Mint, for purposes of subsidiary coinage, were much smaller in 1908 than in 1907, when 14,776,500 oz. were taken. In 1908, up to April 30, these purchases amounted to 4,978,300 oz. at prices varying from 58.067 down to 54.612c., the average price paid being 55.723c. From April the mint was out of the market until late in December, when it purchased 125,000 oz. at 49.118c. delivered. The total silver bought was only about one-third of that taken in the preceding year.

Platinum

The imports of platinum into the United States for the 11 months ended Nov. 30 were 68,712 oz. in 1907, and 38,857 oz. in 1908; a decrease of 29,855 oz. This indicates a large decline in demand, as was to be expected from the general depression of business. It must be noted that a large part of the platinum sold is not consumed in the ordinary sense of the word, but returns to dealers in the form of scrap, practically uninjured, and ready for use as new metal.

At the close of 1907 refined platinum was quoted in New York at \$26 per oz.; during that year it had been as high as \$38. During 1908 the price receded from \$26 to about \$22 in July. For two or three months the market was disturbed by offers of the metal at \$18 and even as low as \$17; the source of these offers, or at least of the supply of metal, being involved in some mystery. These offers gradually ceased, and in November and December of the year prices recovered. At the close of the year dealers quote \$24@24.50 for refined platinum; \$26@26.50 for hard, which contains some iridium; and \$20@22 for good scrap.

The market for Russian platinum is controlled by a syndicate of Paris and London speculators, whose usual course is to depress prices, make long contracts with the Ural producers, and then exact from consumers all they will pay. This course is made possible by the limited quantity of the output, and the fact that there is no substitute for the metal known, in most of its uses.

The Copper Production of North America

The Production of the United States was 952,395,477 Pounds; of Mexico, 84,159,000 Pounds; of Canada, 53,494,202 Pounds

DECREASE IN REFINERY PRODUCTION

The production of copper in the United States in 1908 is given in Table I. These statistics are compiled in the same way as those for 1907, which for the first time stated the production upon the uniform basis of output of Michigan mines plus fine copper content of blister copper. The statistics for 1908 are computed from reports of all the producers, with a few insignificant exceptions, who have stated their actual production for the first 11 months with their own estimates for December. The reports having been received in most cases after the middle of the month and in some cases after the close of the year the estimates are probably close. However, some large smelters frequently make clean-ups at the end of the year that turn out larger or smaller than expected, and even in the possession of the complete data for computing copper production there are numerous items whereof the

I. PRODUCTION OF COPPER.

Group.	1907.	1908.
Michigan mines.....	220,317,041	221,500,000
Smelters in Arizona and Texas.....	262,597,624	293,365,977
Smelters in Montana and Wyoming.....	229,362,164	258,102,000
Smelters in Utah and Nevada.....	90,100,052	81,051,799
Smelters on Pacific Coast (a).....	21,936,026	40,698,720
Smelters in Mississippi Valley.....	24,062,550	24,019,355
Smelters on Atlantic Coast (a).....	13,640,930	15,190,847
Smelters in Tennessee.....	14,784,379	14,750,000
Miscellaneous (b).....	2,441,000	3,716,779
Totals.....	879,241,766	952,395,477

(a) These statistics do not measure the relative importance of these groups of smelters which produce much copper from foreign ore. (b) Includes exports of ore and matte and copper produced by lead desilverizers.

II. PRODUCTION OF COPPER BY STATES.

State.	1907.	1908.
Alaska.....	6,610,680	5,311,600
Arizona.....	256,866,761	288,885,644
California.....	34,398,823	37,529,007
Colorado.....	13,344,118	15,042,312
Idaho.....	11,471,101	9,125,797
Michigan.....	220,317,041	221,500,000
Montana.....	226,290,873	255,446,447
Nevada.....	1,462,450	11,362,638
New Mexico.....	8,652,873	5,737,505
Utah.....	68,333,115	75,298,906
Wyoming.....	2,919,137	2,551,468
South and East (a).....	22,408,696	20,182,328
Other States (b).....	6,166,098	4,421,825
Total.....	879,241,766	952,395,477

(a) Includes Vermont, New Hampshire, Pennsylvania, Virginia, North Carolina, Alabama and Tennessee. (b) Includes Washington, Oregon, South Dakota, Texas, and the production of the lead desilverizers and others which it is impossible to distribute according to place of origin.

III. CONSUMPTION OF COPPER. (a)

	1907.	1908.
Stock Jan. 1.....	9,000,000	120,000,000
Imports of refined.....	5,000,000	None
Production.....	1,152,747,890	1,105,000,000
Total supply.....	1,166,747,890	1,225,000,000
Exports.....	508,929,401	664,000,000
Remaining in U. S. Stock Dec. 31.....	657,818,489	561,000,000 (b)
Delivered for consumption.....	537,818,489	(b)

(a) The figures for 1908 in this table are estimates, and are to be taken only as an attempt at a generalization. The stock of refined copper Jan. 1, 1908, is well established. As for the production, we take the American output of blister and Lake copper (952,000,000 lb.), plus the imports (212,000,000 lb.), plus 20,000,000 lb. for copper remelted from scrap and junk, the last being a guess based only upon the production in 1907. (It is well-known that much less of this material is reclaimed at low than at high prices.) From the total of 1,184,000,000 lb. it is necessary to deduct 10,000,000 for copper marketed as bluestone, and 9,000,000 lb. for ore and matte, included in the United States production, which was exported to Mexico and Canada and figures again in the imports from those countries. We make a further deduction of 60,000,000 lb. for blister copper included in the statistics of production and imports that could not have been turned out as refined before the end of 1908. This leaves 561,000,000 as available for consumption in the United States. The separation of this into consumption and stock is uncertain. There has been an idea in the trade that the domestic consumption has been smaller than in 1907, which has probably been the case, but there are no authoritative statistics upon this subject nor upon the amount of stock on hand. (b) No reliable data available.

entry or rejection is necessarily a matter of opinion, wherefore the final report will doubtless show a difference of perhaps 1 per cent. from this preliminary report.

The allocation of the production among the States and Territories can never be made with precision; that being so in the case of the final statistics, the distribution at this early date is necessarily less perfect. So far as possible we have made a distribution in Table II. The figures for Arizona, Michigan and Montana are probably close; those for California, Nevada and Utah will undergo more revision, California and Nevada probably to gain at the expense of Utah.

We made no attempt to collect statistics of the production of refined copper at this early date. The total is doubtless less than in 1907. At the beginning of 1908 the refineries were just feeling the curtailment begun at the mines 60 to 90 days earlier. At the end of 1908 they were not yet turning out the big output of Washoe, Cananea and Steptoe in November and December. Basing our estimates on such data, together with the production and importation of blister copper, we

compute the production of refined and amount available for consumption in Table III.

Production of Copper in Mexico

On the basis of the net imports into the United States plus the Boleo production, the copper production of Mexico in 1907 was 126,710,000 lb. Figuring in the same way, the production in 1908 was 84,159,000 lb. Our reports from nine smelting works, producing blister from Mexican material, give 85,476,763. Boleo and Moctezuma increased their production, but not enough to offset the decrease from Cananea, which was idle during the major part of the year and Teziutlan, idle throughout the year. Operations are now in full swing again at Cananea, the new concentrator at Moctezuma is working, and the new smeltery at Teziutlan is to be blown in during February, 1909. Boleo was the largest producer in Mexico in 1908; Aguascalientes next, and Cananea third.

Production of Copper in Canada

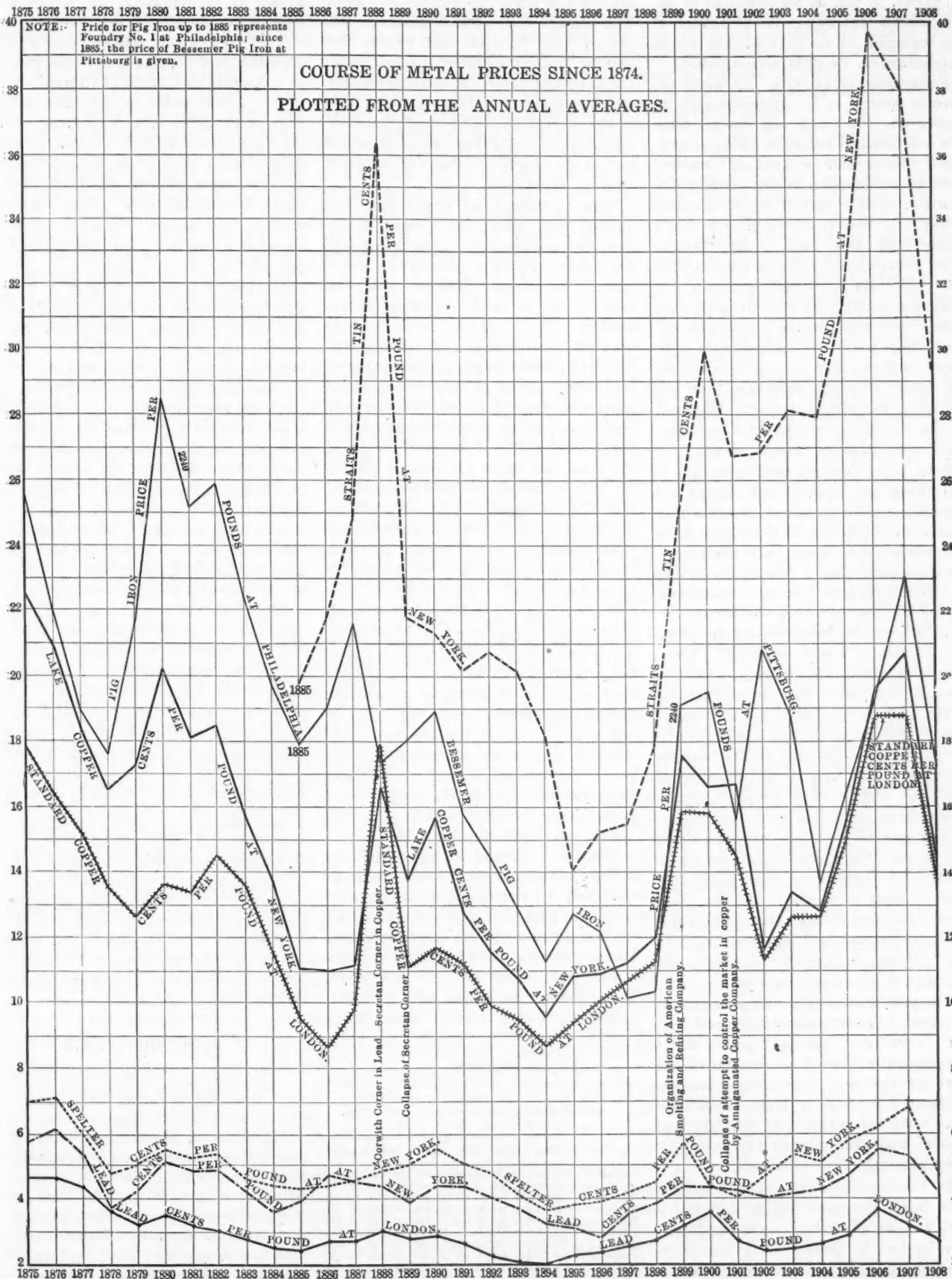
The copper production in the Dominion, computed from direct reports from all of the producers was 53,494,202 lb. in 1908, compared to 46,356,382 lb. in 1907. The production in 1908 by districts was approximately as follows:

Boundary.....	26,361,483
Rossland.....	5,538,207
Coast.....	1,849,473
Ontario and Quebec.....	19,612,243
Nova Scotia.....	122,000
Miscellaneous.....	10,796
Total.....	53,494,202

The above statistics are computed on the basis of blister copper reported. Several smelters producing matte in Canada reported matte shipments in excess of the blister reported by the concerns converting their product, the difference being explained, of course, by material in transit and accumulated in stock.

The Copper Market at New York

The severe financial depression which culminated in the fall of 1907 had a highly disturbing influence on all industries, but especially on those that are the principal users of copper. Money became exceedingly scarce, interest rates in consequence very high, and the uncertainty



as to the future did not tend to encourage large commitments on the part of the great financial institutions in this country. The railroads, our chief consumers, were particularly affected by

such conditions, which in their case were further aggravated by hostile legislation in a great many States, directed toward a regulation of freight and passenger rates. Improvements under way were

stopped and plans for further extensions abandoned.

All this, and similarly unfavorable conditions in other industries, naturally affected to a large extent the consumption

of copper, so that an accumulation of approximately 120,000,000 lb. of refined at the beginning of the year was the result. Production on all sides was curtailed.

Fortunately, much better conditions existed in Europe as far as consumption of copper was concerned, and exports from this side reached record-breaking proportions. These and a gradual improvement in consumption in this country disposed of a large part of the accumulated stocks and current production by early spring. By this time, money became more plentiful and rates of interest were once more on a normal level, so that home consumers, who had all along been most conservative and in buying had covered their immediate requirements only, began to show some interest in purchases for future delivery, something they had not done for almost a year. However, by the middle of the year there was again an accumulation of unsold stock.

Late in the summer, production was in full swing, and while the old camps had resumed normal operations, the new producers in Nevada and Utah also made themselves felt. In the Fall, when it became apparent that a Republican victory at the Presidential election was assured, buying of copper among consumers became general and requirements up to the end of the year were covered. These purchases and continued large exports to Europe took care of current production.

The outlook for copper is fairly favorable. The market is not burdened with an enormous stock, that in this country being no larger than at the beginning of the year, while that in Europe, although much larger than for some years past, is not any bigger than was considered the normal supply at a period when production of copper was only about one-half of what it is now. On the other hand, consumers have not anticipated their wants and will have to replenish their stocks of copper whenever new business is entertained by them.

The year 1908 opened with prices ruling at about 13¾ for Lake copper and 13½ for electrolytic. During January, there was an entire absence of demand on the part of domestic consumers. Europe, however, continued a large buyer and thus sustained prices, which at the end of the month had advanced to 13¾ for Lake and 13¾ for electrolytic.

In February it developed that for the time being European buyers were satisfied, and an effort was made by American holders to induce fresh purchases through a reduction in prices, which gradually established quotations at the end of the month on basis of 12¾ for Lake and 12½ for electrolytic. These low prices had the desired effect, and the Chinese, who are always alert to any undue depression in the price of copper,

also became buyers to a moderate extent. The demand thus created, however, was not of long duration, and by the first part of March quotations stood at 12½ for Lake and 12¼ for electrolytic. Domestic consumers at that time took hold of the market, so that a steady improvement set in and prices advanced at the end of the month to 13½ for Lake and 13 for electrolytic.

Prices remained on about this level during April, when fairly large quantities were purchased by home consumers for nearby delivery to take care of orders booked by them. Interest was also evinced in purchases for more distant delivery.

In May, fairly large quantities of copper were pressed on the market by Japanese holders, owing to a severe financial crisis then existing in the Far East, and tended to unsettle prices, which declined toward the middle of the month to 12¾ for Lake and 12½ for electrolytic. At the end of the month, some improvement was again noticeable, brought about by the more confident feeling shown in the stock exchanges of the world, and quotations were established at 12¾ for Lake and 12½ for electrolytic.

In June, activity continued to a moderate degree, and prices practically remained unchanged. By this time a slow but gradual improvement had manifested itself in the more important copper-consuming industries. For instance, the wire industry, which during January had stood at 25 per cent. of the normal capacity, showed an increase in February to 33 per cent., March 40 per cent., April 50 per cent. and May-June 60 per cent.

This improvement made still further progress in July and both domestic and foreign consumers were buyers of large quantities of copper. In consequence of these transactions, prices advanced during August to 13¾ for Lake and 13½ for electrolytic. A disturbing influence toward the second half of that month were offerings of copper held by speculators, which lots, however, were readily

picked up by consumers at a discount from prices quoted by first hands.

After the great activity during the preceding two months, a reaction was to be expected, and occurred during September. First hands were, thanks to the large sales made, in a comfortable position, and did not press on the market. Sundry small lots of second-hand copper, however, were offered and made themselves disturbingly felt. Prices declined steadily, and at the end of September closed at 13½ for Lake and 13¼ for electrolytic.

The approaching elections had a restricting influence on buyers during the first half of October. The feeling as to the outcome of the elections became more hopeful during the second half of October and influenced by a cheerful tone on the stock exchange, which inspired confidence, buyers took hold of the market in earnest. Enormous quantities of copper were purchased during the last 10 days of October and immediately after the election of Mr. Taft, so that prices advanced by leaps and bounds and on November 10 reached a basis of 14¾ for Lake and 14¾ for electrolytic. The activity of the market, however, received a check during the second half of November, when the demand subsided and when copper bought by speculators during the advance was realized upon. While necessarily under these conditions prices had to decline somewhat from the high level, many of the first hands showed no disposition to enter the market, having practically disposed of all the copper that they expected to have available up to the end of the year. The undertone, therefore, remained sound and prices steady at a level of 14¼@14½ for Lake and 14@14¼ for electrolytic. These conditions lasted nearly to the end of December, the holiday season always exercising a check upon business, but at the end the market started upward, the year closing with 14½ for Lake and 14¼ for electrolytic.

Copper in Arizona

By JAMES DOUGLAS*

The financial gloom with which the past year opened did not acutely affect the large copper mines of Arizona, if we may judge by their activity. The Verde ran continuously and produced its normal output. In the south the Warren district increased rather than diminished its contribution, and the Clifton witnessed no falling off.

In Arizona's neighbor, Sonora, the Greene-Cananea Company, which shut down in October of 1907, resumed work

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COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.		1907.	1908.
	1907.	1908.	1907.	1908.		
January...	24.404	18.726	24.825	18.901	106.789	62.386
February...	24.869	12.905	25.256	18.098	107.356	58.786
March.....	25.065	12.704	25.550	18.876	106.594	58.761
April.....	24.224	12.743	25.250	18.928	98.625	58.331
May.....	24.048	12.598	25.072	18.788	102.372	57.887
June.....	21.665	12.875	24.140	18.877	97.272	57.842
July.....	22.130	12.702	21.923	18.383	96.016	57.989
August....	18.355	13.462	19.255	13.639	79.679	60.500
September	15.565	13.388	16.047	13.600	68.375	60.338
October...	13.169	13.364	13.551	13.646	60.717	60.139
November.	13.391	14.130	13.870	14.386	61.226	63.417
December.	13.163	14.111	13.393	14.411	60.113	62.943
Year.....	20.004	13.208	20.661	13.424	87.007	59.902

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

in September of 1908, under the management of Dr. L. D. Ricketts. The concentrating plant, which had been built from designs by Doctor Ricketts during the previous administration, underwent no change. But the furnace and converting plants were completely rebuilt on the old site; the reverberatory was remodeled advantageously, in both its smelting and steam-generating qualities; the bedding and conveying devices, which had been planned by Arthur S. Dwight and the Robins company, were put into working order, and justified the economical results which were claimed for them. Notable saving in cost of smelting resulted, and all and more than was expected has been realized from the introduction of the caving and milling system in the mines. This great property has resumed work with every probability of attaining success, despite the enormous capital with which it is overburdened. C. F. Shelby has, in the JOURNAL, described with such candor and fullness of detail most of the improvements introduced in his smelting department so that outside testimony would be superfluous.

At Nacozari the old mill was put, perhaps only temporarily, out of commission, and the new mill of 2000 tons capacity is treating 1500 tons of Pilares ore a day. The concentrates are still shipped for metallurgical treatment to Douglas, and yield in copper about 2,000,000 lb. a month. The economies obtained at Cananea in the reverberatory smelting, with oil as fuel, of concentrates and flue dust, revived the discussion of the wisdom of the resumption of smelting at Nacozari. In addition to discarding the old concentrator, the gas plant and gas engines have been supplanted by a large power plant in which Curtis engines are used to operate the generators. The wood gas and gas engines were not rejected on account of dissatisfaction with cost, but the size of the new transmission plant required for moving the new mill, and supplying the necessary power to the mines would have demanded a cumbersome equipment of gas engines. Accurate estimates of cost of a horsepower under the two systems have not yet been made.

BISBEE AND DOUGLAS

At Bisbee preparations have almost been completed to hoist by a skip ore from every section of the mine through the new Sacramento shaft; then to load a train of cars by a belt and tripper and by this means to secure a uniform mixture. In the central power house, situated near the Sacramento shaft, power is derived from Curtis turbines, and is distributed for underground haulage by electric current and by compressed air to the engines of the old shafts, which will be used only for the hoisting of timber and of men.

At Douglas the Calumet & Arizona works were not only enlarged, but also

rearranged to meet the increased demands made on them by the production of the Superior & Pittsburg mines. At the Copper Queen Douglas reduction works the shipment of about 300 tons of concentrates a day from Nacozari, necessitates a modification of both method and plant. Experiments are under way to determine whether sintering or reverberatory smelting will be used as a supplement to the blast-furnace practice.

Nothing of note occurred in the Clifton district, but the output of all the three smelting companies shows an increase.

OTHER DISTRICTS

In the Warren district the Copper Queen produced less than in 1907, and the joint mines of the Calumet & Arizona and Superior & Pittsburg much more than in 1907. The result of the mining in the Warren and Clifton districts will probably show an increase for 1908 over 1907 of approximately two and a half million pounds.

The Imperial company erected a second furnace and contemplates the building of a third. Saddle Mountain, Twin Butte, Helvetia and most of the smaller mines, have not resumed operations, or are working in a very languid way.

The Old Dominion furnaces exceeded their 1907 output by about 940,729 lb., and of the total output about 30,560,832 lb. came from the company's own mines. The development of the Miami mine and the success in floating that company gave a great impulse to both mining and smelting in that territory; but last year none of the companies except the Old Dominion was a large producer.

The closure of the smelter on the Agua Fria continues to impede general copper mining in Yavapai county.

During the year 1908 a new district loomed up as a possible large producer. As far back as the prosperous Tombstone days the Turquoise district, situated in the foothills of the Dragons where they sink into the Sulphur Spring valley, attracted much attention on account of its silver mines. They were said to have been abandoned on account of the refractory character of the ore and the presence of copper. Nearby there has, of late, been opened in what is known as the Courtland district, by the Calumet & Arizona Company and by the Great Western Mining Company, a most promising bed of copper carbonate in a manganese gangue. The deposit is in limestone cut by intrusive rocks, and the geological conditions, as well as the actual developments promise well. The year, 1909, will determine whether another notable district will add to the already large production of the Territory. If so, it will maintain its supremacy for all of the running mines; unless overtaken by accidents or unfavorable general conditions, will maintain to the full their present output, and some, such as those of the Calumet & Arizona and

Old Dominion companies, will probably show an increase. The low-grade mines of Gila county, notably the Miami, may contribute something to the year's total, but it will not be much, as the Miami mill will not be running till 1909 is nearly drawing to a close.

PRODUCTION OF THE YEAR

Under the tax law passed by the legislature of Arizona in 1907, the gross product of the mines and mining claims is taxed, and, therefore, the tax statement gives besides the quantity, the actual gross value of the copper, gold and silver extracted from the minerals mined in the Territory. The law was passed in 1907, but was effective for taxes due for 1906. The returns are, therefore, available for 1906 and 1907.

The number of companies taxed in 1906 was 62, which was increased to 80 in 1907.

The total quantity and value assessed in 1906 was: Copper, 255,012,155 lb.; gold, 125,016 oz.; silver, 2,704,044 oz., with a total gross value of \$53,801,781. In 1907 the figures were: Copper, 253,784,698 lb.; gold, 118,374 oz.; silver, 2,423,723 oz., with a total gross value of \$54,788,674.

In both years the Copper Queen heads the list of gross value of product with \$14,236,428 in 1906, and \$13,699,107 in 1907. In 1906 and 1907 the United Verde comes next with \$8,038,126 and \$7,060,126. The Calumet & Arizona follows with \$7,337,748 in 1906, and \$6,226,664 in 1907. The Arizona Copper Company occupied the same position in both years with \$4,973,400 in 1906 and \$6,160,050 in 1907. In 1906 there are only three other companies, all copper companies, which produced more than \$1,000,000, whereas in 1907 there were five.

The most equitable system of taxing mines is a question upon which there is great difference of opinion. As the rate is assumed to be adjusted to the total value of the property taxed, the total value of the product in metal or mineral of mines, above a given minimum, is perhaps open to less ambiguity than a valuation of product based on net returns, as is the system applied in Montana. The Butte mines in 1907 were taxed on the following net returns:

		Net Proceeds.
Anaconda	1-1*	\$5,456,395
Anaconda	1-B	362,790
Butte & Boston	1-1	1,239,055
Butte & Boston	1-B	10,412
Boston & Montana	1-1	7,049,988
North Butte	1-1	3,271,214
Parrot Silver	1-1	14,300
Parrot Silver	1-B	127,431
Red Metal	1-1	1,432,761
Trenton	1-1	481,624
Original Consolidated	1-B	663,260
Monidah Trust	1-B	3,053
La France	1-W	151,013
Clark-Montana Realty	1-B	188

Total net proceeds.....\$20,263,482

Deductions may be drawn from the tables as to cost of production, but they will be of doubtful accuracy.

*1-1 means outside city limits, levy 18 1/4 mills; 1-B means inside city limits, levy 29 7/20 mills; 1-W means inside Walkerville city limits, levy 28 1/4 mills.

The Lake Superior Copper District

By C. L. C. FICHEL.*

The year 1908 in the Lake Superior copper district was noted for the vast amount of exploratory and development work done, practically all of the producing mines inaugurating this policy. The known lodes traversing the various properties were opened and great tracts of virgin ground were investigated. The producing mines throughout the district were operated consistently and production will be about the same as for 1907. Osceola will show a decided increase, Copper Range will be about the same (the increased production at the Champion and Baltic properties making up for any falling off in the Trimountain), and the Calumet & Hecla mines will, in all probability, show a slight decrease due to the conglomerate lode gradually diminishing with depth in its mineral yield, the rock now running about 40 lb. to the ton. The year was devoid of any labor troubles, or serious casualties and as a whole was very prosperous.

KEWEENAW COUNTY.

The Keweenaw Copper Company became a producer. Its Medora shaft was sunk below the 13th level and the bottom levels were extended and showed a decided improvement at depth. The Phoenix mill, owned by this company, was overhauled and equipped with Woodbury jigs and at the close of the year was handling about 120 tons of rock daily. The Keweenaw Central railroad was completed during the summer months and regular freight and passenger service was maintained between Calumet and Mandan.

The Tamarack Company operated the old Cliff property throughout the year and openings were extended on several of the fissure veins running across the property. Rock shipment averaging about 80 tons weekly were shipped to this company's mill for treatment. During the last part of the year the shaft on the Avery tract was unwatered and cleaned out preparatory to sinking.

The Ojibway company made remarkable progress during the year, sinking both its shafts below 600 ft. and exposing the lode at the first and second levels of No. 2 shaft and the first level of No. 1 shaft. This was accomplished by crosscuts, the shafts being in the footwall side; the lode opened at No. 1 shaft was especially rich. The surface equipment is complete and the railway now runs into the property.

Exploratory work was started on the Seneca tract and a shaft was sunk about

175 ft. The surface equipment was completed and is sufficient to carry the property through its development stages. The shaft is sunk in the footwall about 75 ft. behind the lode which will be reached by crosscuts. Considerable diamond drilling was done previous to shaft sinking.

The Gratiot property under the management of the Calumet & Hecla company was opened thoroughly. Both shafts were sunk deeper and drifts were extended; the showing is indicative of better results.

All five shafts of the Mohawk company were sunk deeper and drifts were extended from the various levels. At No. 5 shaft, the newest of the openings, the ground was especially good; this shaft was equipped during the year with its permanent hoisting plant. The stamp mill ran satisfactorily and treated an average of about 2000 tons of rock daily.

The Ahmeek company started sinking two new shafts to work the northern and central portions of the tract. These shafts will encounter the lode at about 1200 ft. Openings in the two producing shafts were extended and the ground opened to the south was especially good. At the fifth level of No. 2 shaft the south drift encountered a fissure of mohawkite. The company also purchased a mill site on the shores of Torch lake and began the erection of a modern four-head stamp mill which will be ready during the summer of 1909.

Both shafts of the Allouez company were sunk deeper and No. 2 shaft is approaching the lode and it is expected that it will be cut early in 1909. The lode has been opened from this shaft by a crosscut at the 6th level and a drift, connecting the two shafts, was holed through. No. 1 shaft maintained rock shipments to the mill averaging about 650 tons daily.

HOUGHTON COUNTY.

A new hoisting equipment was installed at the Wolverine's northern shaft and at the stamp mill two heads were converted into steep compound. Conditions underground are in fine shape and the property continues one of the most successful on the lake.

The Centennial company sank both its shafts deeper and the drifts north from No. 2 shaft entered the zone of the Wolverine mineralization and excellent rock was mined. At the stamp mill, owned jointly by the Centennial and Allouez companies a 3-head addition was built to the building and two heads were installed.

The Calumet & Hecla company did a vast amount of construction work during the year; the pumping station at Lake Superior was electrically equipped and consists of a 3,000,000-gal. multi-stage centrifugal pump, with its accessories. The

station required the erection of a high-tension transmission line about 5 miles long. A series of pumps were installed underground at the north end of the property; a large addition was built to the foundry and a complete drill-sharpening plant was installed. At the stamp mill the twenty 510-h.p. boilers, comprising the new plant, went into commission and at the company's electric-power plant the third 2000-kw. generator was installed, bringing this plant up to about 11,000 h.p. The first section of the large re-grinding mill was equipped and is ready to go into regular service; throughout the mills all railway trestles were remodeled and structural steel replaced all wooden construction; this was made necessary by the additional weight of trains used on the standard-gage equipment. All the shafts on the main, or conglomerate lode were operated but the copper content of the rock gradually decreased and the available working ground in some of the shafts is becoming exhausted. The Osceola amygdaloid formation was opened extensively. All 6 shafts were sunk deeper, new ground was opened and the upper drifts were extended. Nos. 13 and 16 shafts were equipped with two skip roads and No. 15 will soon be ready. The company operated one shaft on the Kearsarge lode (No. 21) and with the additional depth and openings especially good rock was exposed. Exploratory work was carried on by this company in Ontonagon county, on the White Pines and Nonesuch tracts.

At No. 1 shaft of the Tamarack company all rock hoisting was suspended and the shaft was equipped to handle all the water from the underground openings; all water-way connections were made with the working shaft and also with the Tamarack Jr. property. At No. 2 shaft arrangements were made to install the Kimberly skip system. The company has discontinued sinking its shafts vertically, and henceforth all additional depths will be obtained by shafts sunk on the vein.

The Osceola company materially increased its production during the year; No. 6 shaft opened up especially good ground. This shaft was equipped with 6-ton skips and its hoisting facilities were strengthened. Both the North and South Kearsarge branches of this company are in fine shape. No. 4 shaft of the North Kearsarge, the newest of the openings, disclosed the lode by crosscuts from three different levels and found it well mineralized.

The LaSalle, a subsidiary company of the Calumet & Hecla company, was opened consistently. The Tecumseh shaft showed good copper rock, but the two shafts on the Caldwell tract gave indifferent results; sinking was suspended on

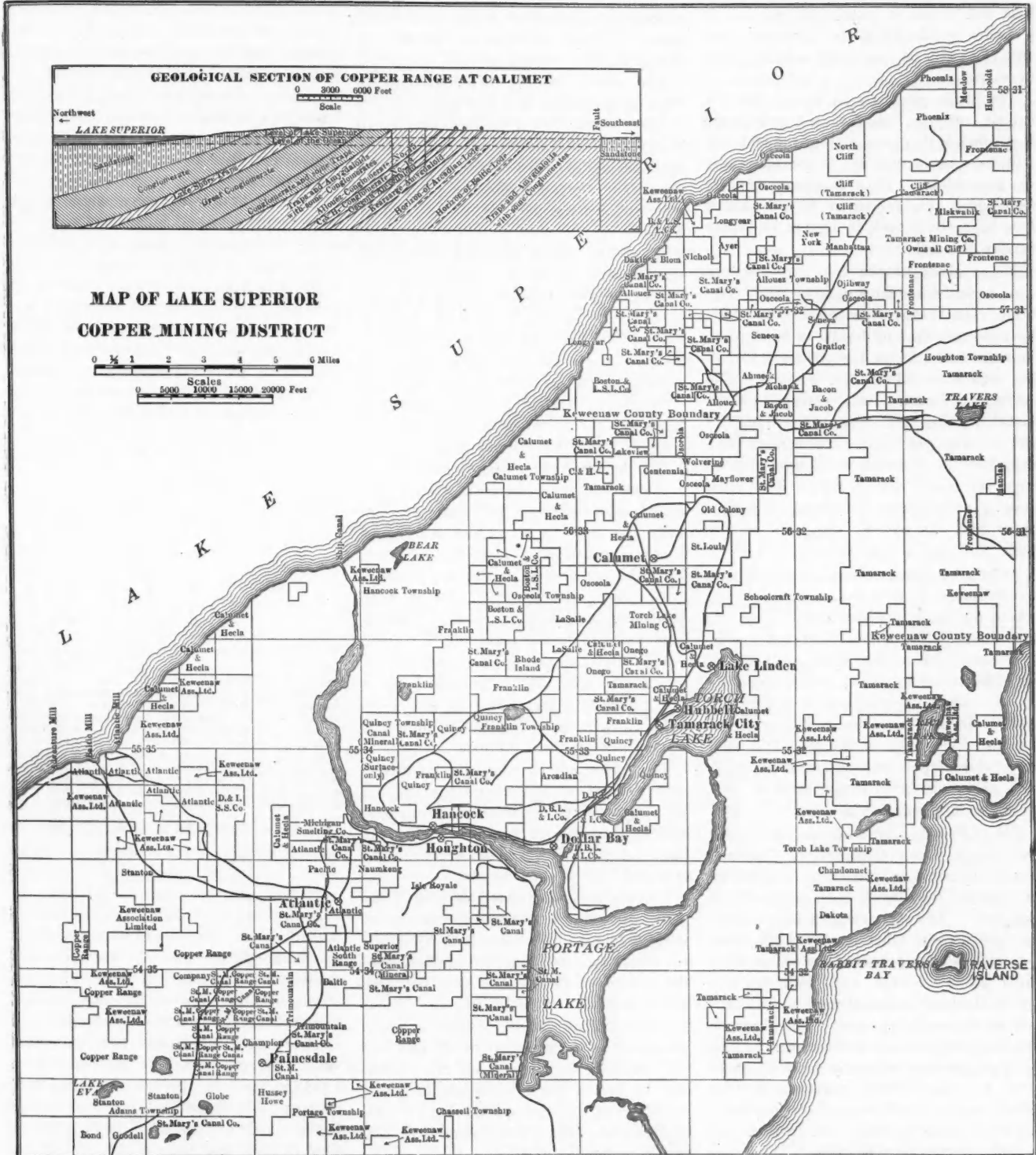
*Electrical department, Calumet & Hecla Mining Company, Calumet, Mich.

this tract and crosscutting was started to open more fully the surrounding territory. Operations at the Rhode Island property were centered in drifting on the Pewabic lode from the 10th level of its shaft.

some land belonging to the St. Mary's Mineral Land company. Under such conditions development will be centered upon the Pewabic lode as the main working body.

The Arcadian changed management

shaft known as the Pontiac, or No. 9, which is down 200 ft. in good copper rock; the shaft will develop the northern portion of the tract. A new steel shaft house was erected on the site of No. 2 shaft and is a model in all respects. At



Redrawn from Map by R. M. Edwards, Houghton, Michigan.

The Franklin company opened the Pewabic lode at depth by crosscuts extended from the conglomerate shaft and at the 23d level the lode was exposed highly mineralized. In all probability a consolidation will be effected between the Franklin and Rhode Island companies, including

during the year and its office was removed to Houghton, Mich. The company did not do any active work, being out of funds, but at a meeting to be held early in 1909 reorganization will be effected and work should be resumed.

The Quincy company started a new

the stamp mill the single-cylinder heads have been equipped with 24-in. single cylinders and excellent results are being obtained. This company will, if present plans materialize, take over a portion of the old Franklin workings.

The Hancock company sank its large

5-compartment shaft below the 15th level and from the 13th level started a cross-cut to connect with No. 1 shaft; this shaft has reached its permanent bottom at the 14th level and all additional ground will be worked through No. 2 shaft. At No. 1 shaft the crosscuts opened the west lode and found it more uniform and of a better grade than the Hancock lode and this will be the main working lode hereafter.

The three southern shafts of the Isle Royale company, viz., Nos. 4, 5 and 6, were furnished with permanent equipment and will soon be in position to aid materially in production. This company is also developing the extension of the Baltic lode by a shaft sunk in section II, which carries the lode.

No. 1 shaft of the Superior property was widened to accommodate two skipways. This shaft has opened the lode by crosscuts for 10 levels; a fine grade of rock shows below the 5th level. Sinking was resumed at No. 2 shaft. The surface equipment was enlarged, additional hoisting and compressor facilities were added, and railway connections were made to the Atlantic mill, which is to treat its output temporarily. The company is on the verge of becoming a producer and has as fine prospects as any Lake Superior copper mine.

At the Atlantic mine all operations were centered at its section 16 tract, where the shaft was put down below the 18th level. The same shattered condition continued in the shaft with depth, but the extensions of the drifts, especially to the south encountered a more substantial formation. The rock was sorted the last few weeks of the year and as it accumulated was put through the mill. This shaft will be in shape, early in 1909, to maintain regular shipments.

The Champion and Baltic mines of the Copper Range Consolidated Company closed the year in fine shape; many improvements were made both at the mines and mills. The Trimountain is gradually approaching the other two in production; the ends of the property are revealing a good grade of rock and with depth a better showing is being made in the central portions of the mine. The shaft on the Globe tract, held under option by this company, cut the lode at a depth of about 1000 ft. and drifting was started but results were unsatisfactory; copper-bearing rock appeared from time to time, but it had no commercial value. This company is also diamond drilling on sections 7 and 8 to open the old Atlantic lode.

ONTONAGON COUNTY

The Elm River company started a vertical shaft on the site of an old test pit and it is down well in the ledge; when

sufficient depth has been reached it is planned to drive a crosscut east to cut the various formation supposed to traverse the tract.

The Wyandot began crosscutting from the bottom of its exploratory shaft 700 ft. from surface and encountered an amygdaloid formation carrying a small seam of copper; drifting to ascertain its condition was recently started.

The shafts of the Winona property were sunk deeper and the lode was cut at the various levels by crosscuts which revealed a satisfactory mineralization in all cases and improved with depth. The electrically operated hoisting plant went into commission and is doing regular service.

The King Phillip property, under the management of the St. Mary's Mineral Land Company, was systematically opened on the Winona lode. No. 1 shaft is below the 8th level and the lode, cut at this point by a crosscut, was encouraging. No. 2 shaft is sinking close to the 2d level. A duplicate electric hoisting plant was installed at this property, and power is received from the Winona plant.

The wonderful showing, opened close to surface, at the Lake property has continued with depth. The shaft was put down to about 370 ft. without any change in the formation and drifts, extended from the 1st and 2d levels, are breasted in the same rich ground. An enlarged equipment was installed and a railway spur was laid to the shaft site.

The lands adjoining this property on the north and east aggregating about 1120 acres were taken over by the North Lake company and diamond drilling was started to open the Lake lode.

The Adventure company carried on extensive diamond-drill operations and cut an encouraging amygdaloid formation; additional drill-core data are being obtained, and when complete, shaft sinking probably will be started.

The Mass Consolidated Mining Company carried on extensive exploratory work throughout the year both by means of trenching and diamond drilling, but the nature of the results have not been announced.

The Michigan Copper Mining Company resumed the construction of its mill and "C" shaft again was put on the producing list and a much better showing was encountered on the Calico lode. This company also did a large amount of diamond drilling.

The Main lode of the Victoria property was disappointing and the company took up the search for a more consistent formation. A crosscut was started from the 2d level of its shaft and is just entering a copper-bearing formation; better results are being noted in the tunnel. Diamond drilling is being continued.

Antimony

The market for antimony in 1908 was quiet and without the sensational fluctuations in price that characterized the market in 1907. The chief factors which influenced low prices were heavy shipments of Chinese ore which readily cared for the demand and the restricted use of the metal by the railroads due to the financial depression. Throughout 1908 prices for Cookson's fluctuated between narrow limits; in January the average price was 9.344c. per lb. and in December it was 8.20c. per lb.

Hallett's brand was very scarce at the close of the year and Hungarian antimony was not prominent. Low prices affected these brands more than Cookson's.

But little antimony ore was mined in the United States in 1908 and the only smeltery in operation was that of Mathison & Co., at Chelsea, Staten Island. Low prices prevented the great majority of mines from extensive production and many were not operated at all during the year.

AVERAGE PRICES OF ANTIMONY.
(In cents per pound.)

	1907.			1908.		
	Cookson's.	Hallett's.	Ordinaries.	Cookson's.	Hallett's.	Ordinaries.
January.....	25.906	25.219	24.156	9.344	9.031	8.344
February.....	25.062	24.062	23.437	9.266	9.016	8.406
March.....	24.900	23.750	23.025	9.000	8.650	7.988
April.....	24.125	21.344	20.875	8.969	8.672	8.297
May.....	21.937	18.562	17.750	8.875	8.625	8.250
June.....	15.750	13.812	12.650	8.734	8.531	8.094
July.....	11.875	10.500	10.125	8.594	8.375	8.125
August.....	10.906	9.687	9.375	8.313	8.150	7.850
September..	10.750	10.000	9.650	8.234	7.922	7.609
October.....	11.750	10.406	10.047	8.284	7.922	7.625
November..	11.000	9.937	8.906	8.640	8.075	7.775
December...	9.662	9.060	8.088	8.200	8.063	7.688
Year.....	16.969	15.527	14.840	8.704	8.419	8.004

During the first half of 1908 France, according to *Min. Journ.*, Oct. 5, 1908, produced 38,626 tons of acid bessemer ingots, 807,192 tons of basic bessemer ingots, 508,386 tons of open-hearth steel ingots, and 10,793 tons of crucible and electric steel. The total steel production was 1,364,979 tons, as compared with 1,318,530 tons in the corresponding half of 1907. The production of coal during the first half of 1908 comprised 18,116,143 tons of coal and 383,499 tons of lignite.

The output of copper ore in the United Kingdom in 1907 was 6792 long tons, against 7758 tons in 1906. In 1863 the production of ore and precipitate was about 210,000 tons, valued at more than £1,000,000.

The Production of Lead and Spelter in 1908

Statistics of Production and Price—Imports and Exports—A Review of Mining Conditions—The Markets—Production of Zinc Oxide

LEAD, 323,841; SPELTER, 207,735 TONS

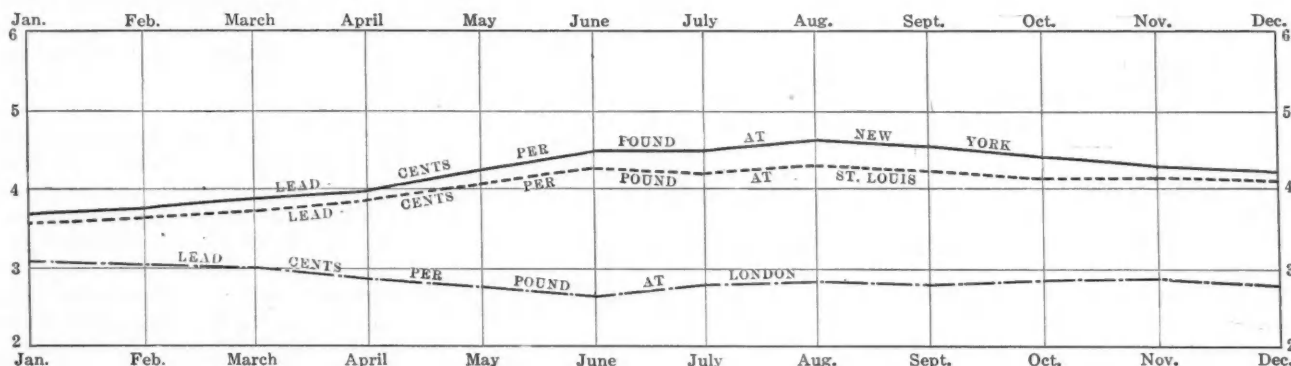
The bulk of the domestic lead production comes from two districts, viz., southeast Missouri and the Cœur d'Alene, of Idaho. If we include Joplin, Mo., Park City, Utah, and Leadville, Colo., we account for nearly 80 per cent. of the production of the United States. The Missouri lead ore is non-argentiferous. Almost all the other lead ore is argentiferous and is treated by the silver-lead smelters. With them the lead is not only an object of recovery for its own sake, but also it plays the part of collector for the precious metals of ores containing no lead that are smelted along with the lead ore. This condition is of great economic importance in determining the price for lead. The cost of producing lead in southeast Missouri is now about 3c. per lb., delivered at St. Louis. In the Cœur d'Alene it is 2.5

great life to this market. The average price for the year was 4.24c., which may be compared with 4.53c. as the average for the 10 years 1898-1907; this is a fair showing for 1908. However, lead is not a good criterion of commercial conditions in general. About 35 per cent. of the domestic consumption is for making white lead and oxides, the business in which was good in 1908. Labor being plentiful at reduced wages, many persons took advantage of this favorable opportunity to do necessary painting.

Mining continued in southeastern Missouri without any check to speak of throughout 1908. There was but little recession in the output of the Joplin district. Combining the production of these two districts, Missouri again holds the premier place among the lead-mining

mines of the Cœur d'Alene were adversely affected by the declining price for silver, the cost of producing their lead being affected greatly by the amount realized for that by-product. Apex litigation was inaugurated in 1908 between the Federal Mining and Smelting Company, and the Bunker Hill & Sullivan company, and the Cœur d'Alene is now to be afflicted with that curse. Undoubtedly the expense of this litigation will materially increase the cost of production to both companies.

Elsewhere in the United States there were no important developments in lead mining in 1908. In general the Western smelters curtailed operations during the early part of the year, resuming later on. Among the refineries, that of the United States Smelting, Refining and Mining Company, at Grasselli, Ind., was the only



COURSE OF LEAD PRICES DURING 1908. PLOTTED FROM THE MONTHLY AVERAGES

to 3.5c., delivered at New York, when the silver by-product realizes 50c. per oz. These mines alone cannot supply domestic consumption under normal conditions. A considerably higher price is necessary to maintain the production of Park City, Leadville, and a hundred miscellaneous mines; and unless the smelters have their ore they cannot treat so much gold and silver ore as is offered. Consequently the price for lead affects not only the lead mines but also many mines that yield precious metals only.

The year 1908 began with a large stock of unsold lead on hand and the price 3.55c., New York, which was only a trifle above the lowest of the panic period. During 1908 there were constant fluctuations with a generally upward trend until August, after which the market fell off a little, closing at about 4.20c. The stock on hand appears to have been reduced to ordinary and comfortable proportions, but at no time during the year was there any

States. There is not yet in sight any limit to the productive capacity of the mines of southeast Missouri, except the ability to secure the necessary labor. The ore deposits are of immense extent, and great improvements in the methods of mining, milling and smelting have been, and are still being made.

Some of the mining companies of the Cœur d'Alene affected to be seriously hurt by the low price for lead at the beginning of the year, and curtailed their production. In some cases this action was doubtless justified, certain of the mines having been worked to such depths as to be no longer profitable. Indeed, the Tiger-Poorman mine, at Burke, of the Federal Mining and Smelting Company has been abandoned. On the other hand, certain companies, especially the Bunker Hill & Sullivan, can operate profitably at a lower price than was reached in 1908. This great company produced on a large scale throughout the year. All of the

one to be closed entirely. This was made necessary by the suspension of operations at the works of the United States Smelting Company, near Salt Lake City, because of the smoke injunction. That company developed a process for neutralizing the acid in the smoke, after which smelting was resumed.

The mines at Eureka, Nev., were idle during 1908. The old mines at Pioche, Nev., are being reopened, and there is talk about these becoming an important source of lead production.

Production of Lead

The production of refined lead in the United States in 1908 is given in the accompanying table, the statistics of which are based on reports from all of the refiners stating their actual production for the first 11 months and their own estimates for December. Inasmuch as these

reports were for the most part made after the middle of December, the estimates are probably close, but in these preliminary statistics there is usually some uncertainty as to the separation of desilverized lead of domestic and foreign origin.

PRODUCTION OF REFINED LEAD.

(IN TONS OF 2000 LB.)

Class.	1907.	1908.
1. Desilverized.....	213,383	182,401
2. Antimonial.....	9,614	12,491
3. Southeast Missouri.....	108,510	110,059
4. Southwest Missouri.....	17,833	17,890
5. Miscellaneous.....	790	1,000
Total domestic.....	350,130	323,841
Total foreign.....	76,016	80,293
Grand total.....	426,146	404,134

(1) Does not include the lead, chiefly of Missouri origin, which is desilverized by one smelter in Illinois and is here entered under Class 3. (2) The production of antimonial lead which used to be divided according to domestic and foreign, in 1907 and 1908, has been wholly entered under domestic. (3) Includes two smelters in Illinois, which use chiefly ore from southeastern Missouri. (4) Includes one smelter in Kansas, which uses ore chiefly from southwestern Missouri. (5) Includes small smelters in Wisconsin, Illinois and Iowa.

IMPORTS AND EXPORTS OF LEAD.

(FOR FIRST 11 MONTHS OF THE YEAR.)

(IN TONS OF 2000 LB.)

	1907.	1908.
Imports:		
In ore and base bullion.....	62,973	97,092
Pigs, bars and old.....	9,164	2,753
Exports:		
In ore and base bullion.....	47,467	67,924

The Lead Market at New York in 1908

An upward movement, culminating in August, and a subsequent downward movement, which appears not to have exhausted itself at the close of the year, characterizes what has been an unusually erratic market. Under the impetus of an improvement in the general situation, heavy buying on the part of speculators took place in the first months of the year, reinforced by purchases on the part of consumers in anticipation of a better business. While the output in Missouri assumed normal proportions as early as January, production in the West continued heavily curtailed until the spring months, and this fact helped greatly in the distribution of the large stocks which had accumulated and the advance in the price which was almost uninterrupted until August.

The business of manufacturers was more or less of a dragging nature throughout the entire year, with the exception of the white-lead branch, where up to November the requirements were of very large volume. An equilibrium was reached in the middle of the year. At that time the resumption of Western mining operations on a normal scale made itself felt in the available quantity of marketable lead, but when the white-lead manufacturers ceased their purchases on a heavy scale, upon entering their dull

season at the beginning of fall, the rate of offerings again overtook the requirements, and a rapid decline ensued. Prices at the close of the year again reached a level where they may be called cheap from a general point of view.

It is not unreasonable to assume that prices are now not very far from bottom, the expectation being general that those branches of the lead business which have been hitherto neglected, particularly lead-covered cables, sheets, pipes and miscellaneous products, will be greatly benefited by the increase in corporate activity and in the building trades, which for these particular purposes came too late to be felt in the fall, and now must wait until the winter has passed.

At the beginning of 1908 the market stood at 3.55@3.60c., New York, and a gradual and slow advance established prices at 3.70@3.75c. at the close of the month. This level was maintained well into March. The surplus which was left over from the previous year had been largely distributed by that time, and the market was depending upon the actual lead output which was restricted by the reduced activity in Western mining centers. A realization of this brought consumers and speculators into the market, and in consequence a sharp advance took place to 3.90@4c., New York. There was not much change from these figures until late in April. The spring season is always the busiest for the lead manufacturers, and the resulting influx of increased business brought them into the market for correspondingly larger quantities. Under the influence of this, prices reached 4.05@4.10c. toward the end of April.

The better outlook encouraged resumption of mining operations in the West on a normal scale, but the heavier production did not reach the market until several months later, and meanwhile the shortage of supplies facilitated the forward movement, a steady appreciation taking place throughout May and June, when sales on a large scale were effected at 4.47½@4.52½c. New York. The most urgent demand being satisfied, the market reacted in July to 4.40@4.45c. New York. There was a rally from this level during August, due to speculative influences, which caused an advance to 4.57½@4.62½c., New York, the highest point reached during 1908. This movement was short-lived. The weight of offerings became heavier during September, owing to the increased supplies turned out by the Western mines, which by that time had passed through the refining works.

The last three months of the year recorded, with one short interruption in November, a retrograde movement, which

is still a factor at the end of the year, the close being steady at 4.15@4.20, New York.

LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January.....	6.000	3.691	19.828	14.469
February.....	6.000	3.725	19.631	14.250
March.....	6.000	3.838	19.708	13.975
April.....	6.000	3.998	19.976	13.469
May.....	6.000	4.253	19.688	12.938
June.....	5.760	4.466	20.188	12.600
July.....	5.288	4.447	20.350	13.000
August.....	5.250	4.580	19.069	13.375
September.....	4.813	4.515	19.776	13.125
October.....	4.750	4.351	18.531	13.375
November.....	4.376	4.330	17.261	13.638
December.....	3.658	4.213	14.500	13.156
Year.....	5.325	4.200	19.084	13.439

New York, cents per pound. London, pounds sterling per long ton.

White Lead in 1908

There was an active demand for white lead during the early months of 1908, due in part to the necessities of paint grinders and other large consumers and distributors, who had allowed their stocks to run down under the depression of the latter part of the preceding year, to a point that gave them no surplus from which to meet the anticipated requirements of the spring business. The consumption of paints during the first half of the year was not all that had been hoped for; there was no general revival of the building industry, and the last quarter was distinctly disappointing because business was not greater than in the corresponding months of 1907, when the depression was at its worst. In spite of these facts, however, sales of white lead showed an increase over 1907, and this seems to have been an exceptional feature of the paint industry. The reason for this is chiefly the proportionately large demand for pure white lead or high-grade paints due to the educational work of the paint laws enacted in several States and the wide discussion that has attended their adoption.

LEAD CARBONATE

In spite of advancing prices for pig lead, consumers of the carbonate were given the benefit of the low-cost metal bought by corrodors during the latter part of 1907, and there was no change in quotations from the list established in December, 1907, until the latter part of June, when an advance of ¼c. was made. This advance was maintained on lead in oil until Dec. 10, 1908, when there was a reduction of ¼c. and the year closed at 6½@6¾c., the prices ruling a year ago. This is the base price for lead in kegs of 100 lb. and upward, with an advance of ¼c. on 25- and 50-lb. kegs, and ½c. on 12½-lb. kegs. This differential is necessitated by the custom, adopted by all corrodors during the year, of making all pack-

ages full net weight instead of including the weight of the wood in the invoiced weight as was the previous custom on sizes under 100 lb. Where the cost of the package bears so large a proportionate relation to the value of the contents it has to be charged for in some form, and as the newly enacted paint laws generally require that packages shall be branded at actual net weights, the added price is necessary. It is generally expected that in the near future a further innovation in the trade in paint in oil, will be the adoption of steel packages in place of wood, for all sizes from 100 lb. down. The high cost of cooperage makes this a change in the direction of economy for the corroder, and from the standpoint of the consumer the metal package has many advantages.

The last reduction in price applied to lead in oil only and was due chiefly to the wide margin that had existed all during the year, and especially during the fall months, between the price of dry lead and that of lead in oil. This margin has been sufficient to give paint grinders an exceptionally good profit, even though their dry lead has averaged them a little above last year.

As a matter of fact quotations on dry lead were largely nominal throughout the year, and the bulk of the sales were even below the nominally quoted price for carload lots. During the first half of 1908 the price generally quoted was 5½¢. and this was fairly well adhered to as a price to grinders, although sales at 5¼¢. were by no means exceptional. The same nominal quotation prevailed during the last six months, but there were more sales at 5¾¢. than at the higher fraction, and the largest corroding interests entered into heavy contracts with grinders, and other large consumers during October at 5¼¢. Since then, however, the business has been mainly at 5¾¢.

LEAD OXIDES

Lead oxides did not have as satisfactory a year as did the carbonate. While there was some improvement in demand as the year progressed, many of the large consumers of red lead were practically out of the market due to a lack of structural work, and in some other industries litharge was substituted for red lead because of an unusually wide difference in cost. Prices for both oxides, and especially litharge, were unsatisfactory to manufacturers, since some of the makers, who have recently become active in the market, have freely offered their product at narrower margins above the cost of metallic lead than had almost ever before prevailed. As a result published quotations were wholly nominal, and the bulk of the business in red lead was at 6¼ @ 6½¢.; these figures, of course, represent the prices to large consumers, and in casks. Through the ordinary channels of distribution prices

have ranged from 6½@7¼¢. as to quantity and size of package, for both oxides.

The year closed with an evident expectation of a good spring business in all forms of high-class paints, but with marked conservatism on the part of large buyers as to present purchases based upon a lack of confidence in prices. The buyers of all lead products now watch closely the published quotations for pig lead and base their ideas of the value of the carbonate and oxides thereon; and while manufacturers do not always meet these ideas, they have a tendency, on a declining metal market, to keep the demand from this class of buyers down to their current running requirements.

Southeast Missouri Lead District

By H. A. WHEELER*

The output of the southeastern lead belt of Missouri closely approximated 104,000 tons in 1908, with an estimated value of \$8,320,000. This is high-water mark as regards tonnage, for it exceeds the highest previous production, that of 1907, by about 6 per cent., but on account of the much lower metal prices, especially in the early part of the year, the production of 1908 is nearly 25 per cent. less in value.

In view of the discouraging condition of the market at the beginning of the year, this record is very satisfactory, and emphasizes the healthy, basic conditions prevailing in the district. It continues the record of continuous growth—a record that any old mining district might well envy—and while hitherto the output has increased at the rate of 10 per cent. or more annually, it should be borne in mind that the above growth of 6 per cent. is figured on the highest previous production.

The severe panic in the latter part of 1907 caused considerable curtailment in the output last winter, but it also enabled the rapidly rising wages to be lowered to a more reasonable basis. When the lead market unexpectedly showed such healthy improvement last spring, the larger producers resumed full-time work and continued to work full time up to the close of the year.

The increase in the output resulted from improvements largely made in 1907, as in 1908 no new work was attempted until the latter part of the year. No new orebodies were discovered; nor were any new companies floated in 1908. As the market maintained its improved condition, toward the end of 1908 it encouraged the starting of betterments that should increase production considerably in 1909, if the present bright outlook continues.

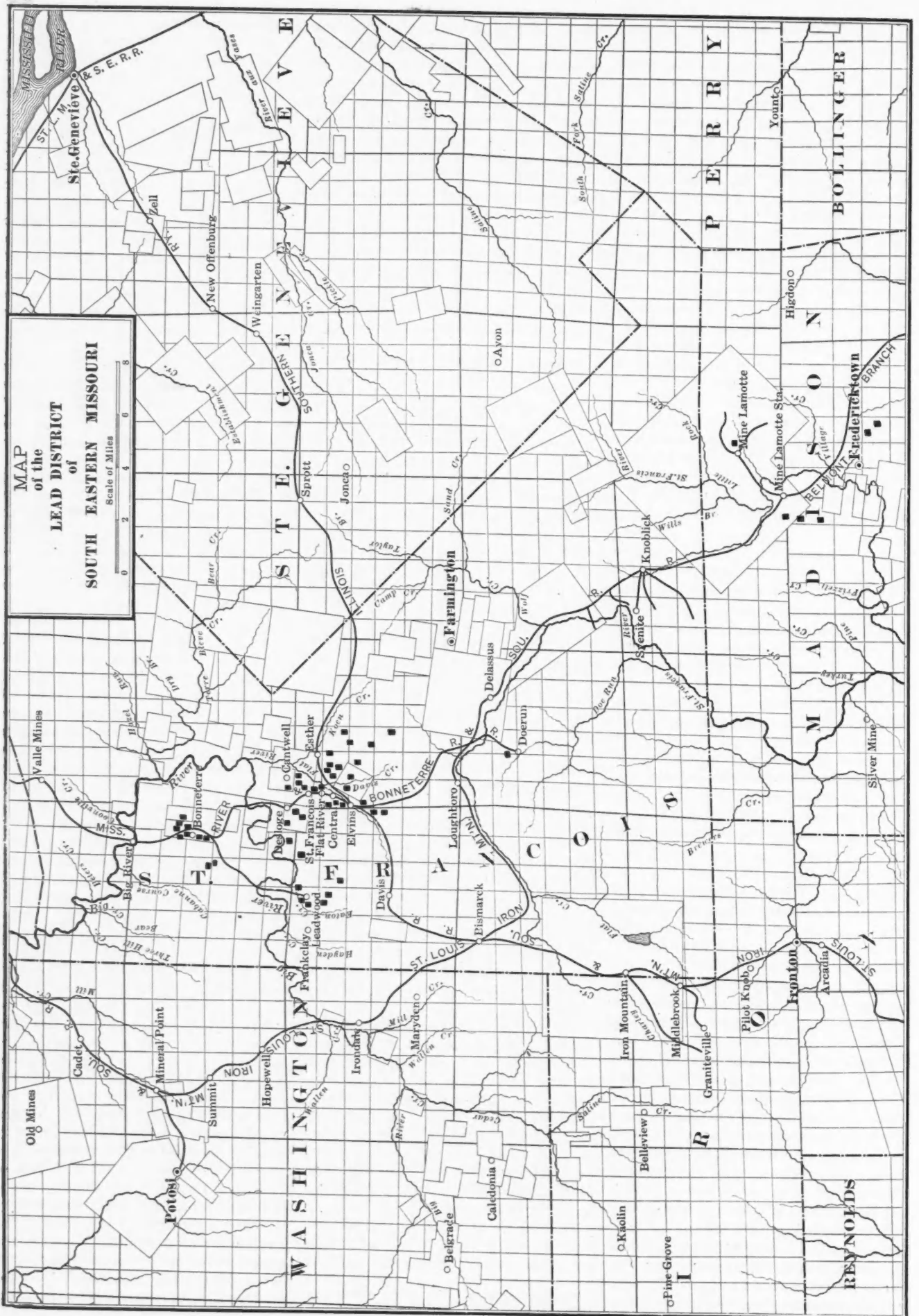
The output, as usual, was almost entirely derived from the five large producers in the Bonne Terre and Flat River

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camps in St. Francois county, especially as the depressed market was felt much more severely by the smaller producers in Madison, Washington, Jefferson and Franklin counties. But the decreased tonnage in these camps was not enough to affect materially the results of the district. The output of Madison county, which includes the Mine la Motte and Fredericktown camps, amounted only to about 4 per cent. of the total, while the production from the old shallow diggings of Washington, Jefferson and Franklin counties was less than 1 per cent. The unusually small output of the latter is not due to exhaustion, but rather to the sensitiveness of the mines in that area to a low market and to their slowness in recovering from the benumbing action of the severe panic of 1907, for, although the market rallied from an opening price of 3.4@3.5¢. at St. Louis to 4.25@4.3¢. later in the year, this failed to restore confidence among the small leasers who operate in the shallow diggings.

The searching for new orebodies with the diamond drill that was so conspicuous in 1906 and 1907 and which was so abruptly brought to a close by the panic has been taken up again on a large scale by only one of the large companies. Some diamond drilling was done by the other companies in 1908, but on a relatively small scale and mainly to define and extend the orebodies now being worked. The steady absorption by the large companies of mineral-bearing lands in the lead belt that had been in progress until the panic has not yet been renewed; but the few good tracts remaining are likely to soon be taken over as the times improve, for, with the steadily growing outputs and increased size of the mills, the present orebodies are being rapidly exhausted and foresight requires the accumulation of virgin properties to supply future ore reserves, especially while the prices are still so moderate. Prices that today look high at \$100 to \$300 per acre as compared with prices of \$50 to \$100 an acre that ruled scarcely 10 years ago will probably look extremely cheap 10 years from now.

An important innovation was introduced in this district in 1908 by the starting of an electric power plant in which gas engines supplied by producers are the prime-movers. Although the district, being only about 60 miles from the Illinois coalfields, enjoys probably the cheapest coal of any metal-mining district in the country, two 2400-h.p. plants were erected to still further reduce the fuel costs by utilizing the much greater economy of gas engines; these were installed to replace compound Corliss steam engines, equipped with condensers. But, since nearby bituminous coals can be laid down at the metal mines for \$1.75 to \$2.50 per ton, the margin for economy is not as attractive as usual. This will be especially so if higher grade coals have to be shipped in to obtain



efficient work from the producers. Local experience in operating gas producers with western Illinois coals has shown that, as these coals are so high in sulphur and ash, in the past it has been more profitable to use the higher-grade and more expensive coal from Indiana or southern Illinois.

THE ST. JOSEPH LEAD COMPANY

This pioneer company in the operation of the modern disseminated mines still holds its well earned prestige of being the largest, most important and most profitable of the Missouri producers, in spite of being the oldest. It is still producing heavily from its No. 1 mine, which is now more than 40 years old, and its latest shaft, the No. 13, was recently sunk to open up an extension of its famous Bonne Terre orebody. While this company reduced its output 50 per cent. and entirely stopped extensive improvements in the latter part of 1907, the mines were reopened on full time early in 1908, and later in the year much of the new work was resumed. Betterments at its model town of Bonne Terre have been continued by adding to the new sewage system, and by the building of a large, attractive new store, now nearing completion. The second story of this building will be devoted to the use of the local Mine Club.

In October the gas-engine power plant of this company, at Bonne Terre, was completed and is now in successful operation. It consists of three 600-k.w. Westinghouse generators each directly driven by duplex, horizontal gas engines of the Snow type. The power plant is housed in a well lighted, fireproof, steel building that is equipped with a 10-ton traveling electric crane. At present the alternating current is distributed at 6600 volts to the nearby mines and mill, but later it is expected to enlarge the plant and send power to the more distant mines. The gas is furnished by two batteries of duplex producers of the Loomis-Pettibone down-draft type, which are housed in an adjoining steel building, with an intermediate large gas-holder.

The St. Joseph company is operating eight shafts. These supply the old or No. 1 mill at Bonne Terre, having a capacity of 1,500 tons, and the new or No. 2 mill at Owl Creek, having a capacity of 1200 tons. The concentrates are shipped 30 miles north to the company's smelter at Herculeum, on the Mississippi river.

THE DOE RUN LEAD COMPANY

The Doe Run Lead Company has completed the installation of a gas-engine power plant at its No. 1 shaft at Flat River—a duplicate of the St. Joseph company's plant—and has resumed the construction of the concentrator at West Elvins, on which work was stopped by the panic. This mill will have a capacity of about 1500 tons and is expected to be in operation by July 1, 1909.

Like the St. Joseph company, the pro-

duction was cut down 50 per cent. in the latter part of 1907, but work at full capacity was resumed in the early part of 1908. Four shafts are being operated, from which the ore is shipped ten miles south to the 1500-ton mill at Doe Run; the concentrates are then shipped to the St. Joseph company's smelter at Herculeum.

THE FEDERAL LEAD COMPANY

The Federal Lead Company has entirely recovered from the partial shutdown in the latter part of 1907, and is today making the largest production in its history. Its new No. 2 mill at Central is being remodeled by taking out the 3-compartment Hartz jigs and replacing them with Hancock jigs. This is resulting in a marked saving in labor, power and water, besides materially increasing the capacity. When other improvements are completed it is expected that the No. 2 mill will have a capacity of 3500 to 4000 tons per day, making it by far the largest mill in the district as well as in the Mississippi valley. The company is operating its No. 1 mill, which has a capacity of about 1000 tons per day.

A new shaft, the No. 11, is being sunk on the south side of the No. 2 mill to tap the old Central orebody, and work is shortly to be started on Nos. 9 and 10 shafts; the sinking of both these was discontinued in the latter part of 1907. Six shafts are being operated at present, but before the close of 1909, nine will probably be supplying ore.

THE NATIONAL LEAD COMPANY

The National Lead Company kept steadily at work and made an excellent record for a busy, active year that has been far from unprofitable. Equipped as it is with one of the best and most compact plants in the district, it was probably the best money-maker during 1908, for it never curtailed its output, and its up-to-date plant was under no expense for improvements. Four shafts supply the 1500-ton mill; these are only $\frac{1}{4}$ to $1\frac{1}{2}$ miles distant from the mill.

The Desloge Lead Company maintained its usual output and did not attempt materially to curtail its production during the depression. The new No. 5 shaft has been completed; this shaft is not situated conveniently to the mill, being about four miles distant, but it promises to prove a valuable producer. The new orebody opened up by this shaft lies almost over the line in Washington county. The company's small plant of Flintshire or air furnaces has been operated on the Desloge brand of pig lead, but, as this plant is too small to smelt all the output, most of the concentrates have been shipped to the Illinois smelters. The company's 1000-ton mill is supplied from three shafts that are $\frac{1}{2}$ to 4 miles distant from it.

The plant of the Mine La Motte company in Madison county has been equip-

ped with a new 500-ton mill under the present Pittsburg management. The output was not pushed in 1908 owing to the low market, but instead the reserves were increased and the property developed. The lease of the old copper-mine tract that was sub-let by the Mine La Motte company to the Hudson Valley Mining Company has been transferred to the Eastern Lead Company which operated most of the year on a royalty basis.

The North American Lead Company at Fredericktown, in Madison county, continues to be operated as a copper property and the small amount of lead that it recovers in working the copper sulphides is merely a by-product that is shipped away to be smelted.

The Madison Lead and Land Company, which operates the old Catherine mine in Madison county, partially restricted its output during 1908 and ran only one of its two mills.

Spelter

The bulk of the production in the United States continues to be derived from the Joplin district. The fact that the resources of that district have been seriously diminished is of determining influence in the spelter industry. If it had not been for the appearance of the Rocky Mountain zinc ore, the rejuvenation of mining in Wisconsin, and the importation of Mexican ore during the last five years, there would undoubtedly have been a spelter famine. In spite of the new supplies it has been necessary to mine a very large quantity of ore at Joplin that yields only $2\frac{1}{2}$ to 3 per cent. of concentrated mineral, which could be done only at an advance in price for the ore and consequently for spelter also. This condition is becoming more and more emphasized.

There is not now in sight any supply of cheap ore that might oust the Joplin district from its present position of premier zinc producing district. Consequently continuance of a high level of price for spelter must be expected, because it will be necessary to enable the Joplin sheet ground mines to continue to operate. The price might rise inordinately high under the demand for increasing consumption, but it will be restrained by supplies of ore from other districts. However, the other districts, except perhaps Wisconsin, will be unable to furnish cheap ore; because in spite of their advantage in a higher grade of crude ore, their cost of mining and milling per ton of crude ore is high (in most cases inevitably high), and their concentrated product is subject to high freight charges, owing to remoteness from the smelting centers. The experience of 1907-08 has shown that a price of less than 5c. for spelter tends to check production from these mines.

Yet it would be unjustified to say that

this condition will continue indefinitely, inasmuch as new zinc-producing districts may be discovered. None that can be pronounced as promising a substitute for Joplin is now in sight, but geologists consider that similar deposits may reasonably be expected along the skirts of the Ozark uplift, and the development of important mines at Miami, Okla., in 1908, lends color to this belief. Dr. Keyes, formerly State geologist of Missouri, has recently expressed the opinion that the name of "Joplin district" has become a fetish, upon which attention has been concentrated to the exclusion of other prospects that may develop into important zinc-producing centers. If this be so, and Dr. Keyes is not alone in the opinion, it is to be expected of course that sooner or later further zinc resources will be discovered in Missouri, Kansas and Oklahoma.

The spelter market was very unsatisfactory in 1908. It began with a greatly decreased production, a stock of 33,000 tons on hand, and the price $4\frac{3}{8}$ c., New York. Spelter is a good criterion of domestic business, inasmuch as practically the whole production is consumed in this country, while 80 per cent. of it is used by the galvanizers and the brass makers, wherefore spelter connects with both the steel and the copper manufacturing industries. During the first half of 1908 the demand for spelter was slack, but the smelters laid off so many furnaces that the small demand led to an advance in the price; however, by mid-year the latter was only $\frac{1}{8}$ c. above that of the beginning and the unsold stock had increased, estimates varying from 35,000 to 50,000 tons. The gradual improvement in the demand for consumption induced the smelters to fire more furnaces in the second half of the year, and the price averaged materially better, being a little over 5c. in November and December, but 1908 closed with a large unsold stock in the hands of the smelters, including what they were holding for speculators, the account of the latter being rather large. Applying to spelter the remarks that we have made respecting copper, the stock on hand at the end of 1908 does not loom large, being less than two months' consumption, but in this industry it is not common to have an unsold stock in first hands of more than 2 or 3 per cent. of the annual production.

The statistics given in a following table show a large decrease in the spelter production and also in the consumption as compared with 1907. The Joplin district does not show a corresponding decrease. Its production of ore in 1907 was 286,500 tons; for 1908 its output was about 256,000 tons. These figures correspond with about 143,000 and 128,000 tons of spelter respectively. Wisconsin made a small increase in 1908. It appears, therefore, that the Rocky mountain districts and the ex-

porters of ore from Mexico suffered most. The year was one of the most disastrous on record for the smelters, whose competitive bidding for the necessary Joplin ore wiped out all margin for profit, of course to the advantage of the miners. This was a powerful factor in sustaining the Joplin production. Another factor was that many miners discharged by companies unable to work at a profit went to the old diggings and earned their living by old-fashioned hand work, thereby contributing to the increased total.

In spite of this mulcting of the smelters, the operators in the Joplin district found it hard to realize any profit and there was great complaint about the adverse conditions. The fact is, of course, that the old lens deposits, yielding 5 per cent. ore, have been to a large extent exhausted, during the last five years and a large part of the production has had to be derived from the "sheet ground," which yields only $2\frac{1}{2}$ to 3 per cent. Prices for the concentrated product rose correspondingly and the producers were able to do finely up to the latter part of 1907. Yet, even under the adverse conditions of 1908, the Joplin district was immensely profitable, although not to the operators. The latter work generally upon leased land and pay the fee-owner a royalty upon what they produce. This royalty may have been reasonable when richer ore was mined, but under present conditions it is outrageous. Consequently the mining profit is going to the fee-owners. The operators command pity in their present situation, but they have made no serious or concerted attempt to secure a readjustment of the royalty question.

The works of Hegeler Bros. at Danville, Ill., were put in operation in 1908, but they had been completed in 1907. Otherwise there were no new constructions in 1908. Indeed, at least one plant begun in 1907 was abandoned. Few, if any, of the older smelters made additions to plant. Several small works remained idle throughout the year. Others were idle for longer or shorter periods. No one operated at full capacity.

There was a large increase in the zinc production of Australia in 1908, and the treatment of the mixed sulphide ores of Broken Hill now seems to have been successfully solved. The Zinc Corporation which experienced a great deal of difficulty during its experimental period finally succeeded in overcoming difficulties and during 1908 established itself upon a profitable basis. From now onward this company will probably make a large production. The Broken Hill zinc ore has become a highly important factor in the European market, where it has displaced a good deal of the ore formerly mined in Spain and other European countries. Although the Australian ore is not of the most desirable character for smelting,

nevertheless it is advantageous to smelters to be able to contract for a long period for a large supply of ore of even character. Certain of the Broken Hill companies have sold their output for eight years ahead.

Toward the end of 1908 the convention among European zinc producers, under consideration all through the year, was consummated, but previous to the appearance of this article it has not been publicly announced. This convention appears to be the most severe and most scientific of any that has been organized in the zinc industry of Europe. Its fundamental idea is restriction of production to conform to the requirements for consumption at a certain price for spelter, which appears to be £20@23. If the unsold stock of spelter, to be reported monthly, exceeds a certain amount, there is to be a restriction of production according to schedule based on the excess of stock. Or if the price for spelter falls below £20 there is also to be a restriction of production. The regulation of production is to be in the hands of three commissioners. Bad faith on the part of any member of the convention, or failure to comply with the allotment, is to be punished by a fine. The members of the convention deposit with the commissions good securities as a guarantee for the collection of the fine. All of the zinc smelters of Europe, with two or three insignificant exceptions, have joined this convention. The convention has fortified itself against the entrance of new interests in the smelting business by associating with itself some of the largest banking interests of the Continent, including the Deutsche Bank, which on its part undertakes to refuse to assist in the financing new enterprises.

Production of Spelter

According to the accompanying table the production of spelter in the United States in 1908 decreased by about 33,000 tons. The statistics for 1908 are based on reports from all of the producers, who have given their actual production for the first 11 months of the year, together with their estimates for December. Inasmuch as the bulk of the reports were made subsequent to the middle of December, it is probable that the estimates for that month are very close.

A large number of the producers reported their unsold stock, as of Dec. 15, 1908, these reports including the amount held in storage for other parties. It appears from these statements that smelters who produced 147,876 tons of spelter had 20,112 tons in stock at their works. Estimating the stock of other smelters as being in the same proportion, the total stock of spelter in first hands in the United States, Dec. 15, 1908, was approximately 28,000 tons. On this basis, the de-

livery into consumption is computed in the second table.

PRODUCTION OF SPELTER.

(IN TONS OF 2,000 LB.)

State.	1907.	1908.
Colorado	5,200	2,152
Illinois	56,103	50,202
Kansas	133,561	97,574
Missouri	11,594	10,068
Oklahoma	5,094	14,911
South and East	38,060	32,828
Total	249,612	207,735

DELIVERIES INTO CONSUMPTION.

(IN TONS OF 2,000 LB.)

	1907.	1908.
Stock January 1	4,550	32,883
Production	249,612	207,735
Imports	1,778	900
Total supply	255,940	241,518
Exports	563	2,710
Stock, December 31	32,883	28,000
Deliveries	222,494	210,808

The Spelter Market in 1908

The large accumulations carried over from 1907 exerted an influence which was felt throughout 1908. At the opening of 1908, weak holders had been fairly well eliminated and the existing stocks were in a large measure concentrated in strong hands. Production was at low ebb. The consuming community began to emerge from the demoralization incident and subsequent to the panic. The purchases of spelter for legitimate requirements had been practically nil for some months. The tendency everywhere was to work up the stocks on hand to the lowest point possible, which policy was facilitated by minimum requirements.

Meanwhile the production has adjusted itself to this state of affairs. Unlike other base metals, the greater percentage of zinc ore is obtained from small properties, the operation of which can be stopped without serious sacrifice. The cost of idleness leaves a very small margin for losses incurred through sales of ore below cost, so that whenever spelter prices show a permanent decline, the production is automatically checked, depending upon the cost of producing in various mines. The proportion of the output which can be produced below 5c., St. Louis, as compared with the total requirements, is growing smaller in proportion to the growth of the total requirements, and this was clearly illustrated in the market developments during 1907 and 1908.

At the opening of 1908, the reduced output was just about sufficient to supply current requirements. When it was found that stocks were not increasing, speculative buying became an influence in the market and brought about an appreciation in the price, from 4.15c., St. Louis in early January, to 4.40@4.45, St. Louis at the end of that month. The movement made further progress in Feb-

ruary, during which month there was an uninterrupted advance to 4.65@4.70c., St. Louis. Realization of speculative holdings caused a decline in March to about 4.50c., St. Louis, and around this level the market fluctuated within narrow limits until well into May.

During all these months the demand was never large enough to enable liquidation of the old stock. In consequence, some of the first-hand holders lost patience and in their efforts to force sales, depressed prices throughout June and July, bringing about a decline to 4.27½@4.30, St. Louis. They, however, accomplished their purpose by shifting a good portion of the stock to consumers, who wisely took advantage of this opportunity to replenish their empty yards at low prices.

The revival in general business during the fall months was reflected in the spelter market through increased business not only from galvanizers, but also from the brass manufacturers, who then, for the first time in over a year and a half, became buyers of anything like normal quantities. As a result, an advance started in August, which continued slowly but steadily throughout the remaining months of the year. The rise would doubtless have been more rapid if it were not that the remaining surplus is being gradually fed out with the current output. This, in itself, illustrates that the output is not adequate to meet current requirements, even though requirements of consumers have not yet attained normal proportions. A further increase in the consumption can only be satisfied at higher prices, without which a corresponding enlargement in the output of ore is not to be expected. The market closes firm at 4.97½@5c., St. Louis.

SPELTER

MONTH.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January	6.732	4.513	6.582	4.363	27.125	20.563
February	6.814	4.788	6.664	4.638	25.938	20.875
March	6.837	4.665	6.687	4.527	26.094	21.075
April	6.685	4.645	6.535	4.495	25.900	21.344
May	6.441	4.608	6.291	4.458	25.563	19.906
June	6.419	4.543	6.269	4.393	25.469	19.000
July	6.072	4.485	5.922	4.358	23.850	19.031
August	5.701	4.702	5.551	4.556	21.969	19.350
September	5.236	4.769	5.086	4.619	21.050	19.563
October	5.430	4.801	5.280	4.651	21.781	19.750
November	4.925	5.059	4.775	4.909	21.438	20.875
December	4.254	5.137	4.104	4.987	20.075	20.625
Year	5.962	4.726	5.812	4.578	23.771	20.163

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

In Western Australia there are 29 State stamp mills and 21 State cyanide plants. Prior to Jan. 1, 1908, 505,286 tons of gold ore was treated, and gold amounting to £2,036,156 was extracted in the stamp mills and £277,166 in the cyanide plants, while tin, valued at £52,915 was obtained from the 31,166 tons of tin ore treated in State batteries.

Zinc Oxide

The production of zinc oxide and zinc-lead pigment in 1908 was 65,100 tons, valued at \$5,876,040, against 85,390 tons, valued at \$7,731,100 in 1907.

Zinc and Lead in the Joplin District

By JESSE A. ZOOK*

At the beginning of 1908 conditions in the Joplin district were bad owing to the financial panic. This condition continued until toward the end of September. However, as soon as the mine owners and miners adjusted the wage scale an increasing production followed, and, although the margin of profit for the mines in the sheet-ore area was comparatively small, yet prices for zinc and lead concentrates were high enough for the richer properties to resume production. Shipments increased from 14,000 tons in January to 20,000 tons in February. The average per month continued at approximately this figure until October, when the output increased to 25,000 tons for the month.

The more rapid recovery of lead prices, from the extremely low point at the close of 1907, made it possible to resume mining operations at many lead-zinc mines, especially in the sheet-ore area, that could not have been operated but for the sharp demand for and strong prices of lead. Instead of representing the profit of the mine as had been frequently the case previous to the panic, lead had to bear a portion of the expense of operating the mine. Development opened up new orebodies in outlying camps and in the areas where the ore is easy to concentrate; these deposits helped to maintain the average production.

DEVELOPMENTS IN 1908

Much development work was done during 1908 along Springs river northwest from Carthage to Alba, and northeast from Alba. The richer of these newly found orebodies added materially to the output of this part of the district, for many of the older mines of Alba-Neck have been abandoned. New discoveries in the Spring City-Spurgeon mines in Newton county south of Joplin kept pace with the abandonment of worked-out mines. This area, aside from the channel deposits, produces principally silicate of zinc. The panic halted underground development around Sarcoux and Reeds, southeast from Carthage, but a large amount of prospecting was done with drills.

South and southeast from Galena con-

*Statistician, Joplin, Missouri.

siderable drill prospecting was done in 1908, and some ore was found. Low ore prices had little effect on curtailing the work of drill prospecting, but it retarded development work all over the district. A few lens deposits were developed west and southwest of Joplin, but no effort was made to develop the disseminated deposits west of town, as that ore requires higher prices than those prevailing in 1908 to be profitably mined.

other parts of Oklahoma may become producing mines before the close of 1909.

THE INCREASED PRODUCTION IN OKLAHOMA

The phenomenal increase of Oklahoma came almost wholly from the new camp of Miami where a wonderfully rich deposit of zinc and lead was discovered in 1907. This deposit lies in horizontal layers or sheets in a blanket form; the thick

output, a number of new mills are just preparing to produce, so it is believed that in 1909 the Miami camp will double or treble the tonnage produced in 1908. Miami is burdened with excessive royalty, the rate being universally 30 per cent. The land was leased in large tracts by the parties who discovered the ore while drilling for water, and they placed the royalty base at the maximum assessed in the older camps of the district. Toward the end of 1908 drill prospecting indicated the occurrence of ore in other parts of Ottawa county; at least three of these new areas look promising.

TABLE I. PRODUCTION OF ZINC AND LEAD ORE IN THE JOPLIN DISTRICT.

	ZINC ORE (Short Tons).				LEAD ORE (Short Tons).			
	1908.	1907.	Increase.	Decrease.	1908.	1907.	Increase.	Decrease.
Oronogo.....	8,506	9,945		1,439	410	506		96
Webb City-Carterville.	70,460	74,030		3,590	16,890	17,482		592
Prosperity.....	7,691	7,487	204		2,182	2,912		730
Duenweg.....	11,939	17,767		5,828	1,840	3,436		1,596
Totals.....	98,596	109,229	204	10,857	21,322	24,336		3,014
				10,853				3,014
Carl Junction.....	1,386	901	476		65	98		33
Zincite-Sherwood.....	2,064	2,912		848	83	339		256
Cave Springs.....	945	940	5		6	15		9
Joplin.....	51,727	56,344		4,617	6,278	7,108		830
Spurgeon-Spring City.	6,863	6,635	228		1,479	1,509		30
Diamond.....		38		38				
Seneca.....	18		18		76		76	
Granby.....	10,599	11,413		814	831	1,345		514
Totals.....	73,602	79,183	727	6,317	8,818	10,414	76	1,672
				5,590				1,596
Alba-Neck.....	11,968	22,438		10,470	86	157		71
Carthage.....	3,893	2,227	1,666		3	4		1
Reeds.....	82	383		301				
Sarcoxi.....	2,123	1,349	774					
Wentworth.....	597	391	206					
Totals.....	18,663	26,788	2,646	10,771	89	161		72
				8,125				72
Stott City.....	159	817		658				
Aurora.....	8,406	12,302		3,896	204	337		133
Ash Grove.....	19		19		59	33	26	
Springfield.....		193		193		227		227
Totals.....	8,584	13,312	19	4,747	263	597	26	360
				4,728				334
Galena.....	16,576	26,542		9,966	2,807	3,393		586
Playter.....	220	398		178	36	17	19	
Badger.....	9,633	11,421		1,788	509	45	464	
Lawton.....		27		27				
Totals.....	26,429	38,388		11,989	3,352	3,455	483	586
				11,989				103
Quapaw-Baxter.....	3,149	2,320	829		44	640		596
Peoria.....	288	278	10					
Miami.....	5,870	60	5,810		1,254	16	1,238	
Totals.....	9,307	2,658	6,649		1,298	656	1,238	596
			6,649				642	
District.....	235,181	269,558		34,377	35,142	39,619		4,477

AN INCREASED PRODUCTION

Aside from a general resumption of operations in the sheet-ore area that may be looked for with higher metal prices, new production will come from the points where prospecting and development work during the last two years have indicated favorable ore deposits, as mentioned under the heading of developments in 1908. The Quapaw area, southwest of Baxter Springs, should show an increased output, as "wildcatting" has stopped and legitimate development work is being pushed. Miami will increase its output, and some of the recent drill discoveries in

sheets of rich ore are found throughout an area $1\frac{1}{2} \times 3$ miles, while thinner sheets of ore extend outward from the central body. The ore is coated with oil and asphaltum; without vanning from 3 to 7 per cent. of iron pass into the concentrates. On account of the presence of oil, concentration on tables is practically impossible as the lighter ore particles are washed away with the oil-impregnated water. The entire production of zinc for 1907 was 2500 tons, while at the end of 1908 this district produced a tenth of that amount in a single week. Although some of the leases at Miami are decreasing in

AUTOMATIC SHOVELS UNDERGROUND AT JOPLIN

Automatic shovels may be used extensively in the mines of the Joplin district during 1909. The American Zinc, Lead and Smelting Company took the initiative, installing one during 1908; another is ordered for early delivery in 1909. The use of these shovels is partly an experiment in the Joplin mines, and the shovels will need adaptation to the local conditions to be wholly successful. Upon the absolute necessity of some means of increasing the output of ore depends future profits of zinc-lead mining in this district. It is from no disposition to force a lower wage scale that power shovels are to be installed, it is simply a question of obtaining a larger output. The supply of American-born shovelers is about all utilized. Some operators favor hiring Italian laborers for this work, but the automatic shovel is now receiving first attention. If the shovel can be made to do the work, even at a slightly increased price per ton, and will increase the output sufficiently, its use will prove profitable. This problem of handling the ore underground will probably be solved in 1909.

A NEW BASE-PRICE FOR ZINC ORES

The enlarged production of zinc ore from Miami, carrying an average of 5 per cent. of iron, was the foundation of a new system of basing ore values. As prices advanced toward the close of 1908, and all grades of ore grew in demand, one of the smeltermen discovered that he could afford to buy this ore with no deduction for iron, and a price based on ore containing 40 per cent. zinc was made, with \$1 per ton advance for each 1 per cent. of zinc above 40 per cent., and with no deduction for the iron in the ore. As high as \$22.50 per ton was paid for ore containing 40 per cent. zinc. This was equivalent to \$42.50 per ton on the 60-per cent. zinc basis, and as this ore carried 6 per cent. of iron without penalty it equalled a base-price of \$48.50 per ton, while the best ore in the district was selling at \$42.50 to \$43 on a 60-per cent. basis.

This change in base-price opened the

eyes of producers to a fact which previously they had seemed scarcely to realize, that in taking off \$1 per ton for each decrease of 1 per cent. in zinc, occasioned partly by the presence of iron, and in addition deducting a penalty of \$1 per ton for each per cent. of iron in the ore they were being "double crossed." The smelting company making the innovation at Miami foresaw to what it might lead, and abandoned the new base within a few weeks, but other smelting companies continued to make this price until the close of 1908. This may eventually lead to a complete change in the base-price for zinc ores. At present the system of making zinc-ore prices is exceedingly crude.

CONFUSING TERMS

The growing custom of speaking of the ore occurrence in various portions of the district as a sheet or blanket vein is creating a false impression. The sheet or blanket deposits from Oronogo southeast through Webb City, Carterville, Prosperity and Duenweg have no defined side

PRODUCTION BY CAMPS AND STATES
An accompanying table gives the production of the various camps for the first 11 months of 1908 compared with that of the same period in 1907. In table I the first section gives the production of the sheet-ore area from Oronogo southeast to Duenweg; the second section, all territory west and south of the Oronogo-Duenweg area to the State line; the third section, that of the sheet area to the east line of Jasper county; the fourth section, the Lawrence and Green County production; the fifth section, that of Cherokee county, Kansas; the sixth section, the production of Ottawa county, Oklahoma.

Table II is a summary of the larger table, giving the production of Missouri by counties and the total production of the district by States. An approximate reduction to spelter would give the following results: Missouri, 98,326 tons; Kansas, 9724 tons; Oklahoma, 3639 tons.

THE PRODUCTION FOR FIFTEEN YEARS

In only the two preceding years does

ton and lead \$14.20 per ton lower than in 1907, and the district lost over \$5,000,000 in the value of its possible output. The average zinc and lead prices were lower than during the preceding four years.

TABLE III. ZINC AND LEAD PRODUCTION OF JOPLIN DISTRICT.

	Zinc Ore, Tons.	Lead Ore, Tons.	Total Value.
1908	257,071	38,322	\$10,931,790
1907	286,538	42,065	15,419,827
1906	278,930	39,189	15,128,175
1905	252,435	31,679	13,302,800
1904	267,240	34,362	11,487,350
1903	234,773	28,656	9,471,395
1902	262,545	31,625	9,430,890
1901	258,306	35,177	7,971,651
1900	248,446	29,132	7,992,105
1899	255,088	23,888	10,715,307
1898	234,455	26,687	7,119,867
1897	177,976	30,105	4,726,302
1896	155,333	27,721	3,857,355
1895	144,487	31,294	3,775,929
1894	147,310	32,190	3,535,736
Totals	3,460,933	482,092	\$134,866,479

TABLE IV. ORE PRICES IN JOPLIN DISTRICT.

	ZINC ORE.		LEAD ORE.	
	High.	Aver.	High.	Aver.
1908	\$47.00	\$34.36	\$66.00	\$54.70
1907	53.50	43.68	88.50	68.90
1906	54.00	43.30	87.00	77.78
1905	60.00	44.88	80.00	62.12
1904	53.00	35.92	62.00	54.80
1903	42.00	33.72	60.50	54.12
1902	42.00	30.33	50.00	46.10
1901	34.00	24.21	47.50	45.99
1900	38.50	26.50	56.50	48.32
1899	55.00	36.61	55.00	51.34

ZINC ORE PRICES DURING 1908

Zinc ore sold at \$39 per ton the first week of 1908, an advance of \$3 per ton over the closing price of 1907. In two weeks it jumped to \$42.50 and the following week to \$44 per ton. Beginning February at \$42 it declined to \$40, and \$39, then rose to \$40, \$41, \$40.50, \$40, and stood at \$39.50 for three weeks. The two last weeks of April and the first half of May it was \$39, the last half of May \$38, and throughout June it fluctuated between \$36.50 and \$37.75. During all of July and the first week of August the price was stationary at \$38, advancing to \$39, \$39.50 and \$40 at the end of August. September marked a range from \$39.50 to \$41. In October it declined again, opening at \$40.50, dropping to \$39.50 and then to \$39. November opened at \$40, going up to \$41, \$43 and to \$45 at its close. The first week of December the high price was \$46.50, the next week \$47, and the third week \$46.50.

LEAD ORE PRICES DURING 1908

Lead ore brought \$45 per ton the first week of 1908, \$5 higher than the closing week of 1907. It advanced to \$47, and then to \$50, at which price it stood for three weeks, then to \$50.50, \$52 and \$52.50, closing February at \$52. During the first two weeks of March it was \$50 and the latter two weeks \$52 per ton. In April it was \$54 the first week and \$55 the rest

TABLE II. PRODUCTION OF THE JOPLIN DISTRICT BY COUNTIES AND STATES.

	ZINC ORE (Short Tons).				LEAD ORE (Short Tons).			
	1908.	1907.	Increase.	Decrease.	1908.	1907.	Increase.	Decrease.
Jasper county	172,784	196,732		23,948	27,843	32,057		4,214
Newton county	18,077	18,477		400	2,386	2,854		468
Lawrence county	8,565	13,119		4,554	204	337		133
Green county	19	193		174	59	260		201
Missouri	199,445	228,512		29,076	30,492	35,508		5,016
Kansas	26,429	38,388		11,959	3,352	3,455		103
Oklahoma	9,307	2,658	6,649		1,298	656	642	
District	235,181	269,558		34,377	35,142	39,619		4,477

NOTE.—The output of Kansas is from Cherokee county, and of Oklahoma from Ottawa county.

walls, and, as the ore is found in horizontal layers between beds of chert, it is both a blanket and a sheet occurrence. In some of the Spring City mines the ore occurs in layers, but as the deposits have well defined vertical side walls they are not true sheet deposits, though the ore occurring in a channel form has been followed across country for distances as great as half a mile. The ore west of Joplin, discovered by drill during 1907, indicates a wide extent to the mineralized area, but the ore does not form a sheet deposit, for although very little prospecting was done in that part of the district during 1908, enough work was done to indicate that there are no layers of ore. The deposit is a highly disseminated orebody, differing only from the disseminated lens deposits of Chitwood in being more regularly spread over a given area. Present developments point to this ore occurrence as a connecting link between the lens deposits, several of which are being mined in this new area, and the sheet deposits. These orebodies will probably be as expensive to mine as the thinnest sheets in the sheet-ore area.

the tonnage of lead shipped exceed the shipments during 1908, but in zinc tonnage the five previous years exceed 1908. The combined value of the lead- and zinc-ore production during the four preceding years is greater than that of 1908.

Table III gives the zinc and lead shipments for the last 15 years and also the combined value of both ores. It shows the rise of the Joplin district from hand-jig camps to a district rapidly adopting every method for increasing the output of the mines and every known method of making the mill extraction greater. The four years previous to 1898 illustrate the old hand-jig district. In 1898, owing to the swift rise in metal prices, the mining and milling methods began to be modernized. Since then the advancement in methods of mining, hoisting, milling and even in the marketing of the ore has been wonderful.

HIGH AND AVERAGE PRICES

Table IV, giving the high and average prices of zinc and of lead ore for the last 10 years shows the effect of the panic on ore prices. Zinc averaged \$9.32 per

of the month. In May the price advanced from \$55.50, to \$56, to \$57, to \$59, and finally to \$60.50, and in June it continued from \$61.50 to \$62.50, to \$64, to \$66. Then the decline in the price of pig lead began to decrease the lead-ore prices to \$62 and \$61, \$60 for two weeks, then up a little again, \$61, \$63.50 two weeks, back to \$61.50, and finally to \$60 at the end of August. September opened at \$59, declined first to \$58, and then to \$57, and closed at \$55.50. In October the price was \$54, \$55, \$54 and \$56. It went up again to \$58 for the first week and \$60 for the second week of November, dropping back to \$55 and \$54 at the close. In December the price dropped to \$53, then to \$51 and during the third week to \$50 per ton.

Zinc Mining in Wisconsin in 1908

By J. E. KENNEDY

Mining in the Wisconsin district experienced a year of depression, as did all other lines of industry, in the year 1908. Compared with the results attained in 1907 there were few new properties opened up. Many concentrators were idle at all periods, yet it is a significant fact that the ore production of 1908 was, nevertheless, the largest this district has ever made. The total shipment of zinc ore reported to Dec. 26 (57,472 tons), exceeded the smelter figure for the entire year of 1907 by 4461 tons. The production of lead ore, though insignificant in amount, increased 100 per cent.; the total shipment reported to Dec. 26 (5393 tons) exceeded the total of last year by 2786 tons. The shipment of pyrites up to Dec. 26 (2536 tons) exceeded the total of 1907 by 2305 tons.

PRICES OF ZINC ORE

At the very beginning of the year zinc-ore prices started upward from the low-water mark reached in December, 1907. By the end of January the base price for 60-per cent. zinc had advanced to \$40 per ton. Many companies which had shut down were induced to resume by this rally in prices, but before these were well under way again a reaction in the market set in, the downward trend continuing until June, when the base price had landed back to \$32 per ton. In spite of low prices for 60-per cent. zinc, shipments steadily increased. The Mineral Point Zinc Company re-entered the competitive field for low-grade ores in April; the Platteville Separating Company began buying about the same time and the Joplin Separator Works, at Galena, was also active. The increased competition for low-grade blende advanced the price heretofore paid for this ore. The market improved during July, August and Sep-

tember and the monthly average shipment during the last six months increased 60 per cent. over the first half of the year.

ZINC CONTENT

The metallic content of zinc shipped was considerably greater than in 1907. During the first three months of the year there was little or no demand for the lower grade ore. The Mineral Point Zinc Company was practically out of the open market from December, 1907, to April, 1908, and other buyers of low and intermediate grades were restricted to limited purchases during this time. Aside from an increased tonnage from roasting and magnetic separating plants, the electrostatic separator, at Platteville, has been turning out a product assaying between 55 and 60 per cent. metallic zinc.

PRODUCTION BY CAMPS

While there are 18 different camps and shipping points in the district, the bulk of the output has come from Platteville, Benton, Hazel Green, Highland, Cuba City, Linden, Rewey, Harker, Livingston, Galena and Mineral Point. It has been the older camps, and, with few exceptions, the older mines which have been producing the ore. Benton and Cuba City developed exceptionally rich bodies of sheet ground. The individual production of many mines was materially increased by better methods of operation; labor, moreover, was plentiful and more efficient.

NEW DEVELOPMENTS

An important point was the completion and successful development of the electrostatic separator at Platteville, by the American Zinc and Lead Smelting Company, operating locally as the Platteville Separating Company. Blende concentrate assaying between 20 and 50 per cent. metallic zinc is bought in the open market. The accompanying pyrite is separated from the blende and recovered as a by-product, assaying between 42 and 48 per cent. sulphur, for the manufacture of sulphuric acid. In the development of the process the original Huff machines were largely changed and improved upon. A constancy of current has been developed which assures a permanent success for the process. During the last three months the plant has been averaging 70 tons per day; its ultimate capacity will only be limited by the average amount of raw ore available.

Nineteen properties were equipped with concentrators during the year; eight of these plants were begun in 1907 and five were second-hand mills. Two new roasting and magnetic separating plants were built. Foundations were laid for a Sutton, Steele & Steele dry-process mill, at Platteville, but construction was deferred

until the spring of 1909. Twenty-five sinking plants were erected.

INVESTMENTS

Comparatively little capital was invested in new enterprises. Shares of stock in undeveloped properties were unsalable. The event of the year was the consolidation of the Empire, Acme, Royal and Mitchell Hollow properties, at Platteville, into the Wisconsin Zinc Company, subsidiary to the American Zinc and Lead Smelting Company. The Picher Lead Company purchased the D. D. C. mine, at Rewey, to furnish raw concentrates to the Joplin Separator Works at Galena, a roasting and magnetic separating plant. The Mineral Point Zinc Company bought additional mineral lands at Highland and Benton. A few other sales of minor importance were made.

PROSPECT FOR 1909

The average weekly output of zinc ore during 1908 was 1000 tons. During November and December the production had increased to 1500 tons weekly. With an open market for all grades of ore and the base price for 60-per cent. zinc ore above \$40 per ton, the mines already opened up will yield in 1909, 2000 tons weekly.

Tin

This metal is not produced in the United States, but we use 40 to 50 per cent. of the world's production, which is made chiefly by Malaya, the Dutch East Indies, and Bolivia. In 1907 the importation into the United States was 82,549,000 lb. In 1908 the statistics will probably show about 75,000,000 lb. The price suffered heavily. In June, 1907, the average was 42 $\frac{1}{4}$ c., New York. The average for the year was 38.16c. The average for 1908 was about 29 $\frac{1}{2}$ c. January, 1908, showed the lowest monthly average, viz.: 27 $\frac{1}{4}$ c. The failure of tin to make more of a recovery appears to be due to continued large production. At the beginning of the year the prognostications in Malaya were for an extensive suspension of mining. Many of the corporations did indeed suspend, but as in the case of zinc mining at Joplin, the miners went back to old diggings and made a new production by primitive methods.

TIN SUPPLIES, 12 MONTHS ENDED NOV. 30.

(IN TONS OF 2240 LB.)

	1907.	1908.
English production	4,700	4,400
Chinese exports	4,000	4,000
Straits to Europe and America	52,520	59,137
Straits to India and China	3,140	3,265
Australia to Europe and America	6,612	5,869
Australia, consumption	250	250
Banka and Billiton	13,493	13,765
Bolivia	15,500	16,250
Miscellaneous	250	250
Total	100,465	107,186

APPROXIMATE TIN DELIVERIES 12 MONTHS ENDED NOV. 30.
(IN TONS OF 2240 LB.)

	1907.	1908.
United States	35,000	31,700
Great Britain	24,150	29,400
Other Europe	28,840	28,050
China and India	3,140	3,265
Other countries	4,500	4,250
Total	95,630	96,665

The Tin Market at New York in 1908

In sympathy with all other metals, the consumption of tin in this country suffered considerably during 1908. For this reason, the statistical position became

pendent upon the course which the metal takes on the London exchange, with such exceptions as are brought about by a scarcity or a corner in spot material, when premiums to a larger or smaller extent are exacted.

The market at the beginning of the year showed a firm undertone, and prices were quoted at about 26½@27c. for spot delivery. Spot material remained scarce throughout January and a premium of ½@¾c. per lb. was paid for the same.

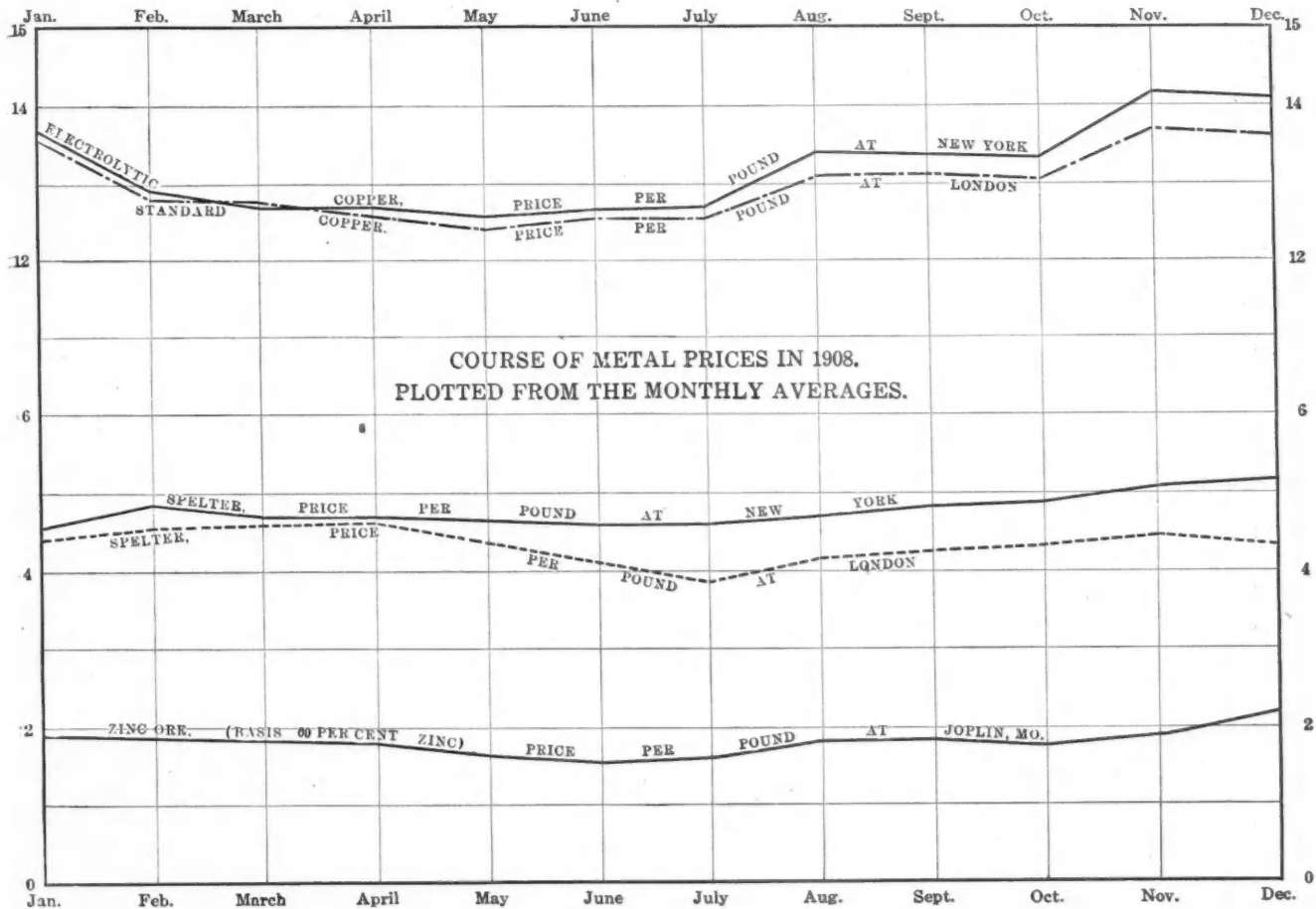
During the first half of February, under the lead of the London market, prices advanced to 29¼c., then declined to 28c., but rallied to 29c., and remained on about that level for the remainder of the month.

the end of May, spot tin was quoted at 28¾c. in this market.

In July the low point of the year was reached, and sales took place at 27¼c. The better feeling prevalent in the copper market toward the end of July and the beginning of August had a sympathetic effect on tin, and prices advanced to 31c. for spot material.

August and September witnessed again a gradual decline in prices brought about by an entire absence of interest among consumers. Quotations were 29½c. at the end of the latter month.

In October, tin remained fairly steady at around 29½c.; it advanced during the month of November to 30½c. per pound; but declined again in December, owing



more unfavorable from month to month, and at the end of the year visible supplies had increased to about 20,000 tons, as against about 13,000 tons in December, 1907.

The market for tin is influenced entirely by the operations of a few large concerns in London, and while 1908 did not witness the spectacular gyrations of 1907, it was nevertheless characterized by severe fluctuations up or down, accordingly as the bulls or bears had the upper hand. The domestic market is de-

The announcement by the Dutch Government at the beginning of March of a reduction in the sale of Banka tin during 1907 led to excited speculation in the London market, where prices advanced considerably. Quotations at that time were established at 30½c. in the domestic market. March showed still further advances, and at the beginning of April quotations were about 31¼c. Until the middle of May, prices remained on this level, when a bear attack in the London market brought about a severe decline. At

to its unfavorable statistical position which became public at the beginning of the month, to 29c., and closed at 29 cents.

TIN AT NEW YORK					
Month.	1907.	1908.	Month.	1907.	1908.
January ...	41.548	27.380	July	41.091	29.207
February ..	42.102	28.978	August	37.667	29.942
March	41.313	30.577	September ..	36.689	28.815
April	40.938	31.702	October	32.620	29.444
May	42.149	30.015	November	30.833	30.348
June	42.120	28.024	December	27.925	29.144
			Av. year..	38.160	29.465

Prices are in cents per pound.

The Iron and Steel Industry in 1908

A Year of Deep Depression and Small Demand with Only Gradual Recovery. An Attempt to Revise Law of Supply and Demand

PIG IRON 15,828,000 TONS

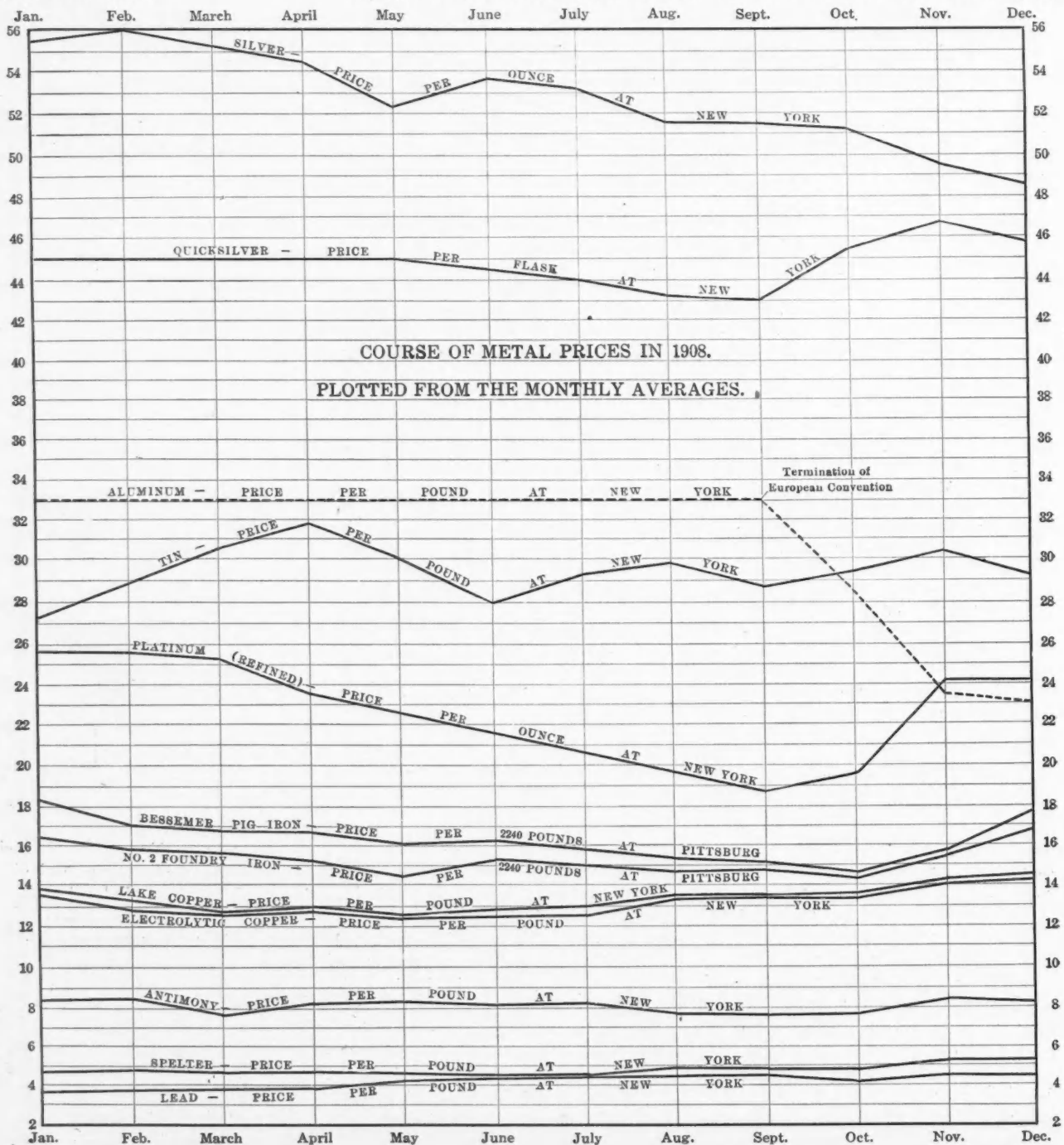
The record of the iron and steel industry in 1908 is one of general and extreme depression followed by a slow and gradual recovery which promises well for the future, but is not yet so fully established as to warrant us in saying that a new prosperity is yet in sight. Another year will be needed, in all probability, to restore conditions fully and place the industry on a solid basis.

Iron and Steel Production

By FREDERICK HOBART

The short and sharp curtailment of the closing months of 1907 put the productive capacity of the United States on a basis lower than had been seen for at least eight years. The conditions were different

from those of any previous period of depression. The dominating influence of the United States Steel Corporation had been exercised only in prosperous times, and it had now to face the reverses which had been brought about by a period of over-trading and too extended credits. The way in which this was done finds no precedent in former years. Through an adroit use of its influence in uniting with



it the larger independent producers the Steel Corporation succeeded in holding the trade to a policy of maintaining prices in the face of a lessened demand. This defiance of the law of supply and demand was maintained throughout the year, only some small reductions being made in a grudging way and at a time when they they were of the least effect. The result is apparent to those who study the operations of the year. Recovery, which has come slowly, might, it is believed by many, have been hastened by free concessions which would have encouraged the investment of capital in construction, by offering the advantages of cheaper material. It was in this way that recovery was started in former periods of depression with undoubted success.

A disturbing element came in during the latter part of the year in the form of the tariff-revision movement. To say nothing of the actual merits of the case, the conflicting testimony submitted at Washington confused the public mind. From present indications it is highly probable that reductions in duties will be made, and that iron and steel products will be picked out for such decreases. It is not probable that this will seriously injure producers or the trade; but the expectation of changes caused a halt for the time being.

The course of production in 1908, as compared with previous years, is shown below:

IRON ORE

The production and consumption of iron ore showed a very considerable decrease from the high level of 1907, as might have been expected. The cutting down of operations was sharp and sudden—more so, perhaps, than in any preceding period of depression, since a much larger proportion of the output is under a unified control than ever before. As in the previous year, Lake Superior ores furnished the raw material for 75 to 80 per cent. of the pig-iron production.

The estimated output of iron ore is as follows, in long tons, compared with the output of the preceding year:

	1907.	1908.	Changes.
Lake Superior...	42,245,070	25,927,000	D. 16,318,070
Southern states..	7,585,000	6,400,000	D. 1,185,000
Other states.....	3,125,000	1,875,000	D. 1,250,000
Total prod'n ...	52,955,070	34,202,000	D. 18,753,070
Add imports.....	1,229,168	675,000	D. 554,168
Total supply..	54,184,238	34,877,000	D. 19,307,238
Deduct exports..	278,298	310,000	I. 31,792
Balance.....	53,906,030	34,567,000	D. 19,339,030

In the imports and exports the month of December is estimated.

In this statement no account is taken of stocks on hand, for the reason that it is impossible to obtain any exact figures concerning them. The stocks on Lake Erie docks at the close of navigation in 1908

showed an increase of 1,055,000 tons over the preceding year; but a considerable part of this is under contract and awaiting transportation. Stocks in furnace yards are believed to be smaller than they were a year ago. In 1907, owing to the sudden stoppage of many furnaces, there was a large accumulation of ore at furnace stockyards; this year the piling up of stock has been at the Lake docks instead. The larger stocks there may be regarded as a provision made against a possible increase in furnace activity before the opening of navigation next spring.

	1907.	1908.
Ore on docks, May 1.....	1,976,988	5,480,300
Receipts for the season...	35,195,758	20,414,491
Total	37,172,746	25,894,791
Shipments to furnaces....	29,787,018	17,453,258
Stock on docks, Dec. 1.	7,385,728	8,441,533

The decrease in shipments to furnaces was 12,333,760 tons; and the increase in stocks on docks Dec. 1 was 1,055,805 tons. This is a sufficient reserve to provide for any probable contingency. The distribution of the stocks held Dec. 1 among the ports, and the receipts of those ports for two years were as follows:

PORTS.	RECEIPTS.		STOCKS.	
	1907.	1908.	1907.	[1908.
Toledo.....	1,314,140	680,553	518,645	590,925
Sandusky.....	83,043	.....	44,546	36,079
Huron.....	971,430	213,377	415,730	458,158
Lorain.....	2,621,025	2,286,388	366,271	426,274
Cleveland.....	6,495,998	4,240,816	1,281,335	1,458,392
Fairport.....	2,437,649	1,518,961	523,981	855,821
Ashtabula.....	7,521,859	3,012,064	2,056,820	2,293,531
Conneaut.....	5,875,937	4,798,631	1,090,774	1,296,675
Erie.....	2,294,239	828,602	652,219	730,530
Buffalo.....	5,580,438	2,835,099	435,407	315,148
Total	35,195,758	20,414,491	7,385,728	8,441,533

Allowing for the probable increase in stocks the consumption of ore per ton of pig iron made in 1908 was approximately 1.98 tons, or a little higher than in previous years.

Lake Superior Ores—The statistics of Lake Superior shipments are so closely kept that it is possible to give definite figures, especially as water shipments close early in December. The only estimate required this year is of the rail shipments, part of which are made during the winter. The shipments of Lake ore, by ports, were as follows, for two years past, in long tons; with the rail shipments added for 1907, and an estimate of them of 1908:

Port.	1907.	1908.
Escanaba.....	5,761,988	3,351,502
Marquette.....	3,013,826	1,487,487
Ashland.....	3,437,672	2,513,670
Superior.....	7,440,386	3,564,030
Duluth.....	13,445,977	8,808,168
Two Harbors.....	8,188,906	5,702,237
Total water	41,288,755	25,427,094
Rail.....	956,315	500,000
Total	42,245,070	25,927,094

The distribution by ranges in 1908 is not yet complete. Escanaba and Marquette are the shipping ports for the Marquette and the Menominee ranges; Ashland for the Gogebic. Two Harbors takes the ore from the Vermillion range and a part of the Mesabi; while the docks at Superior and Duluth are supplied entirely from the Mesabi range. The rail shipments come from all ranges; they go to Zenith furnace at Duluth, to the furnaces at Marquette, Gladstone, St. Ignace and other points in Michigan and Wisconsin.

The season shipments to furnaces from Lake Erie ports, to which about 80 per cent. of the Lake ore goes, and from which it is distributed, were as follows:

The 20 per cent. of Lake ore which does not find its way to Lake Erie ports, goes chiefly to Chicago and vicinity for the furnaces of the Illinois Steel Company and others, and lately for the great new furnaces of the Indiana Steel Company at Gary.

Other Ore Production—The production in the Southern States is the most important after that of the Lake Superior region. It is, as a rule, closely regulated by the activity of the furnaces. The control of the mines by the iron-making companies and the proximity of the mines to the furnaces makes it unnecessary to accumulate stocks, as is done with the Lake ores, which have to be carried from 500 to 1000 miles by water, over routes which are closed by ice for five months of the year.

In the East, New York, Pennsylvania and New Jersey are the larger producers, in the order given. In all of them there was a considerable reduction in output. The same condition prevailed in the widely scattered iron-ore regions of the West.

General Conditions—The depression of the year did not stop preparations for an increase in the production of iron ore. Extensive operations are being carried on in stripping and preparing for mining on the lands of the United States Steel Corporation on the Mesabi range in Minnesota. In the Southern field all the large companies have made arrangements to extend their mining operations, and to improve them by the use of new machinery and appliances. In New York several new mines have been opened and some old mines reopened. The universal anticipation seems to be for a greater demand for ore, which must be met.

A noticeable feature in all this new development work is the tendency to use lower grade ores. Even on the Lake ranges ores are taken into consideration which would formerly have been passed by. This is a significant feature.

The imports of iron ore during the year were chiefly from Cuba, and were used in the Maryland Steel Company's furnaces near Baltimore, and in others near the coast. The exports were chiefly to Canada.

Manganese Ore—The imports of manganese ores for the 11 months ended Nov. 30, the latest complete figures, were 188,526 long tons in 1907, and 170,662 tons in 1908; a decrease of 17,864 tons.

Limestone Flux—The production of limestone and dolomite for use as flux in iron blast furnaces in 1908 is estimated at 9,650,000 long tons, a reduction of more than 6,000,000 tons from the previous year. Dolomite is used chiefly at the Alabama furnaces, limestone being the usual flux elsewhere.

PIG IRON

The sharp contraction in pig-iron production which marked the close of 1907 continued well into 1908. There were, of course, many changes in the list of active furnaces, but only small increases in their aggregate capacity until well on toward the middle of the year. From that point an improvement began, which continued slowly but steadily, the second half of the year showing a substantial gain over the first.

For the first half of the year the American Iron and Steel Association has collected the full figures. Estimating the second half on the basis of the capacity of the active furnaces, we have the following production for the year. The comparative figures for 1907 are, of course, the corrected returns. The figures are in long tons:

	1907.	1908.	Changes.
First half . . .	13,478,044	6,918,004	D. 6,560,040
Second half . .	12,303,317	8,910,000	D. 3,393,317
Total	25,781,361	15,828,004	D. 9,953,357

The decrease in 1908 was, therefore, 38.6 per cent., the greatest proportional loss ever shown in one year.

Assuming that the division of the iron, according to the uses for which it was intended, was approximately the same in the second half of the year as in the first half, for which we have official figures, we find that the production of 1908 compares with that of the preceding year as follows, the figures being in long tons:

	1907.	1908.
Foundry and forge iron . .	6,397,777	4,203,000
Bessemer pig	13,231,620	7,754,000
Basic pig	5,375,219	3,380,000
Charcoal iron	437,397	299,000
Spiegel and ferro	339,348	192,000
Total	25,781,361	15,828,000

It is probable that this apportionment is not quite correct, as the increase in the second half of the year was somewhat greater in the steel-making irons—especi-

ally in basic pig—than in foundry and forge iron.

On June 30, the middle of the year, there were 168 furnaces in blast. On Dec. 1 the number had increased to 220, and was about 225 on Dec. 31. On June 30 there were 24 new furnaces under construction and 17 were being rebuilt. Only a few of the new furnaces were completed at the end of the year, but these included the first group of the great new furnaces at Gary.

The consumption of pig iron in the United States in 1908 was, approximately, as follows:

Production	15,828,000
Imports	89,000
Total supply	15,917,000
Exports	46,000
Approximate consumption	15,871,000

This shows an average yearly consumption of 406 lb. per capita. The imports and exports were both light.

The pig-iron production for 10 years has been as follows:

1899	13,620,700	1904	16,497,083
1900	13,789,242	1905	22,992,380
1901	15,878,354	1906	25,307,391
1902	17,821,307	1907	25,975,944
1903	18,009,259	1908	15,828,000

The production of 1908 was the smallest for eight years; it was rather less than half of our actual capacity for making iron.

STEEL PRODUCTION

No figures are available as to the production of steel for any part of the year, and only approximations can be made, based on the production of pig iron. It is estimated that the output of bessemer steel in 1909 was about 7,200,000 tons; of basic steel 7,100,000 tons; and of other steels 50,000; making a total of 14,350,000 tons, or a decrease of about 9,010,000 tons from the previous year.

No figures are available for the output of finished material, but the reduction was undoubtedly on parallel lines with the falling off in iron and steel. The greatest decrease was in rails and track material; the least in structural iron and steel.

CHANGES AND CONSOLIDATIONS

No important changes are recorded during the year, and nothing so important as the transfer of the Tennessee Coal, Iron and Railroad Company in 1907 occurred. There was some exchange of properties among the subsidiaries of the Steel Corporation, but these did not change the general management. In December there was an important transfer of stocks of the Colorado Steel and Iron Company, which indicated that the Gould interests had parted with their control of that company. The new interest in the company is reputed to be either the United States Steel Corporation, or parties closely allied with it. These reports have not been confirmed, but are considered probable. Under present conditions it is not

likely that the Steel Corporation would openly assume possession of this important Western concern. Its management on a friendly basis would, however, be a valuable asset.

METALLURGICAL PROGRESS

Metallurgical changes during the year have been comparatively few. The great Gary plant of the Steel Corporation has begun work, two of its blast furnaces having been started in December. The most important feature of this plant is the use of blast-furnace gases for the production of power on a scale much larger than has heretofore been attempted. Progress was made in the use of the Gayley dry-air blast, and an extended course of experiments proved that its advantages when applied to the bessemer converter were quite as great as with the blast furnace.

IMPORTS AND EXPORTS

The values of the imports and exports of iron and steel, including machinery, in the United States for the 11 months ended Nov. 30 are reported as follows:

	1907.	1908.	Changes.
Exports	\$182,068,912	\$138,881,661	D. \$43,187,251
Imports	36,740,291	18,247,668	D. 18,492,623

The decreases were 23.7 per cent. in exports, and 50.3 per cent. in imports. The decrease in exports was in almost all branches, the structural steel and wire trades best maintaining their sales abroad. In imports the greatest decrease was in pig iron and in billets and other half-finished material, considerable quantities of which were brought in during the previous year under the stress of active demand.

At different times in the past we have heard a great deal of the possibilities of foreign trade in iron and steel products. This trade was to act as a balance wheel, maintaining production at an even level when the home demand was slack. Much was said of organizations promoted by the larger steel companies for the purpose of handling and extending sales abroad. In the present period of depression, however, these agencies did not work, apparently, as shown by the figures given above, exports having decreased to as great an extent as the home production.

The fact is that, in all the talk about foreign trade, no account was taken of the fact that under modern conditions a trade depression is not confined to one important country. It extends to others in greater or less degree, even spreading through the entire commercial world. When we have a large surplus to sell abroad, the demand there has fallen off, almost on parallel lines to our own. Other countries may be willing to buy our products at a low rate, but the purchasing and consuming capacity has been reduced. The balance-wheel theory failed entirely,

when it came to be tested, because there was little foreign demand to operate it, and low prices offered could not start the wheel.

In Great Britain, the chief exporting country, the foreign trade showed nearly the same course. The exports of iron and steel for the 11 months ended with November were 11 per cent. less in quantity this year than in 1907. While the decrease in domestic demand has been less marked than in the United States, foreign sales have shown even a greater decrease. Evidently the world was not a free buyer in 1908.

Germany alone among the important iron-making nations had a small increase—7 per cent.—in its exports. This was gained at the expense of producers by the large syndicates, which have sold abroad at such sacrifices that there have been strong remonstrances from a number of the constituent companies. Moreover, the gain in exports was chiefly in pig iron and in half-finished products. British, Belgian and French iron-masters took advantage of the syndicate policy to put in stocks of pig iron and steel billets at prices lower than their own cost of production. These crude products are finished in their own mills. Whether such sales of material are advantageous to German makers in an open question.

We do not decry the value of foreign trade, which may be a valuable asset of manufacturers when well established. It cannot, however, be established on short notice, nor can it be relied on any more than home trade in times of depression. And it may—as in the case of Germany—be acquired at a cost beyond its value.

FOREIGN COUNTRIES

European countries report a depression in the iron and steel trades parallel to our own, though not quite as great in amount. The British statements are unusually incomplete this year, but such as are available indicate a decrease of from 10 to 15 per cent. in iron and steel production. Exports for the year decreased considerably, as above noted.

In Germany pig-iron production for 11 months decreased nearly 10 per cent. and the market is reported extremely weak under the pressure of large unsold stocks. In part the overproduction thus indicated is said to be the result of the extended use of blast-furnace gases for power. Many furnaces have been kept in blast because the power was needed for other parts of the works, thus indicating one of the drawbacks of the system. The Steel Syndicate maintains its position so far, but the two important pig-iron syndicates have gone to pieces, with disastrous results to prices.

In other European countries production has declined, and everywhere the markets are in weak condition. As the European depression followed our own, so the recovery seems to be slower in coming.

The Iron and Steel Markets

The markets for iron and steel at the beginning of the year were in the condition of deep depression. The shock of the financial depression which began in October, 1907, was still too recent for recovery to begin, and it was not for some months that the trade was on its feet, so to speak; and not until nearly the end of the year was there a pronounced tendency to better conditions. Even at the present time recovery is progressing slowly. There is confidence in the future, as is shown by the preparations being made in many quarters to increase production; but this confidence has not yet reached the point of inducing active trade.

The most prominent feature of the year was the control over prices exercised by the large producers through the influence of the supervising committees instituted in December, 1907. These committees were active throughout the year, and their work was effective for the most part. The dominating influence was, of course, that of the Steel Corporation. The motives of this policy and its wisdom—or otherwise—are discussed elsewhere, and it is necessary here only to discuss its immediate effects.

The only really open markets for the greater part of the year were those for pig iron, for iron bars and for a few minor products. Pig iron was badly demoralized for a considerable part of the year, and its recovery was gradual and irregular. The business was limited, notwithstanding low prices; but this was due to the fact that so large a proportion of the pig iron made enters into the production of steel, the quotations for which were not materially lowered. Bar iron was an open market, owing to the large independent interests in that branch, and the lowering of prices on that product did stimulate orders and force a reduction in the quotation for steel bars to meet the competition.

The only changes in price made were some small ones in January, and a general "readjustment" in June, which involved reductions of 10 to 15 per cent. in the leading articles of finished steel. These did not have the effect of stimulating trade in any marked degree; and thereafter no material changes were made. It was pointed out by many consumers that there was a wider spread between quotations of pig iron and finished material than had often existed; but these representations had no effect.

The railroads were light customers throughout the year, and their purchases of rails were lighter than for a number of years. In part this was the result of inability to purchase, owing to decreased earnings and difficulties in finance; in part of the still unsettled dispute over specifications; and in part over the question of price. Toward the end of the year some good orders were placed for

locomotives and other equipment, mainly for steel cars. Some good orders for bridge work also came forward. The rail question, however, is still far from a real settlement; and the rail mills enter 1909 with a lighter business on their books than has been the case for several years. In light rails for mining and industrial purposes, on which the price restrictions were removed, owing to the competition of the rerolling mills, there was a good business.

Recently the tariff discussion has had an effect on the markets, chiefly because it has strengthened the tendency to wait developments, and to defer contracting for future requirements until a more settled condition is reached. This question has also been considered elsewhere.

Details of the markets will be found in the following letters, which cover Pittsburg and Birmingham, the chief primary markets; Chicago, the leading distributing point for the Northwest; and the seaboard markets.

The Alabama Iron Market

By L. W. FRIEDMAN

Despite the general depression, which struck Alabama hard, continuing through the better part of the year 1908, the aggregate make of pig iron is only 300,000 tons less than in 1907. The depression came on the latter part of 1907, cutting the production down during the last three months to a considerable degree, but the total production for that year showed an increase over the previous year of about 11,822 tons.

The production of pig iron in Alabama for the year reaches a total of 1,405,000 tons, the last month's output a day or two behind official figures. When it is considered that the high-water mark by the month was not reached until November, 1,412,000 tons, with the first month of the year starting off with 86,000 tons, improving in February and March and then falling back in April to 94,800 tons, thence taking on improvement month by month, the total production can be looked upon with much satisfaction.

The number of furnaces in operation in Alabama varied. There was a good sized accumulation of iron through the first part of the year, but the production was held down and no effort was made to work to full capacity and that condition has not been reached as yet, though the recent depression appears to be a thing of the past.

Alabama iron producers suffered not alone from the general depression, which other districts also experienced, but also from a hard fight with union labor, the United Mine Workers of America in the district declaring a strike. This proved a battle to the finish and in its course there was a considerable falling off in coal and

coke production, causing the iron-masters to make contracts for this supply in other districts, all of which affected the iron production. While by all indications the iron make was maintained during the strike, it was with much difficulty and expense.

The quotations for pig iron in Alabama during the year 1908 ranged between \$11 and \$13 per ton, on No. 2 foundry basis. Recently the \$13 rate became a fixture. On this score there is but little said. Some large-sized sales of iron were consummated during the low-price period, but care was taken by the producers in this section that this business should not interfere with general trade when the conditions improved. One instance is reported where a large bulk of iron was sold during the quiet period, but the stipulation was that the product would be held in yards at furnaces subject to delivery, but there was to be no delivery while the prices were down. When the iron went up, the speculation proved a good one and at the same time did not interfere with the general market.

Alabama witnessed considerable improvements in blast-iron furnaces during the year. But one concern fell by the wayside, the Southern Steel Company, while some of the progressive companies made deals whereby they took in other properties. The Birmingham Coal and Iron Company acquired the properties of the Tecumseh Iron Company (an ore-mining company), and completed and put in blast its new furnace at Vanderbilt, near Birmingham. The Tennessee Coal, Iron and Railroad Company made extensive improvements about blast furnaces and started work on big improvements in the steel plant. The Woodstock Iron Company put in shape one iron-maker and repaired another, besides putting in operation mining and other properties. The Sloss-Sheffield Steel and Iron Company practically rebuilt one furnace and has a force of men improving another. Other concerns made improvements despite the depression.

The raw-material supplies were given some attention and since the general quiet has been passing off the improvements have been worked on with vigor, so that the new year has started in with great expectations.

The depression, the placing of improvements and other reasons, affected the steel production in Alabama. The big plant of the Tennessee Coal, Iron and Railroad Company at Ensley was the only institution of the kind in the State that worked through the year. With the exception of the last week in the year there was no interruption in this industry. The plant produced more than 38,000 tons of blooms in one month, and made 32,424 tons of rail. The average was kept up pretty well toward the latter part of the year. The aggregate production will show a falling off, as there was a cessation of operation

at the big plant for some time. There was but little accumulation at the steel plant and to meet any kind of a demand it will be necessary to have a steady run.

The Chicago Iron Market

By E. MORRISON

Except for two or three large transactions made at low points in the market, the history of the pig-iron market in Chicago for the year 1908 is a record of small buying for needs not more than three months away. The year began in depression. Prices fell gradually as it became apparent that no general revival of business was at hand. Sales of carload lots to 200 or 300 tons became the rule, and May saw iron decline from \$18@18.25, the January price for Northern No. 2, to \$17@17.50. Southern from \$13@13.50 Birmingham (\$17.35@17.85 Chicago), in January had dropped to \$12 Birmingham, in the open local market. One large sale of about 50,000 tons was made in February at \$11 Birmingham, and this transaction weakened the market greatly, the average melter concluding from it that general reduction in prices would follow.

The Spring depression lasted into June, when another sale of nearly as much tonnage was made of Southern at \$11. There was a wave of buying for a brief time, and the market strengthened slightly. Southern was prevented from sagging below \$11.50 in the open market and continued to rise slowly until December, when it brought \$13@13.50 (\$17.35@17.85 Chicago). Northern continued depressed, and in September, October and November sold at \$16.50@17, or for less than Southern. This exception to the ordinary relations of the two kinds was largely due to the selling of considerable iron from Ohio furnaces throughout the months named at \$16.50@17, meeting the needs of users of Northern to the disadvantage of local furnaces.

The high and low points in the market for 1908, compared with the high and low points of the preceding year, are shown in the accompanying table.

	1907.		1908.	
	High-est.	Low-est.	High-est.	Low-est.
Lake Superior charcoal.....	\$28.00	\$25.00	\$24.00	\$19.50
Northern No. 2 foundry.....	27.00	19.00	18.50	16.50
Southern No. 2 foundry.....	27.35	19.35	17.85	15.35
Bar iron.....	1.865c	1.75c	1.65c	1.50c
*Structural material.....	1.88c	1.865c	1.78c	1.88c

* Beams and channels, 3 in. to 15 in., and angles 3 in. to 6 in. by ¼ in. or heavier.

It was the hope of many in the iron business that the national election in November would bring a decided change

in the condition of the market. Immediately preceding the election the market was very weak, but there was no decided change from the election or from any perceptible cause. Very slowly the trend upward became perceptible, however. The last half of the month of December saw a lull in business nearly always experienced in that month, but peculiarly disappointing because of the hopes raised by the gradual strengthening previously of the market.

There was little buying for more than three months ahead of needs at any time during the year and contract-making became restricted to the needs for the current year just before the election. The expansion into more general buying for the future in the last two months of the year rather than any increase in the immediate needs of buyers accounted for the general betterment of the market.

For iron and steel products the market was in general quiet, despite reductions in June from 1.65 to 1.50c. on iron bars and from 1.88 to 1.78c. on structural material. In summer the Western railroads began buying on a large scale in comparison with their purchases in the first half of the year, and they continued to make purchases throughout the last six months. Building projects became important, and the end of the year saw a large tonnage needed for bridge and building operations in sight.

The Pittsburg Iron and Steel Markets

By S. F. LUTY.

Although the depression in the iron and steel trade which began in the last quarter of 1907 continued through 1908 the year was not as bad as the outlook at the opening indicated. This was due to coöperation on the part of the large producing interests. Meetings were held at intervals at which reports on conditions were received and plans for future action decided upon.

The strong position taken by the United States Steel Corporation at the outset in the matter of prices had a great deal to do with preventing a demoralization of the markets. When readjustments were made conditions only were considered, and at no time was the price of a commodity reduced for the purpose of enticing buyers into the market. Chairman E. H. Gary of the Steel Corporation contended that the cutting of prices in a dull period would not induce buying but instead would seriously disturb the situation.

Mill operations in January were unsatisfactory except in the tinplate and wire branches. At the opening of the month the American Sheet and Tin Plate Company had but 52 tin mills on the active list but before the close 154 mills were going. The American Steel and Wire

Company operated its plants at an average of around 70 per cent. throughout the year, starting at over 60 per cent. and closing the year with nearly 90 per cent. of its capacity active. Since the latter part of the first quarter all the large concerns report a gradual increase in production, each month being a trifle better than the previous one.

New business during the year was chiefly for small tonnages, showing that consumers bought only for immediate requirements. Agricultural - implement makers who had placed contracts for the year ending June 30 took all the material ordered and were buyers of large tonnages through the year. The farmers had a profitable season and did not hesitate to place orders for new implements. They were also heavy buyers of fence wire.

Rail buying was disappointing. The tonnage placed all year did not amount

ark, N. J., to Jamaica, L. I., which will amount to \$5,000,000. The Duluth & Iron Range Railroad, a Steel Corporation interest, in December ordered 800 ore cars which are being built by the Standard Steel Car Company, Pittsburg, at its Hammond works. They are of the Summers type and are for delivery in March and April. The 6400 wheels will be furnished by the Carnegie Steel Company which bought the Schoen Steel Wheel Company's works at McKees Rocks, Pittsburg, in July.

The Newburg & South Shore Railroad of the American Steel and Wire Company late in November placed an order with the Pressed Steel Car Company, Pittsburg, for 275 steel cars and the Birmingham Southern Railroad of the Tennessee Coal, Iron and Railroad Company, bought 160 steel cars. The Pittsburg & Lake Erie Railroad placed orders for 2000 cars, 1500 with the American Car and Foundry

company's contract with the Carnegie Steel Company for billets expired on June 30.

The year opened with a weak pig-iron market and most of the merchant furnaces in the Valleys were closed on account of dull conditions. The highest price of the year was in January and the lowest in October. As soon as the result of the national election was known producers advanced prices \$1 and more a ton, and thereby checked what looked like a good buying movement. This did not deter producers from maintaining firm prices the rest of the year.

Average prices for all sales by months are shown in the accompanying table. The official average of bessemer iron in which only sales of 1000 tons or more are considered was as follows, Pittsburg delivery: January, \$19; February, \$17.90; March, \$17.86; April, \$17.49; May, \$16.92½; June, \$16.90; July, \$16.73; August, \$16.11; September, \$15.90; October, \$15.48; November, \$16.74; December, \$17.40.

The production of pig iron at furnaces in the Pittsburg district and the Valleys for the year has not been compiled.

Merchant furnace interests demanded a reduction in ore prices but at two meetings of ore producers, one on Jan. 29 and the other on Feb. 6 the appeal was ignored and old prices reaffirmed. The lake ore shipping season did not open until June 1 and a week later producers cut the price 50c. a ton, the season's new prices being as follows: Mesabi non-bessemer, \$3.50; Old Range non-bessemer, \$3.70; Mesabi bessemer, \$4.25; Old Range bessemer, \$4.50. These prices were guaranteed until May 1, 1909. The lake ore shipments for the short season of 1908 amounted to 25,430,544 tons.

When the Pittsburg Steel Company started four of its new open-hearth furnaces in July it bought 8000 tons of basic iron from the Midland furnace at a low price. Other small lots were purchased until Oct. 19 when it entered into a five-year contract with the Penn Iron and Coal Company, operating a furnace at Canal Dover, O., for 6000 tons a month, or a total of 360,000 tons. The price was on a sliding basis. The Standard Sanitary Manufacturing Company and the Westinghouse interests were large purchasers of pig-iron during the year.

The foundry pig-iron producers held several meetings early in the year for the purpose of devising means for preventing a decline in prices but all were unsuccessful. It was found to be impossible to maintain prices and late in April the pig-iron market was thrown wide open.

While the movement of the United States Steel Corporation and other large steel interests for the maintenance of prices was not an entire success it had the effect of preventing general demoralization.

The first readjustment of prices oc-

to much more than 1,500,000 tons against about 3,600,000 tons in 1907 and almost 4,000,000 tons in 1906. Difference with the railmakers over specifications and also a lack of funds are assigned as reasons for failure to buy more liberally. Early in the year the Pennsylvania Railroad reserved 147,000 tons and on Feb. 6 announced that it had placed 55,000 tons. The railmakers, however, rejected this order on account of the specifications. This road got through the year with less than 10,000 tons of rails which were purchased from the Cambria Steel Company and used for experimental purposes. In December this road entered the market with an order for 135,000 tons for 1909 delivery. Other lines placed orders for smaller tonnages. The large systems are figuring on their requirements and are expected to enter orders early in 1909.

Late in the year railroads were large buyers of track material and bridge work, also rolling stock and other equipment. In November the Pennsylvania Railroad placed an order with the Westinghouse Electric and Manufacturing Company for the electrification of its system from New-

Company and 500 with the Standard Steel Car Company.

Structural steel contracts were confined to small tonnages chiefly, but there were a number of from 2000 to 3000 tons. The largest called for 13,500 tons for the Beaver bridge of the Pittsburg & Lake Erie Railroad and 12,000 for the new Oliver building in Pittsburg.

Work on the steel plant and blast furnaces being built at Aliquippa, a few miles below Pittsburg, on the Ohio river, by the Jones & Laughlin Steel Company which was stopped when the depression began late in 1907 was not resumed, but likely will be early in the new year. The new open-hearth steel department at the Ohio works, Youngstown, of the Carnegie Steel Company, was finished early in the year and put in operation. The Youngstown Sheet and Tube Company's two new blast furnaces were completed and put in blast in November. The Pittsburg Steel Company, the large independent wire interest, completed eight open-hearth furnaces at its plant at Monessen, about 40 miles from Pittsburg, in June and four were started in the following month. This

AVERAGE PRICES AT PITTSBURG, 1908.

Month.	PIG IRON.				STEEL.					NAILS.	
	Bessemer.	No. 2 Foundry.	Gray Forge.	Ferro-Mang.	Bessemer Billets.	Rails.	Black Sheets No. 28.	Tank Plate.	Steel Bars.	Wire Per Keg.	Cut Per Keg.
	\$	\$	\$	\$	\$	\$	c.	c.	c.	\$	\$
January.....	19.15	17.90	16.90	49.00	28.00	28.00	2.50	1.70	1.60	2.05	2.00
February.....	18.15	16.90	15.90	47.00	28.00	28.00	2.50	1.70	1.60	2.05	2.00
March.....	18.15	16.90	15.90	46.00	28.00	28.00	2.50	1.70	1.60	2.05	1.90
April.....	17.65	16.40	15.40	45.00	28.00	28.00	2.50	1.70	1.60	2.05	1.90
May.....	17.15	15.90	14.90	46.00	28.00	28.00	2.50	1.70	1.60	2.05	1.85
June.....	17.15	15.90	14.90	46.50	25.00	28.00	2.50	1.60	1.40	1.95	1.75
July.....	16.90	15.90	14.90	46.50	25.00	28.00	2.50	1.60	1.40	1.95	1.75
August.....	16.25	15.65	14.65	46.00	25.00	28.00	2.50	1.60	1.40	1.95	1.80
September.....	16.00	15.40	14.40	45.50	25.00	28.00	2.50	1.60	1.40	1.95	1.80
October.....	15.65	15.40	14.40	46.00	25.00	28.00	2.50	1.60	1.40	1.95	1.75
November.....	16.90	16.40	15.40	46.50	25.00	28.00	2.50	1.60	1.40	1.95	1.75
December.....	17.65	16.65	15.65	46.50	25.00	28.00	2.50	1.60	1.40	1.95	1.75
Year.....	17.23	16.28	15.28	46.38	26.25	28.00	2.50	1.64	1.48	1.99	1.83

curred on Jan. 6 when tinplate was cut from \$3.90 to \$3.70 a box; black sheets, \$2 a ton from 2.60c. to 2.50c. for No. 28 gage; galvanized sheets, \$4 a ton, from 3.75c. to 3.55c. for 28 gage; blue annealed sheets, 5c. per 100 lb., making new prices as follows: Nos. 10 and heavier, \$1.80; Nos. 11 and 12, \$1.85; Nos. 13 and 14, \$1.90; painted corrugated roofing 10c. a square, from \$1.85 to \$1.75; galvanized corrugated roofing, 15c. a square, from \$3.25 to \$3.10. It was explained that these cuts were not made to induce buying, but were on account of the reduced cost of raw material.

A meeting of the principal bar-iron producers was held in Pittsburg on Jan. 7 at which prices for Pittsburg and Eastern shipment were reduced \$1 a ton to 1.55c. Pittsburg, and for Western shipment \$4 a ton to 1.40c. Pittsburg.

A practical reduction in the price of billets was made in March when the mills agreed to divide the freight of finishing mills located outside of Pittsburg when the rate was from \$1 to \$3 a ton.

At a meeting of steel interests held in New York on June 9 a readjustment of prices was decided upon. Billets were cut \$3 a ton, from \$28 to \$25; sheet-bars and tinplate-bars, \$2 a ton, from \$29.50 to \$27.50; structural material, a general cut of \$2 a ton; shapes, from 1.70 to 1.60c.; plates, \$2 a ton, from 1.70 to 1.60c.; wire products, 10c. per 100 lb.; wire nails, 10c. a keg, from \$2.05 to \$1.95; merchant-steel pipe, two points, or \$4 a ton. Later wrought-iron pipe prices were reduced one point, or \$2 a ton, by manufacturers who did not attend the steel meeting.

On June 1 the price of steel bars was cut \$4 a ton, from 1.60c. which had been the price for two years, to 1.40c. On June 11 bar-iron prices were reduced to 1.40c. Pittsburg, and to 1.35c. for Western shipment.

The season's cotton-tie price was fixed in April at 85c. a bundle, the rate that ruled in 1905 and 1906, and a cut of 10c. a bundle from the 1907 price. Over 2,000,000 bundles, or 40,000 tons, were bought soon after the price was arranged.

On Jan. 22 the price of light rails was reduced \$2 a ton but the new price was immediately shaded. Re-rolling mills cut the price of the large producers from \$2 to \$3 a ton all year.

The established prices on finished material were not strictly adhered to at all times. In the summer plates were cut about \$2 a ton. Sheets also were shaded in some extremely dull periods and in September and October tinplate was shaded from 5 to 10c. a box. In the last two months of the year prices in all lines were firmly held.

WAGE ADJUSTMENTS

Although dull conditions prevailed throughout the year there were no particularly severe wage reductions. Outside of the mills governed by the annual wage

scale of the Amalgamated Association of Iron, Steel and Tin Workers there was no concerted action in the matter of wages. In a few foundries and machine shops wages were readjusted and the reductions were accepted by the workmen without protest.

A largely attended meeting of merchant blast-furnace interests was held at Youngstown on Jan. 21 for the purpose of considering the advisability of reducing the wages of blast-furnace workers 20 per cent. After a thorough discussion it was decided to make no change as a cut might result in a further depression in pig-iron prices.

Bimonthly adjustments under the Amalgamated Association scale were as follows:

January—Bar iron average, 1.55c., a decline of 0.05c. compared with previous settlement, puddlers receiving \$6.37½ a ton, a cut of 12½c. Sheets, average \$2.40 same as previous settlement, workers continued to receive 2.6 per cent. above base. Tinplate, average, \$3.70 a box and workers continued to receive 6 per cent. above the base.

March—Bar iron average, 1.45c., puddlers receive \$6.12½, a cut of 25c. a ton. Sheets, average 2.30c., the base, and workers' pay 2.6 per cent. Tinplate, average \$3.50 a box, and workers cut 4 per cent.

May—Bar iron average, 1.45c. No change, puddlers pay continuing at \$6.12½ a ton. Sheets, average 2.30c. No change. Tinplate average, \$3.40 a box, the base, and workers' pay cut 2 per cent.

July—Under new scale. Bar iron average, 1.35c. and puddlers' pay \$5.37½ a ton, a cut of 75c. a ton. Sheets, at new base, a cut of about 2 per cent. Tinplate, at new base, a cut of about 5 per cent.

September—Bar iron average, 1.30c. and puddlers' pay cut to \$5.25 a ton. Sheets and tinplate no change.

November—No change in the three branches.

The annual convention of the Amalgamated Association opened in Youngstown on May 5 and continued in session for two weeks. No changes were made in the wage scales. A conference was held at Cambridge Springs, Penn., June 1 with the Western Bar Iron Association. A stiff reduction was demanded, but workers refused and conference adjourned without a date. Amalgamated committee met officers of the Republic Iron and Steel Company on June 22 and could not agree on new scale. A conference was held on June 29 with the American Sheet and Tin Plate Company. The result was a complete readjustment of the advantageous scales enjoyed by the workers during the year. The base of the tinplate scale was advanced from \$3.40 to \$3.90 a box precluding any increase under the sliding arrangement, and the general scale was cut about 5 per cent. besides. In sheets the base was raised from 2.30 to 2.50c., and

the general scale was reduced about 2 per cent.

The American company held a conference with representatives of the Tin Workers' International Protective Association and renewed the tin house scale for another year.

At a second conference with the Western Bar Iron Association held in Detroit on July 7 a settlement of the iron scale was reached. The new scale provided for reductions of 8 per cent. in the puddling branch and from 5 to 11 per cent. in the finishing departments. The Republic Iron and Steel Company accepted this scale later in the month when it was ready to start its idle union mills.

The Seaboard Iron Markets

The course of the trade on the seaboard and in Eastern territory is determined chiefly in New York and Philadelphia. New York is the distributing point for the State and New England, but Philadelphia is nearer the primary markets, and is directly connected with a large producing section in eastern Pennsylvania. The seaboard markets for the year followed the general course of the trade rather closely, and the variations were rather less than is usual in a year of depression.

The pig-iron market, which was practically the only open one, showed the greatest variations, as a consequence. For the greater part of the year foundrymen in Eastern territory bought on the hand-to-mouth plan, taking from time to time only such small lots as served their immediate needs. For these orders there was sharp competition among such furnaces as were kept in blast. It was a time when it was almost impossible to follow prices; cuts of 25 and 50c. were made from the nominal quotations, and these were kept quiet as far as possible. For several months there was considerable accumulation of unsold pig iron, and a natural disposition to try and work this off at almost any price was observed. About September a gradual stiffening began. The cast-iron pipe makers were taking a good deal of iron, and other foundries were increasing their requirements. Moreover, there was some rather active inquiry for basic pig, indicating some revival of business among Eastern steel makers. In October this business quieted down and the markets were dull until near the middle of November. Another revival set in, and by the beginning of December unsold iron accumulations were pretty well worked off. It was noticeable, however, that consumers continued the policy of buying for short deliveries only, and there was much reluctance about placing contracts for 1909. Very little business was done beyond the first quarter.

Through all the period of dullness Southern iron had the call in seaboard territory. Sales were larger, and the Southern furnaces kept in more active

operation than the Northern stacks during the entire year. At the close of the year the market shows more activity and greater firmness, the prices of \$13@13.50 Birmingham for Southern No. 2 foundry, and about \$17 seaboard for Northern No. 2 being fairly well established.

In finished material—with the exception of structural steel—the markets were dull throughout the year. Early in the year there was an expectation of lower prices, but these did not come, except in a very limited degree, and there was little change in the volume of business. As with pig iron, buyers took only what they required from time to time, and would not contract far ahead, except upon terms which sellers were unable to grant under the close restriction and supervision from which the markets suffered. Some revival set in in November, and there was some placing of contracts for the first quarter of 1909, but little beyond that time. There was also at this time an increase in demand for nails and other supplies used in small building, indicating a more hopeful condition as to that class of construction.

The structural market in the East showed some exceptions to the general rules. Owing to the withdrawal of money from the speculative markets, there was a large supply ready to invest in building projects, if conditions as to price should prove to be favorable. It was well understood that the Steel Corporation dominated the price situation, and its action was closely watched. The small and grudging reductions in structural prices made in June were a sharp disappointment. They were not enough to stimulate trade, but sufficient to induce hopes of further reductions. The immediate effect was to reduce the business that was ready to be offered.

A little later, however, structural trade began to revive, and more orders were placed. As the year went on the conditions improved, though nominally no further reductions in prices were made. The structural business in the larger cities of the East is done mainly with the large fabricating companies, which contract for the whole iron work of a building. Orders to the mills are sent by those companies. They began gradually to take orders and contracts for finished buildings at prices which, when closely analyzed, indicated a lower price for the steel than the nominal quotations. Though no acknowledgement of such reductions was made, there is no doubt that structural steel was supplied by many mills at cut prices. The exact extent of these cuts has been a secret guarded with unusual care, and it is impossible to give facts or figures. At any rate business improved, and during the later months of the year building and bridge contracts of large aggregate quantity were placed.

One feature of the year in the East was that there were not many failures or collapses in the trade, considering the gen-

eral depression of the year. Labor conditions were fairly satisfactory. The close of the year was quiet and opinions as to the outlook for the new year differ widely.

Mine Accidents and the Geological Survey

Under the terms of its appropriation of \$150,000 for the investigation of mine disasters, the Geological Survey has determined to establish rescue stations at or near the centers of mine accidents for the purpose of teaching miners how to use the most approved apparatus for mine rescue work. Government engineers will be assigned to the stations ready to go to the scene of any disaster, equipped with oxygen helmets. The stations will be supplied with air-tight rooms where gas can be generated, and coal-mining companies will be invited to send selected men to the stations for a sojourn. The men will then be trained in the use of the oxygen helmets. The Government does not plan to carry on general rescue work, but rather to assist mine owners in developing trained rescue crews at the mine, the rescue stations being erected in coöperation with the mine owners and State geological surveys.

The location of stations so far as determined on is as follows: At Urbana, Ill., in connection with the University of Illinois, for a district including, Illinois, Indiana, Michigan, Iowa, northern Missouri and western Kentucky; at Raton, New Mexico, for a district including New Mexico, Colorado, Wyoming, and Montana, with a second station possibly at Salt Lake City, Utah; at or near South McAlester, Oklahoma, for a district including Oklahoma, Arkansas, and southwestern Missouri; at an undetermined point (perhaps Knoxville, Tenn., Birmingham, Ala., or Lexington, Ky.) for a district including Alabama, Tennessee, Virginia, eastern Kentucky, Georgia, and southern West Virginia. George S. Rice, mining engineer, will be given general charge of the mining inquiries at these stations and J. W. Paul, formerly State mine inspector of West Virginia will be assigned supervision of all the rest of the work.

A second function of the stations will be that of acting as headquarters for the engineers engaged in the study of the waste of coal in mining. Safety lamps of all designs will also be tested at these stations in order to ascertain their general safety and efficiency.

Officers of the Survey express the opinion that much progress in averting the evil results of mine disasters can be made through the use of the oxygen helmets which have recently been demonstrated in one or two important accidents with what are considered good results.

Garnet in New York

By D. H. NEWLAND*

The abrasive garnet trade afforded no exception to the general course of business conditions during 1908. The Adirondack mines supplied, as heretofore, the greater part of the production of garnet for abrasive uses, but owing to the poor demand their output was reduced to less than one-half the total of the preceding year. The actual amount, as near as it can be estimated at this time, was about 2600 short tons, compared with 5709 short tons in 1907. There was no corresponding decline in the prices obtained for the garnet, since the margin over the cost of mining is not large enough to admit any material reduction. Most of the output, also, was sold on contracts covering the annual requirements of the consumer.

No new companies have engaged in mining in the Adirondacks during the year. The North River Garnet Company, with mines and a mill on Thirteenth lake, has been the main producer. Since October, 1907, this company has been working a single shift only and suspended operations entirely for a period of three months last spring. On Gore mountain the mines of H. H. Barton & Son were run on a reduced scale. The Crehore mine near North River was inoperative throughout the year. A small output of massive garnet was reported from the new locality near Keeseville in the northern part of Essex county. This grade of garnet is mostly sold abroad.

A recent feature of the trade has been the introduction of foreign garnet which is finding a limited market in this country. It comes from Spain where it is said to occur in river sands, doubtless a product of the disintegration of crystalline rocks. The material can not displace the domestic product to any great extent as it is useful only for the finer sizes of abrasive papers. Garnet is a common ingredient of the sands found along the streams and lakes of the Adirondacks, but it seldom if ever forms deposits of any extent and is also always in finely comminuted condition.

The Cobar district in New South Wales is one of the most important sources of copper in Australia. The ore on smelting yields about 2.7 per cent. copper and 2.5 dwt. gold per ton.

The Luipaards Vlei mill (*South African Min. Journ.*, Sept. 12, 1908) crushed in August, 1908, an average of 9.677 tons per stamp per day. This is the record on the Rand.

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Coal Mining in the United States in 1908

Reviews of Mining Conditions in Many Important Centers of Anthracite and Bituminous Production, with Forecasts of Future Production

TOTAL PRODUCTION, 418,968,000 TONS

The production of coal in 1908 showed less of a falling off when compared with the record totals of 1907, than was generally anticipated by those who were familiar with the apparent slackness in the industry during the year. The total output of coke, however, was rather less than expected.

From the best figures available at this early date, it appears that the coke production in 1908 was about 61 per cent. of the total output for the preceding year. The total coal production in 1908 was approximately 88 per cent. of the 1907 output.

The anthracite production showed a falling off of about 7 per cent., while the bituminous output was 14 per cent. less than in 1907. It is possible that a considerable quantity of the anthracite mined in the late months of 1908, has been stored as a provision in case of trouble on the expiration of the miners' agreement this coming spring.

The Coal and Coke Industries in 1908

BY FLOYD W. PARSONS

The close of 1908 shows a slow, but perceptible improvement in all branches of the coal and coke industries. The Eastern operators were more severely affected by the slackness in business than the owners of coal mines in the South and West. Likewise, the coke industry felt the depression in business considerably more than did the production of coal. The production of coke in the Connellsville region, which district produces more than half of the total output of our country, showed a decrease in production of more than 10,000,000 tons, or about 50 per cent. of the 1907 output.

The enormous falling off in the production of coke was the natural result of the dullness in the iron and steel industries. Practically none of the coke operations in Pennsylvania and West Virginia has resumed on full time, although the outlook is more encouraging as the year draws to a close. In the Western States, the demand for coke was about equal to the output, during the latter half of the year. Both Alabama and Tennessee showed a slight falling off in coke manufacture during 1908; West Virginia produced about 70 per cent. as much coke

in 1908 as was produced in the preceding year.

In the production of coal, some of the smaller States made a much better comparative showing than the more important fields. Michigan, New Mexico, Oklahoma, Washington and Utah had an output in 1908 equal, and in some cases exceeding the production of 1907. As was true in the coke industry, Pennsylvania also showed the greatest percentage decrease in coal production during the year. West Virginia suffered a greater falling off in production than did Illinois, so that the latter State will easily retain its place as the second largest producer in the Union. The production for that district formerly known as Indian Territory is now included under Oklahoma.

CAR SUPPLY AND LABOR CONDITIONS

During the two years preceding 1908, the operators were much distressed over the lack of cars and the scarcity of labor. It is safe to say that no district suffered to any considerable extent from these causes during the past 12 months. There were no important labor troubles, excepting the Alabama strike, and but few wage reductions. The cause of organized labor made practically no headway in bringing new districts into the fold of the Union.

The year brought forth much discussion concerning the advisability of providing our miners with a higher education, so that a better understanding of the elementary problems attending coal mining, might result in bringing about a decrease in the number of mine accidents. These efforts to advance labor to a higher plane of intelligence have been undertaken along two lines: 1. Several of the larger companies have established night schools which provide instruction for all miners, free of charge. The expense incurred in carrying on this work is borne entirely by the mining company. 2. A general belief has arisen that all miners should be compelled to serve an apprenticeship before they are permitted to undertake important or responsible work. Along this same line, pressure is being exerted in several States with the idea of raising the standard of eligibility for mine foremen and fire-bosses.

Several important coal companies were organized during the year, but little new development was undertaken. It was expected that during 1908, the Hepburn law would become effective, and that

as a result of the enforcement of this new legislation, many of the larger anthracite and bituminous companies would be obliged to reorganize and operate independently of the controlling railroad company. The test case against the anthracite coal companies was decided early in the year in favor of the railroads; the case was appealed to the Supreme Court and will probably be decided in 1909.

MINE ACCIDENTS

The question of coal-mine accidents, their cause and prevention, has been the all important subject of discussion during the past 12 months. The year has brought forth many new, if not startling ideas. In the expression of these opinions, our most prominent engineers have differed widely in their views. Several mine managers have made the assertion that we are sending too much air through our mine workings, and that before we adopted such elaborate systems of ventilation, explosions, especially those due to coal dust, were not so frequent. It has also been stated that the practice of sprinkling our mines in order to settle the dust and prevent dust explosions is in error; the opposition to this plan of introducing moisture into our mines, bases its opinion on the idea that excessive moisture in mine air causes roof falls, and thereby adds largely to our list of fatalities.

It is safe to say that the majority of mine managers do not agree with the foregoing statement, and that the introduction of a reasonable amount of moisture into mine air, as well as the practice of sprinkling the dust at the face of rooms and entries before shots are fired, is a precaution that insures greater safety to the miner working underground.

There is no question but that the great number of roof falls is a serious menace to the safe operation of coal mines; however, it is doubtful if we can safely reduce the volume of air at present being sent into our mines or increase the factor of safety by neglecting to sprinkle dusty working places. It is probable that in the future when such problems are better understood we will find that underground, as on the surface, rock disintegrates not so much from either dampness or from an atmosphere of unusual dryness, but rather from the frequent change to one or the other of these extreme conditions.

If we could keep the moisture in our mine air at a certain standard all the year round, we would then materially reduce the number of roof falls due to the disintegration of the top rock.

COAL DUST EXPLOSIONS

The problem of eliminating coal dust as a factor in mine explosions has been the principal subject occupying the attention of coal engineers during the year. The first precaution to adopt is to remove as much of the dust as is practically possible. After this has been accomplished, there still remains an immense quantity of finely divided dust that must be taken care of. This powdered coal will not explode so readily or lend itself to a gas explosion so quickly when it is in a dampened state. Therefore, it seems that so far as present knowledge teaches, the only proper thing to do is to bring this dust to a condition of dampness, thus rendering it less dangerous in case of an explosion. Experiments by English engineers have shown that when rock dust is mixed with coal dust, the latter is rendered in-explosive. Whether this theory can be brought to a point where it will be a practical benefit, remains to be determined.

There are many other modern practices that are looked upon with disfavor by a few. Several important operators have recently declared themselves as opposed to mining machines, and they have stated openly that in solving our difficulties we must again return to pick mining. It is probable, however, that all of our advanced ideas that have been put to practical use have come to stay, and that those who claim to believe that our increased losses of life are due to high ventilating currents, sprinkling our mines, using mining machines, etc., have overlooked the fact that we now operate on a scale of magnitude with which former systems appear primitive. Our large mines are now many times the size of the important producers of a few years ago, and if anyone doubts that our advancement toward better methods has been slow, it is only necessary for him to investigate the working plan of any mine in any district as operated a decade ago, and then compare this map with the modern mine plans that exist in that same district today.

Comparing the present with the past in coal mining, there is not the slightest doubt but that this industry has advanced with equal, if not greater rapidity than other similar enterprises.

BLOWN-OUT SHOTS

The important coal-mining problem to be solved during the next year is that of shot-firing. An examination of the causes assigned for the various coal-mine explosions during the past decade has shown that in bituminous

mines, which latter furnish us with the majority of our serious disasters, the great majority of explosions are due to blown-out shots. Although it is the practice of almost every coroner's jury to bring in a verdict, stating that the accident was due to a blown-out shot, which, of course, means that the miner was negligent and that the company is not to blame, it is nevertheless true that about 90 per cent. of our explosions, where dust has been a factor, are directly caused by such faulty shots.

The various powder manufacturers, and the Federal Government at its experiment station in Pittsburg, are rendering great service in providing us with a better knowledge of the correct kind of powder to use. There is one practice that must eventually be adopted at every coal mine, and that is to have all the shots fired by a special corps of shot-firers. Furthermore, all holes should be fired when the miners, with the exception of the shot-firers themselves, are out of the mine at the end of the day's work. There are no less than 100 important mines in our country today where the continual shooting in the various rooms makes the mine air so cloudy from smoke, dust and gas, that the mine surveyors, with their transits, cannot see a sufficient distance along the entries and up the chambers to enable them to put in their sights properly. Promiscuous shooting of this sort is dangerous and is sure to result in disaster.

When it is suggested to operators that they should have all shots fired by regularly appointed men who do this work after the miners have left the workings, the immediate reply is that the plan is impracticable because of the expense attached, and that there would surely be a falling off in production. Our mines are not institutions owned and operated by wealthy men for the cause of charity, and consequently it is useless to suggest that they adopt beautifully devised schemes that will make their mines safe, and at the same time cause them to show a financial loss at the end of the year. Competition in coal mining is as keen as it is in any other business, and legislators, theorists and students of reform, must remember that it is more desirable to close down a plant than to adopt measures which are sure to result in a loss. It is the common practice of reformers to devote their principal attention to reforming the other fellow's business methods instead of looking to the improvement of their own.

There are mines in this country, as well as in several European fields, where shot-firing, as before recommended, is carried on successfully, both from the point of safety and economy. I do not believe that conditions in any field in our country are such as to prohibit shot-firing by specially appointed men after the day's work has

been done. It has been suggested that this practice is dangerous, especially if the miners charge their own holes, for when they do not fire the shots themselves, they are not so careful about loading and tamping the holes. This point is undoubtedly true to a small extent and cannot be entirely eliminated so long as we have to deal with the personal factor. It is better, however, if we must have explosions, that 8 or 10 men lose their lives than 10 or 20 times that number.

MINE RULES MUST BE ENFORCED

We have examples each day where miners deliberately disobey all rules, and for the sake of personal gain, endanger not only their own, but the lives of fellow workmen. This can only be avoided by stricter supervision, and if necessary, by having a number of additional police underground. The Marianna mine, for instance, which was designed to be a model operation, was as dangerous as any poorly planned and badly managed property could be. The sole reason for this was due to the violation of rules by certain miners who carried black powder into the workings, and even went so far as to use cartridges filled with coal dust for tamping.

We must hold all miners responsible and see that they are severely punished for any infraction of prevailing rules. On the other hand, mine operators should be held responsible if they do not take every possible step to properly police their mines, and thus prevent such reckless violations. Coroner's inquests are laughable comedies, where no one but the dead are held responsible, and where the defendants suggest the questions put to themselves. No matter how many virtues we possess, we are sure to be more careful when we know that there is a possibility of responsibility and blame being laid at our door. In fairness to the honor we all claim to possess, and to those unfortunates who pay the heavy price, we must be willing to assume the burden of blame when it is ours.

The Chicago Coal Market in 1908

By E. MORRISON

From the point of view of the dealer in steam coals, particularly those from the Illinois and Indiana fields, the year 1908 has been disappointing. The demand for such coals has been low throughout the year and although demand steadily bettered in the last three months of the year, it averaged probably 20 per cent. lower than in 1907. Prices of Western bituminous were low, but continued without any material reduction from the previous year, when keen competition brought them down to a low level. Domestic coals were low-priced and the lack of universal pros-

perity aided the western producers somewhat by bringing into demand low-priced bituminous as a substitute for anthracite and high-priced eastern bituminous.

The year opened with a weak market owing to mild weather and business depression. By February the demand for both bituminous and anthracite improved greatly and demurrage evils practically disappeared. In the first half of March, the demand became light again, although in the latter half the buying was heavy because of apprehension that a strike was impending in the bituminous-producing regions; the month of April, in which mining was generally suspended throughout the western fields, saw little demand for coal and no rise in prices. Consumers and retailers alike refused to lay in large stocks.

In May, after the arrival of new supplies from the fields where mining had been suspended, the trade quieted down to a steady and dull condition that lasted with hardly a break until November, when a condition of slow improvement began. Fine coals were more generally in demand throughout the summer than in any previous year. Contract making was not so large or so general as in the previous year, open market conditions being too favorable to the consumer.

For harvesting purposes, the demand in summer and autumn was large and this helped to hold up the level of prices. Fine coals began to weaken in September and dropped to a condition of enforced sales at low prices, to escape demurrage, by October. Lump strengthened gradually as the autumn months brought an increased demand for domestic supplies, but the slow market for lump continued without noticeable strength up to the end of the year, owing to lack of cold weather and the slowness of the revival of general business.

The range of average car prices of Illinois and Indiana coals, which formed about two-thirds of the total supply received in the Chicago market, was as follows:

PRICES OF WESTERN COALS (CHICAGO).

Mo.	Lump and Egg.	Run-of-Mine.	Screenings.
Jan...	\$2.00@2.75	\$1.60@1.90	\$1.20@1.60
Feb..	\$1.90@2.75	\$1.60@1.80	\$1.20@1.50
March	\$1.80@2.60	\$1.60@1.80	\$1.30@1.50
April.	\$1.75@2.30	\$1.50@1.75	\$1.30@1.60
May..	\$1.75@2.25	\$1.65@1.85	\$1.30@1.60
June..	\$1.75@2.25	\$1.65@1.75	\$1.40@1.60
July..	\$1.75@2.25	\$1.50@1.75	\$1.40@1.60
Aug..	\$1.75@2.25	\$1.60@1.70	\$1.35@1.50
Sept..	\$1.75@2.45	\$1.55@1.75	\$1.25@1.50
Oct..	\$1.75@2.25	\$1.65@1.75	\$1.20@1.50
Nov..	\$1.75@2.65	\$1.65@1.75	\$1.00@1.55
Dec..	\$1.75@2.65	\$1.65@1.75	\$1.10@1.65

The demand for anthracite was quiet throughout the year, car prices being the same as in the previous year—\$6.50 for egg, stove and chestnut, and \$6.25 for grate. As for several years previous, the graduated monthly discount system was in

use between April 1 and Sept. 1, giving 50c. off on April sales, 40c. on May sales and thus down to 10c. off on August sales. Retailers and consumers bought lightly in the closing months of the year, mild weather chiefly accounting for their apathy.

Eastern bituminous coals suffered throughout the year from a tendency of steam users to seek low-priced coals, and throughout the summer and autumn from over-supply. High-grade smokeless coals sold fairly well as a result of persistent advertising; low-grade smokeless was moved with difficulty and was constantly sold at less than circular prices. Smokeless brought \$3.05@3.30 for run-of-mine, and \$3.85@4.05 for lump. Hocking shipments were well restricted and though the demand was not heavy it was fairly uniform, the price ranging \$2.95@3.15. Youghiogheny was very quiet and steady throughout the year at \$3.15@3.25 for 3/4 inch gas.

Many producers of bituminous coals learned greater caution about sending surplus products to the Chicago market, in 1908. The desirability of regulating the supply so as to prevent flood waves of shipments of one kind of coal or another has often been pointed out and was emphasized by the year's history. In default of such regulation, shippers found most uniform success in closely watching the market rather than in taking speculative chances.

Pittsburg District Coal in 1908

By S. F. LUTY

Coal production in the Pittsburg district in 1908 did not come up to the prediction made late in the previous year by fully 20 per cent. With data for December and from some independent companies unavailable, it is estimated that the production in the Pittsburg district and including the Westmoreland field did not exceed 42,000,000 tons, a decline of about 10,000,000 tons compared with 1907, a record year, and equal to the output of 1905.

The Pittsburg Coal Company, the leading interest, in the first nine months produced 9,726,387 tons compared with 13,302,634 tons in a like period of the previous year. Its total for 1908 was nearly 13,000,000 tons as against a trifle over 15,000,000 tons in 1907.

The Monongahela River Consolidated Coal and Coke Company produced in round numbers 6,000,000 tons, or 1,500,000 tons less than the previous year and equal to the production of 1906. Of this tonnage 2,250,000 tons went to lower river ports, and 1,500,000 tons was shipped by rail. The rest of the tonnage was distributed among the manufacturing interests along the Monongahela, Allegheny and

Ohio rivers and in the home market. Other river-coal interests produced about 2,250,000 tons, or about 750,000 tons less than the previous year.

River shipments were very good for the first five months of the year, but the rivers have not been navigable since the second day of June. What coal was not consumed in the home market, or shipped by rail, was still in the pools and harbor at the close of the year, and amounted to a round tonnage of 700,000 tons, or about 20,000,000 bu. When navigation was suspended in June there were enough empty coal boats and barges in the pools to keep the mines running for two months. Since that time operations were practically suspended, only rail shipments being made. About the middle of December the rains brought the rivers to a stage that permitted the return of empties and a partial resumption of the river-coal mines followed.

LAKE TRADE WAS DISAPPOINTING

The lake-coal trade also was disappointing. In 1907 the Pittsburg Coal Company and other interests shipped 10,485,000 tons to the northwestern market, and in 1908 shipments fell off to around 8,000,000 tons. One reason was the late opening of lake transportation. In former years ore was sent down the lakes as soon as navigation was opened, but owing to conditions in the iron and steel trade no ore was shipped until June 1, and as coal is shipped on the return trip of these boats, none went out before the middle of June. Shipments to lake ports began at the usual time, but the docks at Cleveland soon became congested, and there was considerable delay.

Prices remained throughout the year on the basis of \$1.15 for mine-run coal at the mine for both river and rail shipments. Producers figured that as the demand was not normal no advantage would be gained by cutting prices as it would not bring any more business. Some of the small producers, however, did shade the price, but not sufficiently to disturb conditions. Slack fluctuated, the highest point being 80c. and the lowest 40c. a ton at the mine.

A general suspension occurred on April 1 owing to the expiration of the two-year wage agreement on the mining rate with the United Mine Workers of America. The interstate agreement was dissolved when the joint convention, held at Indianapolis in January, failed to reach a settlement. The mine workers' organization demanded a renewal of the wage scale, which was on the basis of 90c. per ton for pick mining over a 1 1/4-in. screen. The two-year agreement expired on March 31, and the miners wanted an agreement for a period of one year. At a conference held in Toledo in April, a settlement was reached and a contract for two years was made.

NO SCARCITY OF RAILROAD CARS

For the first time in many years there was no complaint of a scarcity of railroad cars. Idle cars could be seen at the mines at almost any time, and there was no delay in shipments. It is not likely that any of the annual reports of the different corporations will show serious losses, but all profits were greatly diminished and dividends were not paid by some large concerns.

At the annual meeting of the Pittsburg Coal Company, held in Jersey City in February, all officers were reelected. The report showed that the gross earnings of the company for the year 1907 increased \$434,859.95, or 8.21 per cent. Net earnings for the year 1907 showed an increase of \$765,824.88, or 34.93 per cent.

The only serious accident of the year was the explosion at the Marianna mine of the Pittsburg-Buffalo Company on Nov. 28, when 154 lives were lost. It was caused by a blown-out shot which ignited gas and dust.

Following is the verdict of the coroner's jury at the inquest on the body of one of the victims:

"We, your jury, after hearing evidence of mining experts, inspectors, miners and operators, find that John J. Ivill came to his death from an explosion in the Marianna mine, West Bethlehem township, Washington county, Penn., Saturday, Nov. 28, 1908, and that said explosion was due to a blown-out shot in Blanche entry No. 3, which ignited the gas and dust, and that a secondary explosion occurred in the main dip entries almost simultaneously.

"We further find that no blame is attachable for said accident and we recommend that mine inspectors frame and submit to the incoming legislature a set of rules to be adopted into laws, namely:

"For the employment of experienced shot-firers to fire all shots; that all shooting be done between shifts, and that black powder and other highly inflammable explosives be excluded and the excessive use of brattice cloth be prohibited. That all charges of explosives be stemmed with clay; that safety lamps be used exclusively in gaseous mines; that an efficient water system be installed and the dust in all parts of mines be fairly wet.

"And further, owing to the fact that laws governing electricity in mines are very meager, that a more rigid set of laws be submitted for adoption."

CONNELLSVILLE COKE IN 1908

Coke production in the upper and lower Conneltsville fields in 1908 was fully 5,000,000 tons less than the previous year. The output of the H. C. Frick Coke Company with December estimated was in round numbers 7,000,000 tons, and the independent interests produced about 6,000,000 tons. At times during the year less than 50 per cent. of the ovens were in blast.

A number of ovens were closed late in the previous year when the depression in the iron and steel trade began. In January conditions became worse, and thousands of men were thrown idle. Most of them were foreigners, who returned to their former homes where they remain awaiting a return of better times.

At the opening of the year furnace coke had dropped to \$2 and foundry coke to \$2.50. These prices did not continue long until there was a further decline, and sales of furnace coke during the year were made at from \$1.60 to \$1.75, and foundry at from \$1.90 to \$2 per ton. On account of the low prices, the H. C. Frick Coke Company made a reduction in wages effective Jan. 1. No change was made in some classes of labor, and the reductions in others ranged from 5 to 12 per cent. A readjustment was not a surprise, as coke prices had declined fully \$1 a ton compared with the prices in the first quarter of 1907. On March 1 of that year the Frick company voluntarily advanced the wages of its workers from 8 to 12 per cent.

At the close of the year furnace coke for spot shipment was quoted at \$1.85 and on contract at \$2. Foundry coke late in December was quoted at from \$2.25 to \$2.40 for both spot shipment and on contract.

Alabama Coal Production for 1908

BY L. W. FRIEDMAN

Statistics from the coal-mining industry in Alabama are always slow in being received at the office of the State Mine Inspector, J. M. Gray, and consequently the estimates are necessarily based on the figures submitted for the early months of the year. The production of coal in Alabama in 1908 will show a falling off of at least 2,000,000 tons in the aggregate as compared with the output of 1907, the estimate being that the production for the past year will total about 11,900,000 tons. The production in 1907 was 14,424,863 tons against 12,851,775 tons in 1906.

During the year 1908, in addition to the depressed conditions throughout the country, there was a big strike on in this State; the United Mine Workers of America carried on the struggle from July to September. The State was asked for troops and the militia was called out for more than a month. The sheriffs of Jefferson, Walker, Bibb and Shelby counties, in Alabama, were called on for protection and the necessity of deputies was shown and responded to. The laborers brought in to replace the union men had much trouble in remaining at work, and the production of coal, except at mines

where convict labor was employed remained unsteady and unprofitable.

Summary of Coal Industry in Colorado During 1908

BY JOHN D. JONES*

The coal production of Colorado in 1908 was 9,773,683 tons; this was 1,191,957 tons less than the tonnage of 1907. The relapse in production is accounted for by the tightness of the money markets prevailing during the earlier part of the year, and which resulted in shutting down many fuel-requiring industries in adjoining States, and canceling the orders contracted in this State to supply the coal. The plants of many metalliferous mines in Colorado closed, or limited their producing forces, which in turn curtailed the freight traffic and considerably slackened the demand of the railroads for fuel.

In addition, the winters of 1907 and 1908 were exceptionally mild, and this, together with the above stated reasons, seriously affected the trade. In consequence numerous coal mines were obliged to suspend operations, and some did not resume business until late in the fall. There were but few mines working to their full capacities. At the present time nearly all the mines which ceased operations pending better markets have reopened and are forging ahead with renewed activity. The depression in the trade did not affect the wages of the miners, nor the price of coal.

The relation between operators and employees in general has been harmonious, and no labor troubles occurred to interfere in any noticeable way with the total production of coal.

The supply of railroad cars has been unusually regular, although at times there have been shortages, caused more through the inability of the companies to furnish motive power to haul the coal than to a lack of cars.

ATTENTION WAS DIRECTED TO MAKING THE MINES SAFER

What makes the year a memorable one is the fact that in spite of the poor demand for the commodity the operators turned their efforts in another direction. The low financial profits of the year did not discourage them, and they took this opportunity to place their mines on a safer and better working basis, both for the protection of the employees and the safeguarding of their property; it was also true that in many instances attention was directed toward developing larger producing capacities. In short, a general desire was manifested to place the mines on a safer and more sanitary basis, with the view of meeting increased demands of trade. A number of new mines were opened which are not yet producing, and

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which will, when completed, be equipped with modern and costly appliances.

From the fact that many of the industries which were shut down a year ago, have resumed operations and new ones have started up, there is every indication that the coal industry of this State is on the verge of a prosperous era, which will result in a material increase of tonnage in the years to come.

The following summary in which the December totals were estimated gives a fairly accurate digest of the industry during the past year:

SUMMARY OF THE COAL PRODUCTION OF COLORADO FOR 1908.

Number of producing mines.....	190
Number of new mines opened.....	8
Tons of lignite coal produced.....	1,991,234
Tons of semi-bituminous coal produced.....	818,272
Tons of bituminous coal produced.....	6,824,737
Tons of anthracite coal produced.....	69,440
Tons of unclassified coal produced, estimated.....	70,000
Total tonnage produced.....	9,773,683
Total tonnage of coke manufactured.....	854,662
Total number of coke ovens.....	2,811
Number of employees at the coke ovens.....	1,104
Number of employees in and about the mines.....	14,126

The Illinois Coal Industry in 1908

SPECIAL CORRESPONDENCE

The production of coal in Illinois during 1908 showed but little change when compared with the output of the preceding year. Labor troubles which occurred in the central fields early in the year, caused the closing down of many mines. The demand was so slack, however, that it is probable the output would have been no greater had there been no enforced suspension of work. The depression in business caused many consumers to use the cheaper grades of bituminous coals in preference to the more expensive anthracite product.

According to the reports of the State mine inspector for the year ending June 30, 1908, there were 54 counties in Illinois producing coal. The number of mines and openings of all kinds that were being operated totaled 922, while 97 of these operations were new developments of the year. There were 108 mines closed down during the year which shows that the abandoned operations exceeded the new developments by 11. The latter half of 1907 which is included in the fiscal year ending June 30, 1908 was the period of greatest production. The total output for the year ending June 30, 1908 was 49,272,452 tons. Of this production, 47,809,730 tons were produced by 407 mines, while the remaining 1,462,723 tons were produced by 515 mines which latter were engaged in local trade only. The average value per ton for all grades of coal at the shipping mines was \$1.02. The aggregate home value of the total product was \$50,989,082. There were 105 mines in which machines were used, which com-

pare with 101 machine mines in the preceding year. Of the total production, 15,210,423 tons were produced by mining machines. The total number of employees is estimated at 70,841, of which number, 64,424 work underground.

The average price paid per gross ton for hand-mining was 59.3c.; the average price paid per gross ton for machine mining was 46.7c. In blasting the coal the miners used 1,328,454 kegs of powder. In operating the mines throughout the year, the number of men killed by accidents totaled 175. These fatalities made 89 widows and left 217 fatherless children. For each life lost, 281,557 tons were mined. There were 2.5 deaths per 1000 employed; it is, also estimated that there were 3.6 men killed for each million tons produced.

Indiana Coal Production in 1908

SPECIAL CORRESPONDENCE

Indiana continues to hold a place in the ranks of the six principal coal producing States; however, conditions of mining and coal trade during the past eleven months were not equal to the corresponding period of 1907. The total coal production in Indiana in 1907 was 13,985,713 tons, having a spot value of \$15,114,300; this output was an increase of 1,893,153 tons over that of 1906. While the growth of the industry has been remarkable it is estimated that the production for 1908 will only be about 12,000,000 tons, or a decrease of nearly 2,000,000 tons as compared with 1907.

There are several important factors, which, in addition to the general financial and industrial depression during the present year, played an important part in the large decrease in the output. After the month of March, two months were required to adjust satisfactory working conditions, wages, etc., with the mine workers; the drought had some influence; there were a few strikes and labor troubles, but the principal, controlling feature was the lack of orders. Heretofore, Indiana has furnished a large amount of steam coal to manufacturers throughout the central States. This demand was curtailed nearly one-half. The Ohio river market, because of the low stage of water, was cut out, and this loss was perceptibly felt by the producers of southern Indiana. The usual demand for domestic coal from the Northwest was tardy and not up to volume, while the lake demand was by no means equal to previous seasons.

Considering all these conditions which contributed to the closing of a number of mines, the decrease in the estimated output is not greater than the decrease or depression in other business enterprises.

About 21,000 miners have been employed in the Indiana mines during the year. The average number of days worked were less than the previous year. The operators in many instances took occasion to improve their mines during the slack time and employed the idle miners to do the work. In addition to putting the plants in good condition, several new mines were opened and a number of old and abandoned operations were repaired and worked in a limited way.

IRON ORE IS TO BE MINED

A start has been made in the iron ore mining and smelting business in this State. A smelter has been established and equipped at Linton, and ore is being mined in the Greene county field and shipped to Linton where crucial tests are being made relative to the quality and richness of the ore. It is understood that the Steel Corporation at Gary is back of the test. It is generally known that this latter company holds an option on a large acreage of the iron-ore land.

Coal has been found in several localities in the State heretofore unknown to contain workable seams. In each case the work of developing the new field is being pushed successfully.

The special session of the legislature amended the prevailing laws so as to make the use of a 3/4-in. bit permissible, instead of the 2 1/2-in. bit prescribed by the law of 1907. The operators are not inclined to furnish the larger bit because of the increased danger, and this has precipitated serious trouble in the Clinton district.

There have been fewer accidents and explosions in the mines than last year and the fatalities from this source will not exceed six or eight lives.

Notwithstanding the decreased output, there is a decidedly optimistic feeling among the operators, who share in the belief that the future will restore the industry to its accustomed activity, and doubtless, during the next two years, the yearly production will surpass any previous totals.

Coal Mining in Iowa in 1908

By JAMES H. LEES*

The coal-mining industry in Iowa has not been quite so active during the present year as it was in 1907. This has manifested itself in a reduction in the number of days the miners worked, and a consequent diminution in the coal output. This latter, however, has not amounted to a great deal as a comparison of figures will show. In 1907, according to data collected by the Iowa Geological Survey, the output amounted to 7,574,322 short tons. In 1908

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the production was about 7,050,000 short tons, the figures being based on the closest possible estimates.

There were a number of causes contributing to this decrease. One of these was the falling off in railroad business, which was especially noticeable in the early part of the year, notwithstanding the increased passenger traffic due to the 2c. fare. Another cause was the suspension of mining operations during April, pending the adoption of the working agreement by the operators and the miners. Still another reason has been the mild weather prevailing during most of the fall months. Even in December many of the mines have worked only four or five days a week, and this is true of railroad mines as well as of others.

MUCH ACTIVITY IN NEW DEVELOPMENT WORK

Perhaps one of the most important factors has been the shutting down of numerous worked-out mines and the delay in opening others, together with the gradually decreasing output of some of the old mines. This factor is partially offset by increasing activity in prospecting and exploitation in certain counties in the central coalfields, notably Boone and Dallas. Here there has been more prospecting and development than for years past. This is due to the finding of several good seams of coal at greater depths than had been prospected before, depths varying from 170 to 270 ft. One firm has recently secured control of some 7200 acres of coal land in these two counties. Polk county, in the same general field, has also received an impetus through the opening of about 10 new mines; the larger size and superior equipment of these mines will result in increased output in the near future.

Another element which will aid in advancing the production in 1909 will be the more settled market conditions throughout the country and the stability and confidence engendered by the Des Moines agreement between the miners and the operators which will be in force until March 31, 1910. This will both enable the operator to reach out after new markets and longer contracts, and will insure better mutual consideration from both parties.

ACCIDENTS

In spite of the slight decrease in production, there has been some increase both in the number of mines operated and of the employees. Over 330 mines were in operation, giving employment to 17,312 men. During the fiscal year ending June 30, 1908, there were 38 fatal accidents, or 2.2 per 1000 employees, in addition to 100 serious, nonfatal accidents. This means the loss of one life for each 188,301 tons mined, and serious injury to an employee for each 71,544 tons raised. It must be said that these accidents are in a considerable measure due to the carelessness of

the miners themselves, since the Iowa mining laws are broad, and are for the most part well lived up to by the operators. During the last half of 1908, fewer accidents have been reported than for some time previous.

The use of mining machines is not extensive in Iowa, and the same may be said of electric haulage, etc. Many mines are not large enough to use them profitably, and the broken nature of the deposits also tends to discourage the installation of expensive equipment except in the larger fields.

Taking all things into consideration in Iowa, the past year has yielded all that could be expected and the coming year holds out promise of improved conditions for the coal industry.

The Coal Industry in Michigan in 1908

There was much activity manifested in the operation of coal mines in Michigan during the year just passed. Thirty-five mines were operated, and the average number of employees was about 3200. The average daily earnings of each employee was \$3.05, and the aggregate sum paid in wages totaled to nearly \$1,200,000. The average cost of each ton of coal produced was approximately \$1.60. The most reliable estimates place the coal production for Michigan in 1908 at about 2,000,000 tons.

Coal Mining in New Mexico in 1908

SPECIAL CORRESPONDENCE

The coal-mining industry in New Mexico during 1908 did not prove as prosperous as anticipated, although the percentage of increase will fall but little short of the average of the past 10 years.

There was every reason to expect a much greater increase of production, as the larger mines had recently been equipped with machinery of the most improved design and of far greater capacity than had heretofore been used in the Territory; extensive development work had been carried on for a year previous, in order to satisfy the great demand for coal, which, during the two previous years it was impossible to fully supply.

The demand for coke had also far exceeded the supply, and a considerable percentage of the coke for the metal-smelting plants of the Southwest and of Mexico, had been brought from Colorado, Pennsylvania, Australia and Germany.

To help in supplying this demand, 446 new underflue ovens were completed at Dawson, in the fall of 1907. Two hundred and ten new beehive ovens were

built at Koehler, and 110 new beehive ovens had been recently added to the coking plant at Gardiner, New Mexico.

The general business depression of the fall of 1907 was felt most acutely by the copper mining and smelting companies of the Southwest, because of the greatly lessened demand for their product. Through the channel of the copper-producing companies, the coal mines and coke plants were similarly affected. Therefore, instead of any large gain in production, the percentage of increase fell slightly below the average. The fact that miners were plentiful to operate the mines and that transportation facilities were better, to some extent compensated for the lessened demand; but the capacities of the mines for production were not taxed to near their limit, nor indeed given a test of what might be accomplished.

THE PRICE PER TON WAS LESS THAN IN 1907

From January 1, 1908 to July 1, 1908, fully one-half of the coke ovens in the Territory were idle, and the mines were operated on half time; in one or two instances some of the mines temporarily suspended operations. About July 1, an increased demand for coke aided the demand for the product of the coal mines. However, an unusually warm fall and winter throughout the Southwest and Pacific coast lessened the demand for coal until November 15, after which date the inquiry for coal has been increasing. The demand for coke is at present keeping all of the 966 ovens in the Territory constantly in operation.

During the year just closed there was produced from the mines of New Mexico 2,725,000 tons of coal, of which 75,000 tons were used in operating the mines and for domestic purposes at the camps; 310,350 tons of coke were produced, requiring 558,630 tons of coal, or 1.8 tons of coal for each ton of coke produced. Approximately 2,091,370 tons of coal were shipped, the average value of which was \$1.40 per ton, a fall in average price, by reason of the lessened demand and greater competition for orders, of about 45c. per ton from prices prevailing in 1907.

An average of 3200 men were employed underground in the mines, and 740 on top, or a total of 3940 men in the immediate operation of the mines; 120 boys were also employed, 72 of whom were underground and 48 on top.

Fully as many persons were employed on the outside in cutting and hauling timbers, operating coke ovens, electrical plants, saw mills and performing other duties incidental to the operation of the mines.

Twenty-one persons lost their lives in the coal mines of the Territory during the year; fourteen of these unfortunates were killed by falls of rock.

The percentage of fatalities is very high, 5.17 per cent., and it can only be remedied by more stringent laws against carelessness in timbering the mines, and by the enforcement of better discipline in the operation of the mines.

With a revival of business conditions throughout the country, coal mining in New Mexico will assume much greater proportions than heretofore, and will move forward with rapid strides.

West Virginia Coal Industry in 1908

SPECIAL CORRESPONDENCE

It is estimated that West Virginia produced 44,091,000 short tons of coal during the year 1908. The coke production was approximately 2,978,000 net tons. The number and seriousness of the accidents in West Virginia during the year showed a great falling off from the appalling figures of 1907. The year's record did not record any such disaster as the one that occurred at the Monongah mines in the 12 months preceding.

Every effort has been made by the State Department of Mines, as well as by the operators, to reduce the number of fatalities to a minimum. With the possible exception of Pennsylvania, it is probable that West Virginia felt the depression in the coal business, to a greater extent than any other State. There were no labor troubles of consequence, and the miners, as a rule, still remain in the ranks of unorganized labor.

Chief Mine Inspector Paul has severed his connection with the State to accept a position with the United States Geological Survey experimental station corps. John Laing, a mine superintendent of experience, has been appointed chief inspector to succeed Mr. Paul. At the close of the year, the outlook for the coal industry in West Virginia is much brighter, and it is expected that the output in 1909 will equal the record production of 1907.

The Coal Mining Industry of Washington in 1908

BY RAYMOND P. TARR*

During the past year more real advances have been made in coal-mining development in the State of Washington, than during any like period of its history. In the person of D. C. Botting, inspector of coal mines, the State possesses a painstaking, capable official who is popular with the laborer as well as the operator.

Both the Northwestern Improvement Company and the Pacific Coast Coal

Company have signed a two-year agreement with the officials of District No. 10, United Mine Workers of America. This agreement is effective Sept. 1, 1908. Previously, the agreement has been for a one-year term.

The coal output has been less than that of 1906, but slightly greater than the production of 1907. Since 1906 the Northwestern Improvement Company has not been engaged in the domestic trade, and has mined solely for the supply of the Northern Pacific Railway Company. Owing to the working out of areas within the fields of the Pacific Coast Coal Company, the output of this latter corporation has fallen short.

At Coal Creek, the Pacific Coast Coal Company has driven a slope to obtain a vast amount of coal in this district lying below water level. The first level, 500 ft. down, has been driven for 4000 ft. in both directions. The slope mouth is 14 ft. in the clear, and is concreted for 40 ft. This company has started a new slope at Burnett, which will tap a body of coal to the extent of several million tons. Black Diamond, Wilkeson and Carbonado, have all done well and are progressing under good management. None of these operations have much to chronicle in the way of construction, however. Carbonado leads in development work. Some trouble over the labor question has kept Wilkeson in a state of unrest during the year.

NEW DEVELOPMENT WORK

During 1908 the Roslyn Fuel Company has gotten well under way in the development of its holdings on the north end of the Roslyn field. Their slope is fine in every particular and is still going down; three right and left gangways have already been turned off. The entire equipment of this mine is decidedly up-to-date. The daily output is 400 tons, and this property is doing much to relieve the decidedly tight straits of the fuel market. The "Patrick and McKay" mine nearby, and the Summit Coal Company at the south end of the field are the other producers in this section.

The Mendota Coal and Coke Company has just completed building eight miles of railroad into the coalfield east of Centralia. The management here is proceeding slowly and everything that is being done is of a permanent and modern character. The Washington Union Coal Company has built a railroad into another portion of this field where the coal is decidedly more lignitic than that found in the former district.

The Northwestern Improvement Company has completed at Ravensdale its new cleaning plant with a 1500-ton daily output. Conditions after the flood and fire are again becoming normal, although the management has suffered two years of reverses at this mine. The company has instituted much new machinery at Roslyn,

such as rotary car dumps, car hauls, box-car loaders, etc. No. 7 mine, at Clealum, and No. 3, at Roslyn, have been opened. Both these operations have been equipped with new tipples. The Roslyn daily output has passed the 700-ton mark, which establishes a new record for the State. Shot-firers are employed at most of the Roslyn mines, and the battery system has been instituted; the whole field is well regulated and is worked according to set standards.

NUMEROUS PROMOTION SCHEMES

There are numerous promotion schemes, large and small, in various portions of the State, and these tend to discredit the true conditions and thereby do great harm. The most noteworthy of these ventures is in Whatcom county, where a so-called anthracite deposit exists. Here the measures are tremendously broken and the coal has even passed the fuel point. Every condition there is against economic mining.

Considerable Japanese, Welsh, Australian and British Columbia coal has been used during the past year. Most of the steamers and the California markets have long since been forced to obtain coal elsewhere.

Experimental work in briquetting has been done with the coals of the Northwestern Improvement Company, the Snoqualmie Coal and Coke Company, and the Seattle Electric Company. Results as yet have not been successful. As gas producers, all the lignite coals are promising; they possess a large amount of gas and are cheaply mined.

The following new companies will, in the future, be large producers of Washington Coals: Mendota Coal and Coke Company, president, F. H. Ketcham, Centralia; Roslyn Fuel Company, president, Walter Oakes, Lournan building, Seattle. The output for 1908 will be approximately 3,000,000 tons; the output for the five years previous is as follows:

1903.....	3,190,477 tons
1904.....	2,905,689 tons
1905.....	2,846,901 tons
1906.....	3,290,523 tons
1907.....	3,712,172 tons

Wyoming Coal Industry in 1908

The greatest trouble experienced by the Wyoming coal operators in 1907 was due to the scarcity of labor and the lack of railway cars. In 1908, these difficulties were largely eliminated; however, the industry was confronted with a lessened demand which resulted principally from the decrease in traffic on the larger transcontinental railways. The output in 1908 showed but little change from the production of 1907. The total output sold for about \$10,370,000 at the mines. This was an average value of approximately \$1.70 per ton.

*Mining engineer, Seattle, Washington.

The Eastern Coal Industry in 1908

By JOHN H. JONES*

The year 1908 will show a production of coal in this country equal to about 85 per cent. of that of 1907, or approximately 400,000,000 tons, which is about equal to the tonnage produced in 1906. Had the increase in production not been so enormous during the past few years, this would have looked very large, and in fact is more than double that of 1897. During the recent depression the industrial centers suffered more than other localities, and the shipments to Pittsburg and the adjacent valleys were probably much more affected than any other section; the tonnage to these points showed a greater decrease than the domestic trade and what is known as the "Western" trade.

The conditions existing this year show the unfairness of freight rates from the Pittsburg district as against those from certain districts in West Virginia. Notwithstanding that this district, in 1908, will show only about 80 per cent. of its 1907 production, certain districts in West Virginia favored by cheap freight and mining rates, actually increased their production during the past year. If the Pittsburg district is to maintain its position in coal production, and to receive the proper returns upon the money invested in coal lands, the time is coming when a radical adjustment of the mining scale and freight rates must be made between certain districts in West Virginia, Illinois and other States, and the Pittsburg district. At the present time coal is being hauled three times the distance from parts of West Virginia and other districts at practically the same freight rate as from the Pittsburg region. This is an injustice and will have to be remedied.

Although certain companies in this district made low prices, the majority of them maintained a fair price throughout the season. By so doing, they lost considerable tonnage, but the wisdom of their position I think is emphasized by their ability to show a small profit instead of a deficit.

During 1909 it will be necessary for the Pennsylvania operators to secure higher prices for their coal on account of the increased cost of production, higher taxes and the greater cost which will be forced by new mining legislation which should and will be passed during the coming session of the Legislature.

FUTURE OUTLOOK IS ENCOURAGING

The prospects for the coming year look

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encouraging and I feel confident that during 1909 the tonnage mined will equal at least 90 per cent. of the amount of coal produced in 1907. Many new propositions have been floated and many railroads have financed their requirements for some time to come. I think we are on the verge of the greatest industrial expansion the country has ever seen, but in my judgment, this improvement will be gradual and before the boom strikes us with full force we will be well on into 1909. The business of 1909 will, in my opinion, be so much better than that of 1908 that we will all be well satisfied. To keep up to the natural increase of consumption, it will be necessary to build new railroads, new manufactories, develop new mines and increase the production and manufacture of all the necessities of life. This means plenty of work for our workmen, increased buying capacity and prosperity for all.

The production of coal in this district for 1908 will be about 40,000,000 tons, which is about twice as great as the output in 1897, which was the banner year up to that time. The production for 1909 will be about 50,000,000 tons.

The settlement of the mining scale by the miners and operators for the two years from April 1, 1908 to April 1, 1910, lent stability to the business during the past year, and I believe was a good thing for both miners and operators, as a great industrial strike would simply have retarded the return of prosperity.

The lake tonnage from all districts for the eight years ending 1908, was as follows:

THE LAKE TONNAGE FOR PAST 8 YEARS.

Year.	Pittsburg District.	Ohio District.	W. Va. District.	Total.
1901	3,795,706	1,954,825	787,572	6,538,103
1902	4,704,093	2,689,974	965,769	8,359,836
1903	6,092,047	2,458,265	1,539,435	10,089,747
1904	6,058,383	2,138,247	1,279,876	9,476,506
1905	7,443,883	2,062,692	2,109,262	11,615,837
1906	9,287,272	2,560,906	2,743,732	14,591,910
1907	10,549,995	4,074,296	3,420,941	18,037,232
1908	8,700,000	3,600,000	3,450,000	15,750,000

From the above figures it is evident that there was a decrease in the Pittsburg district of about 18 per cent., in the Ohio district of about 12 per cent., and a small increase in the West Virginia district, which shows that other districts favored

by cheap mining and freight rates, are making great inroads into the markets which should really belong to the Pittsburg operators.

Every known method is being adopted by the majority of the operators of this country to provide for the safety and health of their employees. Mining experts from other countries have been called and consulted, and every appropriate suggestion carefully weighed with the opinions of the greatest mining experts of this country, before their introduction into the mines. During the past year many serious accidents have occurred in foreign countries as well as in this country, but I sincerely believe that with the benefits to be derived from our Testing Laboratory, and from the combined ideas of brain and skill, within the next two years, the Pittsburg district will show fewer lives lost per man employed than any other mining section in the world. At the present time, a less number of lives are lost per ton of coal produced, than formerly, as is shown by the accompanying tabulated statement.

In adopting new ideas, very often the welding of newer and stronger links makes the weaker ones in the chain more conspicuous, and what once appeared safe, now becomes actually dangerous. In years gone by, if there was an explosion in a coal mine, the air present was insufficient to render it serious; the gas would simply burn in suspension wherever it might be lighted, and do practically no damage. There have been and still are a number of unrecognized conditions in coal mines, but these conditions are rapidly being overcome.

I am satisfied that it is the earnest desire of every company in this country to do all possible for the health and safety of the men in their employ; moreover, all managers are glad to consider suggestions from a really intelligent source, as to the best methods of producing coal with the greatest safety to their employees.

A TAX UPON THE EMPLOYERS OF LABOR

During the past two years, I have recommended the placing of a tax upon the

LIVES LOST PER TON OF COAL PRODUCED.

	Production (net tons).	Employees.	Tons Produced Per Employee.	Lives Lost.	Lives Lost Per 1,000 Employees.	Lives Lost Per 1,000,000 Tons.	Days Worked.
Pennsylvania bituminous, 1903.	103,713,982	151,745	683	402	2.65	3.84	216
Great Britain, bituminous, 1903.	257,974,605	822,000	314	1072	1.30	4.15	264
Germany, bituminous, 1903.	128,569,808	470,305	273	826	1.75	6.35	274
France, bituminous, 1900.	34,123,901	158,580	215	224	1.41	6.56	296
Belgium, bituminous, 1902.	25,217,835	134,889	187	144	1.06	5.71	289
Austria, bituminous, 1903.	13,964,931	66,663	209	114	1.71	8.16	289

pay rolls of the employers of labor, this tax to be administered by a State commission, one-third to be appointed by the Governor and two-thirds to be elected by the people, the duty of this commission would be to administer the fund so collected and to see in case of death that the widow is cared for and the children are well educated and reared in the proper manner, and in case of an accident, not involving death, to pay to the injured person a weekly indemnity equal to the average weekly wage earned by him during the three years preceding. In other words, place a tax on the employers of labor sufficient to prevent their employees, and the wives and children of their employees, suffering from want due to accidents over which they had no control; this would place the injured in position to receive in case of such accidents money which would be due them under this law and which would not be administered as a charitable contribution. The disasters during the past year in blast furnaces, coal mines, railroads, etc., are evidence that we need such a law as suggested and need it badly.

The mining laws of the State of Pennsylvania say to the operators employing miners: "You must employ certificated mine foremen, certificated fire bosses, and place them in absolute charge of your mines. You must furnish them with all the supplies necessary for the operation of these mines, and your superintendents (practically meaning the owners of the mines) must not interfere with these men in the discharge of their duties." These are wise precautions on the part of the State to protect the health and safety of employees in and about coal mines, but notwithstanding all these great precautions, a number of serious disasters have occurred. It is certainly a fact that these State officials (known as mine and fire bosses) would not go into the mines and spend their entire time there, and permit the miners to continue operations if they did not consider the workings absolutely safe.

During the past year, we have made great strides in the knowledge of mining, but the personnel of the men in charge and the personnel of the men employed are an important factor in the safe working of coal mines. It is an old saying that "familiarity breeds contempt," and the fact that a man has done something a hundred times without observing the necessary care, and escaped injury, breeds within him a contempt for the danger and sometimes creates a reckless disregard for his own safety as well as the safety of others. This is the most difficult factor to guard against.

It is absolutely impossible to prevent all accidents in the mines, but what we must do is to figure out the best methods of reducing to the lowest degree the pos-

sibility of accidents. When we take into consideration that about 85 per cent. of the accidents in mines are due to causes other than explosions of gas and dust, or blown-out shots, and that more than 50 per cent. of these accidents could be prevented by care on the part of the persons injured, it is easy to see what good a more rigid police regulation in the mines will mean in the future production of coal in this country.

The mine inspectors of our State are clothed with police power. They are all practical miners, who, by their natural ability, have risen from the miners' ranks, and by study of mining conditions, have fitted themselves for the positions they now hold. They are making a special study of the best methods to protect the men under their care, and I feel confident that with the coöperation of the miners and operators of this country, we will soon be able to show a much lower ratio of accidents to the number of men employed.

Coal and Coke Production in the United States

The following table has been compiled largely from data communicated by the several State mine inspectors, estimates having been made only where no such statistics were available, but in all cases upon the basis of good information:

PRODUCTION OF COAL IN THE UNITED STATES.

States.	1907. Short Tons.	1908. Short Tons.
Bituminous:		
Alabama.....	14,417,863	11,950,000
Arkansas.....	1,930,400	1,750,000
California and Alaska.....	45,300	55,000
Colorado.....	10,920,527	9,773,000
Georgia and North Carolina.....	365,300	275,000
Illinois.....	(c) 51,317,146	48,000,000
Indiana.....	11,692,072	12,000,000
Iowa.....	(a) 7,568,424	7,050,000
Kansas.....	6,137,040	5,600,000
Kentucky.....	10,207,060	9,526,000
Maryland.....	5,529,663	5,000,000
Michigan.....	(b) 1,898,446	2,000,000
Missouri.....	4,350,000	3,900,000
Montana.....	1,810,000	1,800,000
New Mexico.....	(a) 2,302,062	2,725,000
North Dakota.....	268,300	250,000
Ohio.....	32,465,949	30,000,000
Oklahoma.....	3,450,000	3,250,000
Oregon.....	51,600	25,000
Pennsylvania.....	149,759,089	118,309,000
Tennessee.....	6,760,017	5,009,000
Texas.....	1,300,000	1,250,000
Utah.....	1,967,621	2,000,000
Virginia.....	4,570,341	4,000,000
Washington.....	3,713,824	3,000,000
West Virginia.....	47,205,965	44,091,000
Wyoming.....	6,218,859	6,100,000
Total bituminous..	388,222,868	338,688,000
Anthracite:		
Colorado.....	45,113	30,000
New Mexico.....	17,000	10,000
Pennsylvania.....	86,279,719	80,240,000
Total anthracite...	86,341,832	80,280,000
Grand total.....	474,564,700	418,968,000

(a) For the fiscal year ending June 30.
(b) For the 12 months ending November 30, 1907.
(c) As reported by the U. S. Geological Survey.

PRODUCTION OF COKE IN THE UNITED STATES.

States.	1907. Short Tons.	1908. Short Tons.
Alabama.....	3,096,722	2,800,000
Colorado.....	1,097,051	854,000
Georgia and North Carolina.....	71,460	70,000
Illinois.....	372,697	270,000
Kentucky.....	77,055	60,000
Montana.....	31,400	30,000
New Mexico.....	203,437	260,000
Ohio.....	310,640	250,000
Oklahoma.....	57,600	50,000
Pennsylvania.....	23,516,309	11,287,000
Tennessee.....	495,200	250,000
Utah.....	324,692	290,000
Virginia.....	1,622,734	1,200,000
Washington.....	61,400	48,000
West Virginia.....	4,078,222	2,978,000
Other states (c).....	1,650,000	2,000,000
Total.....	37,066,619	22,697,000

(c) Includes output of by-product coke for Massachusetts, Maryland, Minnesota, New York, Michigan, Wisconsin, New Jersey.

If the production of coal in 1908 had shown as large an increase as in 1907, the long predicted half-billion total would have been reached. To satisfy our fuel demands during the last 12 months, we have exhausted about 61 square miles of our available coal lands. If our production should remain stationary, at this total, in future years, it would require over 6000 years to exhaust our coal beds; if, however, the future production should increase at a rate equal to that shown in 1907, the available coal seams would last only about 200 years.

Mineral Output of Japan

The following table, taken from the *Yokohama Chamber of Commerce Journal*, shows the output of various minerals in Japan during the six months ending June, 1908, and the corresponding period of 1907:

	1908.	1907.
Gold.....	297.30 momme ¹	305,098
Silver.....	14,129,593 momme ¹	10,820,357
Copper.....	28,474,318 kin ¹	27,768,090
Iron.....	4,954,794 kwamme ¹	5,779,875
Coal.....	5,945,718 tons	5,793,896
Kerosene....	703,508 koku ¹	723,946
Sulphur.....	19,992,554 kin	18,570,885

COPPER EXPORTS

The export of copper to foreign countries during the first half-year is stated to be 28,630,000 kin worth 10,700,000 yen.¹ The following table shows the quantity and value of export for the last three years:

	Quantity. Kin.	Value. Yen.
1905.....	34,040,000	16,040,000
1906.....	56,670,000	25,100,000
1907.....	53,450,000	29,260,000

The copper is chiefly exported to China, Hongkong, England, France, Germany, and America.

¹ 1 momme = 57.97 grains; 1 kwamme = 8.28 pounds; 1 kin = 601.04 grains; 1 koku = 39.68 gallons; 1 yen = 2s. 0.58d., or 49.95 cents.

The Petroleum Industry of the United States

Production of California, Texas, Louisiana, Lima, Illinois, Mid-continental and Appalachian Fields. Developments in Various Districts

PRODUCTION, 184,734,678 BARRELS

As shown in the accompanying table, the production of crude petroleum in the United States during 1908 showed a large increase over that of 1907.

PRODUCTION OF CRUDE PETROLEUM IN THE UNITED STATES.

Field.	1907.	1908.
California.....	40,085,000	45,000,000
Colorado.....	400,000	(a) 400,000
Gulf {Texas.....	12,350,000	11,904,000
{Louisiana.....	4,620,000	5,896,000
Illinois.....	24,540,024	38,000,000
Lima {Indiana.....	8,030,000	7,287,000
{Ohio.....		
Mid-continental (c).....	47,556,906	50,741,678
Kentucky-Tennessee.....	1,250,000	(a) 1,250,000
Appalachian (d).....	25,500,000	24,240,000
Wyoming.....	13,000	(a) 13,000
Others.....	3,000	(a) 3,000
Total.....	164,347,930	184,734,678

(a) Estimated as the same as in 1907.

(c) Kansas and Oklohoma.

(d) Pennsylvania, New York, West Virginia and eastern Ohio.

California

When California was producing about 20,000,000 bbl. of petroleum per annum, and the prices at the wells were around 20c. per barrel, it was considered that there was an overproduction, owing to the fact that consumption did not keep pace with the gradually increasing yield. In fact at that time many productive wells were capped because the prices were unsatisfactory and a ready market was not found except for the product of the larger companies which had commercial or business facilities for disposing of their oil in a profitable manner. There was some uncertainty as to continuance of supply and difficulty in delivery at specified time. Probable consumers were afraid that they would be unable to obtain the necessary supplies regularly, and continued with their old systems. The railroad companies hesitated to put large amounts of money into oil cars when they knew that eventually pipe lines for oil transportation would be built, and the cars would become useless. The shortage of oil cars for this reason prevented developments which were contemplated in the various fields.

These conditions have changed. Pipe lines have been built not only from the valley fields to tidewater, but also from the various fields to the main lines, and even to productive individual wells. The demand has increased with the production, so that even with the more than doubled output and the trebled price all the oil which is produced is readily dis-

posed of. In virtually all the large railroad manufacturing and power enterprises of the State, fuel oil has displaced coal in the boilers. As a steady supply of oil is assured, there is no hesitation in making contracts for steady supplies, with no fears of interruption or necessity of changing back to old systems of firing.

While there has been a great increase in the consumption of fuel oil, there is little increase shown in the output or consumption of by-products. The revival of the various manufacturing interests of the State since the great disaster in 1906 and the resultant increase in the business of the railroad companies form two of the most important factors in the increased demand for fuel oil. A few years ago 30 per cent. of the cars were laid up on the main railroad lines for lack of business, but now all are in use, requiring many more locomotives and causing a greater consumption of fuel oil. In the steamship business much larger quantities of fuel oil are now used than formerly, while the rapid multiplication of industrial enterprises and the demand throughout the State for power for various purposes has also increased the use of fuel oil.

California is now producing about 45,000,000 bbl. of oil a year, that being the estimated output for 1908. In 1907 the yield was 39,748,375 bbl. valued at \$14,699,956, or about 37c. per bbl. In 1906 the average prices was 29c. per bbl. In 1908 the average price at the well to the producers was about 50c. per bbl., and at the end of the year it was perhaps higher than 60c. per bbl. All the old contracts have been "worked up" and the new ones being made vary from 50c. to 63c. per barrel.

As this is very encouraging to the oil men, every effort is being made to enlarge the output. In 1908 some of the companies nearly doubled the yield of the previous year; much prospecting is going on in undeveloped territory and new wells are being sunk in proved areas. Indeed had the daily yield of all the wells of the State continued throughout the year in the same proportion as it was in October and November, the total output for 1908 would have exceeded 50,000,000 bbl. The daily output was in those months about 140,000 bbl. The Kern River field heads the list in amount of daily production, followed in order by Coalinga, the Lom-

poc and Santa Maria, and the Los Angeles-Salt Lake fields. In the Kern River field there are 1090 producing wells which average 35 bbl. a day per well. In Coalinga there are 385 wells yielding an average of 80 bbl. a day per well. In the Santa Maria field the wells are averaging a daily product of 200 bbl. a day per well. In other fields the flow from the producing wells varies from 20 to 70 bbl. per day.

In 1907 there were 2630 wells which were producing but the figures for 1908 are not yet available. When the entire number of productive wells in a field is considered, the average daily production per well is not nearly as high as many persons imagine. Some will run high and others low, but, when the sum total is added, the aggregate may become quite large. For example, in 1907 the Kern River field had 840 productive wells, which averaged a daily yield of 40 bbl. a well. The average of a smaller number of wells in the McKittrick field was 102 bbl. per day and in the Midway, the average was 87 bbl. while it was only 47 bbl. in the Sunset field. At Coalinga 247 wells averaged 99 bbl. a day per well. At Santa Maria and Lompoc combined the average per well was 291 bbl. per day, there being 80 wells in the field. At Santa Paula and Newhall the average was 4 bbl., and in the Salt Lake field of Los Angeles 80 bbl. per diem.

DEVELOPMENT DURING 1908

The increase in consumption of California fuel oil in 1908 is general and is from 20 to 25 per cent. over the amount in 1907, both for industrial and railroad uses, and the output is expected to keep pace with this. In one field alone—the Kern River—there was in 1908 an increase of 25 per cent. in the number of productive wells compared with the number in 1907 and, while the increase is not so large in other fields, yet there is an apparent increase in all, with the possible exception, perhaps, of the Santa Maria field which has not quite "held its own." In that field a large amount of water is being pumped with the oil, and it has not been found possible thus far to shut this water off.

A great deal of "wildcat" drilling is going on in most of the fields, especially between Coalinga and Sunset, but there are possibilities of opening up a great production in that region. In the Mid-

way field in Kern county somewhat lighter oils are obtained in the wells at some distance from the area where the outcrops are. In the Monterey County region where much prospecting has been done lately there is as yet no production to note. The drilling in that vicinity is hard and slow for there is much granite drift to pass through.

The pipe line 280 miles long, from the Kern river field to Port Costa, at tidewater, was completed in 1908. It is an 8-in. rifled pipe line owned equally by the Associated Oil Company and the Southern Pacific Railroad. Between Bakersfield and Port Costa there are 12 pumping stations, for both water and oil, on this line. The "rifling" of the pipe gives it a much greater carrying capacity with heavy fuel oil, than an ordinary smooth-bore pipe has. This is the second pipe line from Kern county to tidewater.

The Associated Oil Company intends building another pipe line from Sunset on through the Midway, the McKittrick, and the Devil's Den fields to Coalinga. The fields in Santa Barbara county have their pipe lines to the ocean, and there is one from Fresno county to Monterey bay.

The average California oil is quite heavy, with an asphalt base, and lighter oils for local purposes are greatly in demand. Many rigs are at work prospecting for low-specific-gravity oils in what are considered likely regions. This light oil is needed for refining purposes.

The Japanese are large consumers of California fuel oils and have extensive contracts, mainly with companies owning wells in the Santa Maria field. It is understood that they would take 10,000,000 bbl. yearly if that quantity could be guaranteed for delivery at satisfactory prices. They have some fear, however, that the amount desired could not be supplied regularly at stated periods. There is at present in California a party of Japanese oil experts looking over the different fields, and investigating their ability to supply the Japanese demand. There is some talk of these Japanese buying out entirely certain productive fields or companies.

The owners of productive wells in California are quite independent, for they have an assured market and get good prices for their oil. In the valley fields when a good productive well is struck they can, without much difficulty, get someone to build a branch pipe line to it. They are not dependent on a refining company, for their fuel oil does not have to be handled by others to become a marketable product, as is the case with illuminating oils. They get the ground, dig the well, and get out the oil in the same way relatively that the farmer gets his crop. As soon as the oil is pumped it is salable, and there are plenty of

people ready to take it, or make future contracts for it. Moreover, there are a number of California capitalists ready and willing to invest in oil and oil lands, to develop territory, to build pipe lines, etc. Under these circumstances no one company can control the various fields and fix prices. For these reasons the owners of oil wells are becoming particularly independent, and self-reliant.

THE OUTPUT OF THE LEADING COMPANIES

The various oilfields are gradually being enlarged as new wells are sunk and developments progress. All have now good transportation facilities to tidewater, and large refineries are numerous. A great amount of prospecting is being done in new sections which promise good results, and much money is thus being expended in finding new oil-yielding areas. Meantime, in the older fields more extensive operations are being carried on, and deeper explorations are being conducted.

The California Stock and Oil Exchange of San Francisco, in its monthly statement of dividends paid by active listed California oil companies for the month ending Nov. 30, 1908, gives the following:

Total dividends paid to date: Alma, \$136,800; Amalgamated Oil, \$800,000; Apollo \$4,000; Associated Oil, \$1,522,309; Brookshire, \$322,500; Caribou, \$377,720; Chicago Crude, \$15,000; Claremont, \$197,000; Coalinga Pacific, \$39,000; Columbia, \$154,886; Esperanza, \$20,650; Euclid, \$68,000; Four, \$186,000; Globe, \$51,000; Hanford, \$80,000; Home, \$442,000; Homestake, \$69,250; Illinois Crude, \$48,000; Imperial, \$1,640,000; Junction, \$2,500; Kern River, \$92,000; Linda Vista, \$26,870; Lucile, \$8011; Monte Cristo, \$265,000; Nevada County, \$40,000; Peerless, \$741,000; Piedmont, \$11,317; Pinal, \$594,841; Pittsburg, \$124,800; Reed Crude, \$1,107,000; Rich Ranch, \$69,000; Royalty, \$200; S. F. & McKittrick, \$75,000; Sauer Dough, \$329,175; Sovereign, \$65,000; Sterling, \$247,000; Superior, \$30,000; S. W. & B., \$15,080; Thirty Three, \$640,000; Union, \$4,420,961; United Petroleum, \$1,532,952; Wabash, \$72,000; West Shore, \$225,000; Western Union, \$484,951; total dividends paid to date, \$17,393,772; total dividends paid by the above companies for November, 1908, \$358,220.

The total dividends paid up to date by some California companies not listed on the Exchange to date, as copied from other official records are: California Oil Fields, Ltd., \$1,750,000; Central, \$483,926; Continental, \$15,000; Fullerton, \$142,000; Olig Land Company, \$13,000; Olig Oil Company, \$35,000; Olinda Land Company, \$40,000; Perseus Oil Company, \$13,564; total, \$2,756,490; grand total, \$20,150,262.

Illinois

By H. FOSTER BAIN*

The oilfields of Illinois produced in 1908 a little less than 40,000,000 bbl. of petroleum. The returns for the year are not complete, but, estimating the December production as equal to that of November and that the tank-car shipments were very little more than in 1907, a total of 38,000,000 bbl. may be given as the approximate figure for 1908. The detailed pipe-line runs and miscellaneous receipts of the Ohio Oil Company for the first 11 months of 1908 are given in an accompanying table.

RECEIPTS OF THE OHIO OIL COMPANY, 1908.

	Pipe Line Runs, Bbl.	Other Receipts, Bbl.	Total, Bbl.
January.....	2,497,914	98,433	2,596,347
February.....	2,464,914	228,004	2,674,918
March.....	2,591,911	191,963	2,783,874
April.....	3,089,417	439,709	3,529,126
May.....	3,084,815	1,015,263	4,100,078
June.....	2,965,786	947,741	2,913,527
July.....	2,579,977	301,090	2,881,067
August.....	2,690,631	1,059,941	3,750,572
September.....	2,555,871	744,125	3,299,996
October.....	2,582,561	395,818	2,978,376
November.....	2,356,385	318,352	2,674,737

The bulk of the miscellaneous receipts consists of oil purchased in tanks when leases were transferred. No additional lines have been laid into the field though the Pure Oil Company is now laying a line to connect with the Tidewater line. The Indian Refining Company, the Sun Oil Company, the Cornplanter Oil Company, and the Robinson Oil Refining Company continue to ship in tank cars. As in past years production, except for a short time in May and June, ran ahead of the capacity of the pipe lines. For most of the season approximately 60 per cent. of the oil offered was taken. The price remained fixed at 68c. per bbl. for all oil above 30 deg. B, and 60c. per bbl. for that below 30 deg. B. The great bulk of the oil was marketed at the higher rate. On Dec. 1 the gross stock of the Ohio Oil Company amounted to 24,930,030 barrels.

DEVELOPMENT DURING 1908

The principal development work of the year was in Crawford, Lawrence and Clark counties, the largest wells being found in the deepest sands. Within the year Coles county, after repeated failures, became a producer. Drilling was active in the early summer, but the severe drought crippled operations in the fall.

On Jan. 1, 1908, it was estimated that 9772 wells had been put down. Of these 1260 were dry holes. In the first 11 months of 1908, 3296 wells were drilled, with 513 dry holes and 72,353 bbl. of new production. The record by months, taken as heretofore from the

*Director, State Geological Survey, Urbana, Ill.

Oil City Derrick, is given in an accompanying table.

WELLS DRILLED IN ILLINOIS DURING 1908.

	Average Initial Production.	Wells Completed.	New Production.	Dry Holes.
	Bbl.		Bbl.	
January.....	24½	303	6144	55
February.....	24½	157	3329	22
March.....	27½	187	4133	37
April.....	26	197	4285	33
May.....	29	264	6228	35
June.....	29½	390	9876	55
July.....	23	474	9475	65
August.....	23	417	8322	55
September.....	26½	344	7848	49
October.....	26½	290	6091	51
November.....	29½	273	6242	51

The drilling record for 1908 in southeastern Illinois, summarized by counties, is given in an accompanying table.

WELLS DRILLED DURING 1908 IN DIFFERENT COUNTIES, ILLINOIS.

County.	Wells Completed.	New Production, Bbl.	Dry Holes.
Crawford.....	2024	40,326	289
Lawrence.....	601	19,405	63
Clark.....	321	5,996	66
Coles.....	7	91	2
Edgar.....	3	15	1
Miscellaneous.....	27	10	25

Outside the old oil district "wildcatting" continued active throughout the year. The principal result was the bringing in of enough wells to start production at Sparta in Randolph county. Here the Sparta Oil and Gas Company made up of St. Louis people, has a group of wells a short distance east of the old gasfield. The oil comes from the Chester formation. After finding several 5- and 10-bbl. wells, one was shot which is said to have come in at 135 bbl. a day. The oil is shipped in tank cars and through field lines; approximately 50 bbl. a day are going out. Numerous other wells are being drilled in the vicinity.

IMPORTANCE OF THE CENTRALIA FIND

On Nov. 1 a well was brought in at Centralia in Marion county. Oil had been found here seeping into a coal mine along a fault plane. The well was drilled a short distance east of the mine; at about 600 ft. a good sand was found in the coal measures. After shooting, the well settled down to an 18-bbl. pumper. Numerous other tests are now being drilled in the vicinity. The significant points in this find are that Centralia is well toward the center of the great structural basin of southern Illinois and that the sand is of approximately the age of the Casey sand in which oil was first found in Clark county. This geological horizon is widespread, but as yet it has not been found productive in many places.

Small amounts of oil and gas continue

to be found at various points along the western edge of the basin, but so far without any important commercial result. The year as a whole has been quietly prosperous, and the outlook for 1909 is excellent. In 1908 there was no especial change in the situation as regards the production of natural gas.

Texas and Louisiana

SPECIAL CORRESPONDENCE

Nothing but the expected happened in the gulf, coastal and north Texas fields during 1908. Field operations declined, and while two new gusher fields were threatened, fortunately (most persons think) they did not materialize.

The Anse Le Butte district, which in 1907 seemed to promise a large output, simmered down, after the expenditure of a large sum in development, to the original discovery well and a few others in the immediate vicinity. Markham and Goose creek discoveries sent declining crude-oil prices to the lowest point of the year, only to prove a false alarm. Caddo slowly increased its output and prevented the coastal field from showing a decline in production.

Old districts were in some cases extended in area, and held up their production better than expected, so that the yearly output was satisfactory, in spite of the fact that Jennings during November reached its lowest output for many months.

While prices declined very much they were a fair reflex of conditions and above the normal when compared with mid-continent fields.

OUTPUT

The 1907 production in Texas was 12,322,696 bbl., of which 11,410,078 bbl. was derived from the coastal region. The Louisiana production for 1907 was 5,000,221 bbl. and the total coastal field output, 16,410,299 bbl. The 1908 estimates for Texas, as nearly as can be stated at the present time, are 11,904,000 bbl., of which about 10,010,400 bbl. is credited to the coastal field. The Louisiana output is placed at 5,896,000 bbl., making the total for the coastal field 17,000,000 bbl. The figures are only approximate, for the north Texas and the December output of the coastal fields are not definitely known.

The figures given above indicate a decrease of 418,000 bbl. in Texas, half of which is attributed to coastal fields, while Louisiana shows an apparent increase of 895,500 bbl., occasioned by the added output of Caddo and Anse Le Butte.

The selling price of crude varied greatly and was so much lower than in 1907 that the total value declined from \$14,-

000,000 in 1907 to about \$10,500,000 in 1908. Wildcat drilling was generally confined to local owners of land and State corporations, for oil operators who make a regular business of exploiting prospective oil territory were engaged in the mid-continent field, where the percentage of dry holes proved less than in Texas.

According to the *Oil Investors' Journal*, the number of completed wells in the coastal field in the 11 months to Dec. 1 was 748, of which 559 were oil producers, 21 gas wells and 168 dry holes. The record for a similar period in 1907 was 681 producing oil wells, 21 gas wells, and 213 dry holes.

In north Texas to Dec. 1, 1908, 65 wells had been completed, of which 20 were dry. The 1908 figures do not include those wildcat wells outside of the Markham and Goose creek fields, and the gas wells were mainly in the Caddo field though Humble and Henrietta contributed a few.

Jennings was again the largest producer, having an output of approximately 4,960,000 bbl. The production of the other leading pools was as follows: Humble, 4,011,000; Spindletop, 1,814,000; Sour Lake, 1,791,000; Saratoga, 1,774,000; Batson, 1,543,000; Caddo, 615,400; Anse Le Butte, 280,000 bbl. Other small producing pools were Markham, Goose Creek, Mission, and Welch. In north Texas Powell was the largest producer, followed by Corsicana and Henrietta.

COMMERCIAL CONDITIONS

The crude market opened weak in 1908 and the use of weathered crude from Oklahoma and northern Texas further depressed prices early in the year, so that the posted credit-balance prices (which may be taken as the base price paid consumers) ranged from 67 to 75c. The quotations compared favorably with those of 29 to 41c. per bbl. paid in Oklahoma, when the quality of the crude is considered, although it must be borne in mind that for fuel purposes (practically the sole use of coastal crude) an oil of 18 to 20 deg. B. is better than that of 30 to 32 deg. B.

The undoubted effect of high crude-oil prices in 1907 was shown in the 500,000-ton increase in the coal output of Texas for that year where previous years had shown a decline.

Quotations declined in March, April, and May, until the highest price posted was 60c., and in June the Gulf and Texas companies suspended quotations while the Sun Company prices ranged from 38 to 42c., a decline of more than 100 per cent. Stocks were increasing, demand was poor, and there was general uneasiness regarding the capacity of the new pools at Markham and Goose creek.

Buying by cotton compressors, sugar plants, and by the railways, combined

with the failure of the new pools and the operations of the Oil Producers Marketing Company raised the posted prices gradually to 55 to 57c. in October. Since then the market has remained weak. There is no valid reason for any advance in the near future unless production declines greatly, when local conditions may warrant higher prices.

If the proposed Prairie Oil and Gas Company pipe line from Oklahoma to New Orleans is constructed, a market now exclusively supplied by coastal crude will be divided and consumption further reduced. The preliminary survey of 520 miles for this line has been made, and all the interested Oklahoma municipalities have consented to the crossing of their highways. Under existing and probable future conditions coastal producers will be fortunate if the average price for 1909 equals that for 1908, which was about 60c. per bbl., compared with 84c. in 1907.

These prices do not apply to the Caddo field, the oil from which is not taken by the Southern pipe lines, but has been shipped by tank cars and for which recent prices have ranged from 35 to 38c. per bbl.

It became known during the year that the amount of crude carried as stored oil was much too large. The quantity deducted for evaporation, seepage and field consumption during the last few years was much too small, most of the discrepancy being occasioned by the extended use of crude in operating the large air compressors in the Jennings pool.

Careful investigation by the *Oil Investors' Journal* placed crude stocks on Oct. 1 at 3,130,000 bbl., and the amount of stocks on Dec. 31, was approximately 3,200,000 barrels.

LEGISLATIVE AND JUDICIAL PROCEEDINGS

The suits instituted by the State against the Standard Oil Company, Security Oil Company, Union Tank Line Company, and other alleged affiliated corporations resulted in a receiver taking charge of the Union Tank Line Company cars, which were promptly leased to one of the railways. The Security Oil Company succeeded in obtaining relief from the vexatious conditions of the injunction proceedings, and its large refinery near Beaumont was put in operation again in January. The suits which are for ouster and for penalties amounting to many millions with the customary collateral garnishee proceedings drag along subject to the usual legal quibbles and delays.

The protests against the burdensome Kennedy gross tax laws continued, but most operators paid the tax, only one or two, including the Southwestern Oil Com-

pany of Houston, are testing the constitutionality of the act.

LOUISIANA DISTRICTS

Production in Louisiana was confined entirely to fields located prior to 1908, although wildcats were drilled in Rapides, Webster, Terrebonne, Winn, Saint Landry, and Calcasieu parishes during the year. The Welch pool remains small and practically no effort was made to develop it.

The Jennings pool was extended about a half mile westerly, the most important development since the Latrille 40-acre extension in 1907. Many of the new wells had an initial flowing output of 3000 to 5000 bbl. daily. After a brief period compressed air was used on them giving a much larger output than they would have yielded under the pump. The pool is not only the largest producer in Texas or Louisiana, but also leads in average production per well.

More than 50 new wells were drilled in 1908, but the last months of the year show a rapid decline in field operation and production. The maximum output of Jennings was 557,000 bbl. in March and the minimum, 320,000 bbl. in November.

The Anse Le Butte pool proved a disappointment, despite active work and a very large expenditure of money. Salt water is the greatest detriment encountered, and the few producing wells are confined to those in the vicinity of the original well drilled by the Lake Oil Company. The average daily output does not exceed 1000 bbl., and the production for 1908 was about 280,000 barrels.

Caddo field operations were gradually extended during the year, and this pool will certainly be the most active one in Louisiana during 1909; 50 wells were completed up to Dec. 1, 1908, and the total output is estimated at 615,000 bbl. The proved field now extends over an area of many square miles and both the United States and State Geological Surveys are investigating its resources and geology. Conditions are radically different from those of the large gusher fields of the coast (which are of small area) and will be more slowly developed. While the gas wells are of large capacity the oil wells are small producers when compared with those of Spindletop, Saratoga, or Humble. Drilling is expensive in addition to being slow and hazardous on account of the enormous gas pressure usually found in the overlying strata at 820 to 940 ft. Most of the producing oil wells are in the 2200 to 2275-ft. sand, although there are several in a sand at 1580 ft. The gravity of the oil varies from 24 to 39 deg. B., and the initial production runs from 100 to 400 bbl. per well.

The output in January, 1908, was only

8000 and gradually increased to 90,000 bbl. in December.

TEXAS DISTRICTS

Humble and Spindletop were the only pools showing an increased output as compared with 1907. Humble's large production was caused by active development in the northern extension of the proved field. Completed wells to Dec. 1, aggregated 234, a number three times as large as in any other Texas field. The average initial capacity of the wells was also greater than in any pool outside of Jennings.

Spindletop production increased slightly, and field work was more extensive than at Batson or Saratoga. The only feature at Sour Lake was the expanding of the proved area 450 ft. easterly, while at Saratoga drilling into the deeper sand at 1490 ft. prevented a more serious decline than would otherwise have occurred.

The small pools at Mission, Liberty, Dayton, and Piedras Pintas were only notable for inactivity and their output was confined to a few wells of limited capacity.

In Clay county, northern Texas, some excitement was caused by the bringing in of a few oil wells of larger flow than usual. Gas wells of great volume were also located and are being utilized by the Navarro Refining Company to supply the cities of Henrietta and Wichita Falls, with a probable extension of the pipe line to Dallas and Fort Worth.

None of the wildcat wells scattered through Texas created anything more than local interest other than those located at Markman and Goose Creek. The first-named field is in Matagorda county, 6½ miles northwest of Markham, a station on the Victoria division of the Southern Pacific Railway. The topography of the district is similar to that of other coastal fields. Gas seepage induced the Hardy Oil Company to drill a well which was brought in early in June at a depth of 1370 ft. The pay sand resembles that at Jennings, the gravity of the crude is 22 deg. B., and the initial capacity of the well was about 80 bbl. per hour. The Rio Bravo Oil Company (Southern Pacific Railway) promptly laid a pipe line to the railway and contracted for the output at 50c. per bbl. Another well of smaller capacity was soon brought in, but subsequent field operations by the Guffey Company and others extended over a wide area failed to find any extension of the pool. Production soon fell off and in consequence of the failure to "make good" the field is practically idle at the present time, although there is a bare possibility of its developing into a fair producer. The output to date has been about 60,000 barrels.

Goose Creek, the other discovery which

gave promise of being another gusher field, was located about the same time as Markham. The territory lies in Harris county, 25 miles east of Houston at an altitude of 30 ft. above the level of Galveston bay, and only a mile distant from the barge channel. The discovery well was the third test hole drilled by Armstrong, Peden & Co., the second well having yielded a small amount of oil which was utilized for fuel. Well No. 3 was finished at 1600 ft. (much deeper than usual in similar formations along the coast) and yielded about 700 bbl. daily, of 18 deg. B. gravity crude. The Producers' Oil Company acquired the producing property and drilled about ten wells to determine the area of the field. All these holes proved dry except one or two in the immediate vicinity of well No. 3. Several wells are now going down, but most operators have formed an unfavorable opinion regarding their success, although their opinion may be fallacious. The Texas Company has laid a pipe line to the barge channel, so that water shipments can be made, but the output so far is merely nominal.

FUTURE PRODUCTION

It is unlikely that the Texas-Louisiana production will decline materially in 1909, for while the old fields are failing they are still capable of development and will be actively worked. Caddo will surely increase its output and make up largely for the deficiency in other fields. There is also the possibility that Markham and Goose Creek will develop into fairly good fields, although it must be admitted that operators are pessimistic.

It is to be hoped that no very large pools will be discovered in the near future, for the present supply fully equals consumption in local markets and a new gusher field would cause a fall in crude prices demoralizing to producers in the old pools.

Oil and Gas in the Mid-continental Field

BY ERASMUS HAWORTH*

During the year 1908 no remarkable developments were made anywhere in the Mid-continental field, either in oil production or gas production. Drilling was greatly diminished compared with either of the previous two years. Nevertheless, many rigs were in operation almost constantly and in the aggregate a great many new wells (something more than 1600) were brought in. In Oklahoma drilling was confined principally to a search for oil, and, therefore, gas developments in the main were incidental, while in Kansas

more than half of the drilling was done expressly in a search for gas.

OIL.

Drilling was continued practically in every district in Oklahoma, particularly in the Glenn pool area and the Alluwe shallow pool area. The Glenn pool remained the largest producer, aggregating 50,000 bbl. daily throughout the year. The Alluwe area was greatly extended northward and its total production materially increased. Production in the vicinity of Dewey, and generally throughout the Osage, declined. Scarcely a well was drilled for oil in Kansas, and the production in this State was greatly reduced. Numerous wells are standing idle which would produce in the aggregate large amounts of oil were prices better, but with the ruling low prices they would not pay to operate.

(Standard) again was the principal purchaser of oil, although not so emphatically so as previously. The company's total runs aggregated 33,181,951 bbl., the December runs being estimated, which gives a daily average of 90,661 bbl. Of this amount 25,273,941.54 bbl. were delivered to the refineries, the remainder going to storage. At the end of the year the Prairie Oil and Gas Company, therefore, had a total storage of 38,971,913 barrels.

The largest independent purchasers of oil were the Gulf Oil and Pipe Line Company and the Texas Oil Company, each of which purchased more than 5,000,000 bbl. The independent refineries are on the increase and this year consumed perceptibly more oil than the same class of refineries did in 1907. A number of other firms shipped large quantities of oil by rail from different points in Oklahoma,

CRUDE OIL BOUGHT BY PRAIRIE OIL AND GAS COMPANY DURING 1908.

Month.	Total Runs, Bbl.	Daily Average, Bbl.	Deliveries, Bbl.	Stored, Bbl.
January.....	2,914,843	94,027	2,332,098	582,745
February.....	2,773,592	95,641	2,005,285	768,308
March.....	2,985,697	96,313	1,994,992	990,705
April.....	2,979,844	99,328	1,941,284	1,038,561
May.....	2,487,426	80,240	1,987,441	499,985
June.....	2,395,326	79,844	2,162,765	232,561
July.....	2,950,757	95,186	2,326,524	624,233
August.....	2,858,651	92,215	2,353,609	505,042
September.....	2,674,264	89,142	2,405,831	268,433
October.....	2,773,996	89,484	2,297,333	476,333
November.....	2,620,725	87,358	2,310,282	310,443
December.....	2,766,829	89,248	2,192,497	574,333
Total.....	33,181,951		25,273,942	6,871,681

OIL PRODUCTION, MID-CONTINENTAL FIELD, DURING 1908.

Prairie Oil and Gas Company.....	33,181,951 bbl.
Texas Oil Company.....	5,298,545
Gulf Oil and Pipe Line Company.....	5,654,182
Independent refineries.....	3,107,000
Fuel Oil, crude.....	1,750,000
Independent shippers.....	1,750,000
Totals for year.....	50,741,678

PRICES.

No change whatever occurred in the prices of crude oil throughout the year; oil of 32 deg. B or lighter brought 41c. regularly. During the year oil prices in Indiana, Ohio, West Virginia, and Pennsylvania had slight fluctuations, the highest price paid in Pennsylvania reaching \$1.78; Lima, Ohio and Indiana oils, around \$1; Kentucky oils, \$1; Corsicana, Texas, light oils, 70c.; heavy oils, 48c.; Illinois regular, 68c.; and under 30 deg. gravity, 60c. Why such a great discrimination is made by the large purchasers of oil in the Mid-continental field is known only to the purchasers themselves. Probably the public would all guess in the same direction, i.e., that the low price is maintained simply because it is in the power of the purchasers to maintain it. It was hoped by the producers that when the independent pipe lines were put in operation, prices would be advanced, but no apparent change resulted.

PRODUCTION.

The Prairie Oil and Gas Company

the more important shipments being made by W. G. Barnes, Haywood Oil Company, Quaker Oil Company, W. H. Milliken, Laurel Oil Company, Benson Oil Company, Kansas-Oklahoma Oil Company, Superior Oil Company and a few others shipping smaller amounts.

To all of these sums must be added the amount of crude oil used for fuel, which was fully as great as in any previous year. In the following estimates no account was taken of the amount of oil stored by the producers. It is probable that the total storage in the field at the end of 1907 was as great if not greater than at the close of 1908. The figures included in the following tables, therefore, are for the actual deliveries to purchasers. These tables summarize the entire statistics for the year. It should be noted that there is a slight discrepancy in the figures given out by the Prairie Oil and Gas Company, the amount put in storage plus the deliveries not being quite equal to the total runs. The error evidently was an unintentional one, but suf-

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ficient data were not at hand to make the slight corrections desirable.

REFINERIES.

Of the refineries using oil from the Mid-continental field those of the Standard at Neodesha, Kan., and at Sugar Creek, near Kansas City, are much the greater. They consumed the principal part of the 25,000,000 bbl. delivered by the Prairie Oil and Gas Company, the remainder going to the large refineries at Whiting, Ind. At the present time 25 different independent refineries are in existence, 17 in Kansas and eight in Oklahoma, all of which are in operation excepting four; two of these are closed down temporarily and the other two not quite completed.

These 25 refineries have an aggregate annual capacity of more than 3,500,000 bbl. consumption, and are located as follows:

Oklahoma: Big Heart, one; Chelsea, one; Muskogee, one; Oklahoma City, one; Okmulgee, one; Sapulpa, one; Tulsa, two (one closed down).

Kansas: Atchison, one (closed down); Caney, one; Chanute, four; Cherryvale, one; Coffeyville, three (two not yet completed); Erie, one; Humboldt, one; Longton, one; Moran, one; Niotaze, one; Paola, one; Petrolia, one.

The refinery at Paola changed hands late in 1907, at which time it was reported that it was bought by the Standard Oil Company. Since then this report has been denied, and at present the public is uninformed as to where the ownership lies. These independent refineries consumed a little more than 3,000,000 bbl. of oil during 1908.

FUEL OIL.

A large amount of fuel oil is used in the great-plains area of western Kansas, Oklahoma and Texas, and eastern Colorado and New Mexico, a large proportion of which is drawn from the Mid-continental field. Some of it is taken directly from the wells, the remainder being supplied by the refineries after the lighter oils have been removed.

The plains area in general consumes but little fuel; yet in the aggregate it amounts to 4,000,000 to 5,000,000 bbl. annually. It is used by almost every flouring mill, ice plant, electric light plant, and other plants generating steam throughout the entire territory of the plains area where coal is high priced, it having been found that oil is cheaper than coal, especially on account of the lower labor cost involved in its use. Such a large consumer even as the portland cement plant at Yocemento, Ellis county, Kan., finds it advantageous to use oil for fuel.

GAS

But little change occurred in the gas situation in the Mid-continental field dur-

ing the year. At the present time the consumption in Kansas is exceedingly large, while that in Oklahoma is but little more than a year ago.

In Kansas the Kansas Natural Gas Company is the largest consumer. The principal addition to its pipe lines during the year 1908 was in a greater extension of the service in Kansas City, Mo. At the close of 1907 less than half of Kansas City was supplied with natural gas, but before the winter season had passed the greater part of the city was reached with the supply pipes. Pipe-laying was continued during the summer so that at the present time practically all of Kansas City and its suburbs are supplied with natural gas from the Kansas fields. Here is a city which, including Kansas City, Kan., and all suburbs, has a population of nearly 400,000 using natural gas for domestic purposes. Nearly all of the smaller factories use it, while some of the larger factories employ the gas during the summer season.

The supply pipe lines were also considerably extended in the Joplin zinc mining district, thus reaching hundreds of consumers which were not supplied with gas during the year 1907. The Kansas Natural Gas Company's pipe lines extend east from the gasfields as far as Joplin, Mo., and supply gas to every town and village along the line, including Parsons, Oswego, Cherokee, Pittsburg, Baxter Springs, Galena, Joplin, Webster City, Carterville, Carthage and many other places. The company's pipe line also extends north from the gas fields to Lawrence and Topeka, to Leavenworth, Atchison, St. Joseph, Mo., and Kansas City. During the year 1907, according to official statements of this company, the income from sale of gas was a little more than \$3,000,000. For the year 1908 it will aggregate about \$4,000,000.

THE SUPPLY

A great deal of complaint was made last winter at Kansas City about the insufficiency of the supply of gas. Similar complaints were made from St. Joseph and Topeka, but to a much less degree. The gas company answered such complaints with the statement that large pumps, which would guarantee an abundant supply in the gasfield were in process of being installed; during the latter part of the winter and throughout the summer of 1908 a large pumping plant was installed at Scipio, a few miles north of Garnett, Kan., and another large one in the heart of the Montgomery County gasfields, five or six miles south of Independence.

The months of November and December, 1908, were so mild that no opportunity

offered for testing the adequacy of these pumps. It is hoped, however, that they will prove sufficient to supply all the gas that may be needed in the near future.

The second largest consumer of gas in the Mid-continental field is the Wichita Gas Company, which has laid a pipe line from the Montgomery county field westward to Winfield, Arkansas City, Wichita, Hutchinson and other towns in south central Kansas. This company has holdings in Oklahoma but obtained the main part of its gas from the Montgomery County fields, picking up a very considerable amount from various wells in Chautauqua and Cowley counties. In addition to supplying practically every residence and business house in the various towns and cities reached by its line, the company also supplies the smaller manufacturers and to a considerable extent the salt plants at Hutchinson and Sterling, where large quantities of evaporated salt are produced.

The zinc smelters and portland cement plants come next in quantity of consumption, particularly the cement plants. The year 1908 was not a very prosperous year for zinc smelters, many of the plants being idle a considerable portion of the time, which reduced the consumption of natural gas. This reduction was offset in a way by new smelting plants built at Bartlesville and Coffeyville. Most of the cement plants, however, were in operation practically all the time, especially throughout the first half of the year, and consumed more gas than the cement industry consumed in 1907.

Three new plants were added to the list of consumers, one at Fredonia, Kan., which started late in 1907; one at Dewey, Okla., which began operations in the spring of 1908; and one at Chanute, Kan., which began during the latter part of the summer of 1908. With these additions it is evident that the total gas consumed by cement plants was fully equal and probably greater than that in 1907. The glass plants, brick plants and other factories have remained about as they were and their consumption of gas is, therefore, practically the same as in 1907.

RATES.

The rate at which natural gas is sold is almost uniformly 25c. per 1000 cu.ft. for domestic consumption, with a penalty attached if payment is not made by the 10th of each month. This is the price throughout practically the entire extent of the Kansas Natural Gas Company's pipe line service. In a few places a rate of 30c. is made. The Wichita Gas Company likewise charges 25c. in most places, but in the western part of its territory the rate is 30c. Each pipe line makes a great reduction for factories, the rate of 10c. per thousand being most common.

One or the other of these companies has bought out the local company in almost every town and village in the gas region, so that at the present time citizens of Topeka, Lawrence, Leavenworth, etc. obtain gas as readily and at the same rates as do the little villages in the heart of the field.

OKLAHOMA

In Oklahoma conditions are different. The rulings of the secretary of the interior on leased Indian land and the enforcement of the new law in the State prohibiting the piping of gas out of the State, thus far has prevented any considerable amount of gas being taken outside Oklahoma. Rumors are current that in at least one instance the law is evaded, and that a secret pipe line crosses the State boundary, but such rumors lack public confirmation.

One of the results of the enforcement of the State law and the rulings of the secretary of the interior is that no strong company has yet laid extensive pipe lines anywhere in the State for the purpose of supplying gas to the market. Each town in a measure, therefore, has its own pipe line, and obtains its supply from nearby pools. Very recently the Henry Oil and Gas Company arranged to build a 12-in. pipe line from the Hogshooter district into Bartlesville, a distance of from 12 to 15 miles. This has become desirable on account of the rapid growth of Bartlesville, particularly in the manufacturing plants established. Likewise, Tulsa is preparing to increase its gas supply by laying a large pipe line from the strong gas wells in the vicinity of Collinsville, a distance of about 20 miles.

Rates paid by consumers of gas in Oklahoma differ greatly in different places, not only for factory purposes, but for domestic purposes as well. A number of the communities are supplied by the old fashioned flat rates at from 5 to 10c. a gas jet per month for lighting purposes, and from \$1 to \$2.50 on stoves per month for heating purposes. Elsewhere, but not very commonly, meter rates are established.

For manufacturing purposes gas is still offered at very low rates at a number of different places. Bartlesville, for example, immediately upon completion of arrangements to bring gas from the Hogshooter district, published far and wide that it would supply factories using large quantities of gas at the rate of 2½c. per 1000 cu.ft. for a number of years with an increase to 3c. later, which price was to rule throughout the life of the gasfields. Such offers are made in good faith and are used by different cities as inducements to draw factories.

GAS DEVELOPMENT IN KANSAS AND OKLAHOMA

Little attempt was made to obtain gas

in Oklahoma during the year, such wells as were obtained being incidental to oil developments. The only important exception to this statement lies with the Kansas Natural Company which did some drilling in Oklahoma expressly to develop gas. The result is that no new gasfield appeared, but here and there throughout the entire district frequently while drilling for oil good gas wells were obtained. In this way the supply was increased faster than the consumption; so that at the end of 1908 the portion of the Mid-continental field lying in Oklahoma is capable of producing a larger supply of gas than ever before.

In Kansas matters are different. Practically in every place where there was much hope for obtaining gas, drilling was prosecuted with zeal. The new field to the southwest of Chanute has been pretty well circumscribed on three sides, and a large amount of gas was obtained by various private individuals and small companies. The Kansas Natural Company also was alert and got hold of some exceedingly valuable holdings.

To the northeast of Chanute, and farther north by way of Humboldt toward Iola many wells were drilled, the great majority of which were successful, some of them developing from 10,000,000 to 15,000,000 cu. ft. per well. In the vicinity of Altoona also some excellent gas wells were obtained by the Altoona Portland Cement Company and private individuals. It is claimed by the cement company that it has one well with a capacity of 20,000,000 cu. ft. per day. Its territory virtually, however, is a southern extension of the pool southwest of Chanute already mentioned.

Farther north, in the vicinity of Colony, a small field of shallow gas was opened up with eight or nine wells ranging from 750,000 to 1,500,000 each. This, by the way, is an interesting locality, particularly on account of its non-productiveness. Colony is situated on the very summit of the most pronounced anticlinal ridge in the entire Kansas gasfield, and yet every deep well drilled in that vicinity has been a failure. The shallow field just mentioned lies east of town from two to three miles, and forms a narrow band trending a little northeast and southwest. The wells here are from 500 to 600 ft. deep, while the horizon supplying gas at Iola and elsewhere so abundantly in the State would be found at from 900 to 1000 feet.

The small gasfield developed more than a year ago in the vicinity of Rantoul near Ottawa is about the same as it was then, and in many respects is about like the Colony pool just mentioned. Here also may be named the Bonner Springs, and the Eudora pool, each of which furnishes a small amount of gas,

but neither of which thus far has been able to supply large quantities. The development during the past year lends but little encouragement to hope for great production from any of those light fields.

Farther west in the vicinity of Elmdale, Chase county, a small gasfield was developed more than a year ago, which remains about the same as it was when first developed. To the south and southwest from this place a number of small wells were found, particularly in the vicinity of Augusta and Arkansas City. It is to be hoped that future prospecting may increase the supply. Likewise, a little northeast of Elmdale in the same range 12 or 14 miles southwest of Council Grove light wells were found, but none of any particular promise for a strong gasfield.

The Appalachian Oilfield

BY HAROLD C. GEORGE*

The total production of petroleum in the Appalachian or the high-grade oilfields has been steadily declining for years. In 1908 there was a further decrease in the production, for the total production of petroleum in the Appalachian field for 1908 was 24,240,000 bbl., as compared with 25,500,000 bbl. in 1907, 27,345,000 bbl. in 1906 and 28,324,324 bbl. in 1905.

In addition to the natural decrease in production in the Allegheny field of New York State and practically all of the oilfields of Pennsylvania developments and operations have been retarded for several months by the drought and the resulting lack of water. Large numbers of pumping wells have stood idle for the past three or four months and consequently where such conditions existed no new wells were drilled.

It is only by the successful drilling operations in southeastern Ohio and West Virginia that the decrease in petroleum production in the Appalachian field has been gradual and slight rather than rapid and great.

West Virginia is the only district in the Appalachian field that holds out any great possibilities of increasing the supply of high-grade petroleum, for in the southwestern part of that State there is a large unprospected area. This region is now attracting the attention of prospectors. In both Jackson and Lincoln counties some prospecting was done during 1908, but as yet no large wells have been drilled. In Lincoln county nine wells were completed during April and May. These wells averaged 40 bbl. a day. In November twelve wells were completed which averaged 35 bbl. a day. Brooke county continues to lead all other districts in "gushers." The Follansbee pool in Brooke county and the

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Holidays Cove pool in Hancock county attracted much attention during 1908, but it is generally believed that these fields are now on the decline. This section of the State had remained unprospected and undeveloped for years, but finally, after much drilling, oil was discovered in that section of West Virginia which lies across the Ohio river from Steubenville, Ohio. Hancock county has long been noted for its large oil pools, but it is only recently that Brooke county has become a factor in the petroleum production of West Virginia. In Roane county operations continue most active and with profitable results. The best wells are found in the "Big Injun" sand.

In Kentucky and West Virginia weather conditions during October and November were very favorable for construction work in those sections of these States which are almost inaccessible in bad weather. Operators seized this opportunity to move in a large amount of material preparatory to drilling operations this winter.

The operations in southeastern Ohio have attracted some attention owing to the development of the Mingo pool, but like the Follansbee pool across the Ohio river in Brooke county, West Virginia, of which this pool is a part, the Mingo field also is on a decline.

All recent additions to the areas producing oil of Pennsylvania grade have been too small to have more than a temporary effect in checking the waning production. There was no change in the price of the high-grade petroleum during 1908. The price during 1908 staid at \$1.78 per barrel throughout the year; in 1907

The Adirondack Graphite Industry

By D. H. NEWLAND*

The Adirondack mines contributed the usual quota of crystalline graphite in 1908. For several years the production has averaged about 3,000,000 lb. annually, nearly all from the American mine at Graphite, Warren county. The success obtained in the operation of this mine by the Joseph Dixon Crucible Company has furnished an incentive to a great deal of exploration along the eastern border of the Adirondacks, which has demonstrated the widespread occurrence of the Pre-Cambrian graphite quartzites in that section, though workable deposits seem to be sufficiently uncommon. Besides the actual content in graphite, the size of the flake and freedom from other scaly minerals like mica are factors of prime importance in determining the value of a deposit.

The Crown Point Graphite Company and the Glens Falls Graphite Company were active during a part of 1908. The

The Lima Oilfield

By HAROLD C. GEORGE*

The oilfield of northwestern Ohio and northeastern Indiana known as the Lima oilfield has shown a falling off in petroleum production. The total production in 1908 was 7,287,000 bbl., as compared with 8,030,000 bbl. in 1907.

A large number of wells were abandoned in this field in 1908 and the production was maintained only by the increased activity in operation due to the higher market price prevailing in 1908 than in 1907. The average price paid for North Lima was \$1.03 per barrel as compared with \$0.93½ in 1907, and for South Lima \$0.98, as compared with 0.88½ in 1907.

There was a much smaller percentage of dry holes drilled in northwestern Ohio in 1908 than in 1907, as shown in the accompanying table, which gives the production of only those wells that were drilled during the year referred to.

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WELLS DRILLED IN THE LIMA OILFIELD IN 1907 AND 1908.

	Number of Wells Drilled.		Daily Production in Barrels.		Daily Production per Well Drilled in Barrels.		Per Cent. of Dry Holes.	
	1907.	1908.	1907.	1908.	1907.	1908.	1907.	1908.
Northwest Ohio.....	930	837	8,100	9,252	8.7	11.0	15	9
Northeast Indiana.....	682	413	5,673	3,405	8.3	8.2	20	19
Total.....	1,612	1,250	13,773	12,657	8.5	10.1	17	13.5

PRODUCTION OF WELLS DRILLED IN THE APPALACHIAN OILFIELD DURING 1907 AND 1908.

Field.	Number of Wells Drilled.		Daily Production in Barrels.		Daily Production per Well Drilled in Barrels.		Per Cent. of Dryholes.	
	1907.	1908.	1907.	1908.	1907.	1908.	1907.	1908.
Allegheny, New York.....	575	493	1,114	880	1.9	1.8	16.0	13.4
Pennsylvania.....	3,611	3,748	12,176	9,532	3.3	2.5	21.0	19.0
West Virginia.....	1,320	1,329	21,300	27,304	16.1	20.6	38.0	32.5
Southeastern Ohio.....	1,335	1,344	6,793	13,798	5.9	10.3	39.5	39.3
Kentucky and Tennessee.....	212	205	2,006	2,519	9.4	12.3	32.0	33.6
Total.....	7,053	7,119	43,389	54,033	6.1	7.6	27.0	25.0

the average price was \$1.74 per barrel. The accompanying table gives statistics regarding the production of oil wells drilled in the Appalachian field during 1907 and 1908.

In hydraulic sluicing operations in Victoria, Australia, according to D. B. Sellers, in the report for 1907 of the Secretary for Mines, the only improvement during the year was the introduction at the Creswick Black Lead and the Portugese Flat hydraulic mines of high-lift centrifugal pumps coupled in series so as to give the pressure necessary for hydraulicking the gravel.

former company opened a deposit near Eagle lake, about 10 miles from Crown Point, Essex county, where it has erected a new mill with a capacity of 75 tons of rock a day. The crude graphite from this mill is refined and finished at a second mill situated at Crown Point Center. The mines and mills of the Glens Falls Graphite Company are near Conklingville, 8 miles west of Hadley, Saratoga county.

Some development work has been done during the year on a graphite-bearing quartzite just north of Saratoga Springs.

*Assistant State Geologist, Albany, N. Y.

Cadmium

This metal continues to be produced in the United States by but one concern, viz., the Grasselli Chemical Company, of Cleveland, Ohio. The production in 1908 was about 10,000 lb. At the beginning of the year the price was \$1.25 per lb. Later it was reduced to 75c. At the end it was 80c. These prices are for round lots. The production in Upper Silesia in the first half of 1908 was 35,000 lb., against 36,500 in the corresponding period of 1907.

Wolframite in India

Wolframite was discovered in 1908 at Agargáon, seven miles southeast of Maunda, which is 20 miles east of Nágpur on the main road from Nágpur to Raipur. The ore is found in quartz veins intercalated in mica schist. The grade of the ore is good and the deposits are believed to be commercially workable. The discovery was made by J. Kellerschon, of Nágpur, agent in India for the Carnegie Steel Company.

Mining in the United States During 1908

History of the Year in Various Camps of California, Colorado, Nevada, Montana, Utah, South Dakota, New Mexico and Other States

REVIEWS OF PROGRESS

The mining industry in the United States in 1908 was more or less under a cloud, as appears from the following reviews, although in the second half of the year, and particularly in the last quarter there was an improvement in sentiment. Yet after all, 1908 was not a very bad year. The production of copper and gold increased, while the outputs of the other metals were not very much smaller than in 1907, except in the cases of iron and a few of the minor metals. The average prices for the year do not compare unfavorably with the averages for the last 10 years. Why, then, was there so much complaint? Chiefly because the abnormal prices of 1906-7 stimulated the operation of many mines which ought not to have been opened.

Alaska

Members of the U. S. Geological Survey who have recently returned from Alaska report no great advance in the mining industry in the southeastern part of the Territory, although at some of the mines in the Juneau district—the Treadwell group, the Perseverance, and the Eagle River mines—substantial progress was made and extensive mining and water-power projects were undertaken, which promise well for 1909. The following article is compiled from recent reports by the U. S. Geological Survey.

JUNEAU DISTRICT

At the Treadwell mine developments have been pushed on the 1450-ft. level, which is to be used as a base for deeper explorations, and to this level the Seven Hundred Foot and Mexican mine shafts will be extended. At the Ready Bullion mine explorations are being made on the 1500-ft. level. The stamp mills were in continuous operation throughout the year, and the gold production will be about the same as in 1907. The use of oil as a substitute for coal for all purposes at these mines has reduced the fuel expense considerably, and additional water power has been provided by the building of dams on Ready Bullion and Fish creeks. Work on a project to obtain power from Turner lake, on the east side of Taku inlet, 18 miles from Treadwell, is being advanced. This project will necessitate the transmission of power across Taku inlet, a distance of $2\frac{1}{2}$ miles.

At the Perseverance mine the lode de-

posit is now opened at the tunnel level for 1500 ft. in length and 60 to 100 ft. in width. The 100-stamp mill was in operation from June until November. Mining operations were in progress at the Alaska-Juneau mine from the last of June until the middle of October, and the 30-stamp mill was in continuous operation during that period. At the Eagle River mine developments were advanced, and the quartz veins which are displaced by faults, causing much difficulty in their exploration, have been discovered further in the mountain on the various tunnel levels. The 20-stamp mill on the property was supplied with ore obtained principally from the upper tunnel levels. Encouraging results are reported from the Yankee Basin prospects and from other properties within the Juneau gold belt, and also from the De Groff and Mills properties to the north of Sitka.

KETCHIKAN DISTRICT

The copper mines in the Ketchikan district suffered a considerable setback early in 1908 because of the decrease in the price for that metal, and except at the Jumbo mine operations were suspended during the winter. The Mount Andrew and Rush & Brown mines were idle throughout 1908; at the Mamie and Stevenson mines activities were renewed in August, and a relatively large amount of ore was mined, which was treated at the Hadley smelter. Explorations at these mines are to be advanced during the winter months, though the smelter suspended operations in November and no ore will be shipped. The largest production and most extensive developments during 1908 were made at the Jumbo mine, near Sulzer. The operations on this property were confined to the sulphide deposits at the head of Jumbo Basin, and only small developments took place on the copper-bearing magnetite deposits on the north side of that basin. The Niblick mine was operated from Apr. 15 to Oct. 30, during which period the shaft was sunk to a depth of 360 ft. and developments were extended on the 300-ft. level, where two orebodies were opened. Raises were made in these orebodies to connect with the 225-ft. level, and most of the ore thus developed was mined. At the It mine, on Kasaan Peninsula, mining operations were begun by the It Mining Company early in the spring, and a body of high-grade copper ore was developed.

A tramway one mile long was built to tide water, a wharf was erected, and ore shipments were begun in the first part of October.

The copper production of southeastern Alaska for 1908 will be less than that for 1907, but the average content of copper per ton of ore mined will be somewhat greater.

At the Calder Bay marble quarry near Shakan and at the gypsum mine on Chichagof Island work was in progress throughout 1908, and a large production is reported from each locality.

YUKON VALLEY

Three new localities for placer gold in the lower central part of the Yukon valley, brought to the public notice within the last two years, are of particular interest because they show that the gold-bearing formations of the valley are of much wider extent than has generally been supposed.

INNOKO DISTRICT

Since the discovery of placer gold, in 1906, on some of the headwater tributaries of Innoko river, that part of Alaska has received more attention from prospectors looking for new fields than any other district in the Yukon valley. The Innoko, the lowest noteworthy tributary of the Yukon entering from the left, is about 500 miles long and has been the principal route to and from the diggings on its headwaters. During 1906 small stern-wheel steamboats ran up the river to Dichkakat, about 250 miles from Anvik, on the Yukon. From Dichkakat it is 190 miles farther by the river to Ophir, the principal settlement at the diggings, and this distance is traveled in poling boats that will hold about one ton of freight. The most serious drawback to prospecting in the Innoko country is the difficulty and cost of getting supplies to a central distributing point convenient to the creeks on which pay gravel has been discovered. So far most of the provisions have been shipped into the district from Fairbanks, and by the time the freight is delivered at the town of Ophir the transportation cost has reached \$500 a ton.

The Innoko country has been staked in a wholesale manner, about 1200 locations being on record. Of this number only about 25 claims were worked during the summer of 1908; practically all of these were on Ganes, Little and Ophir creeks.

About 150 persons are now wintering in the Innoko district.

GOLD HILL DISTRICT.

The name Gold Hill is applied to an area in the central Yukon valley, about 25 miles below the mouth of Tanana river, that lies along the north side of the Yukon and extends westward from the western slopes of the valley of Tozitna river to the higher mountains north of the United States telegraph station called Birches. Roughly, the district embraces an area extending 30 miles east and west and 20 miles north and south, covering about 600 square miles. Most of this area consists of mountains that form a divide

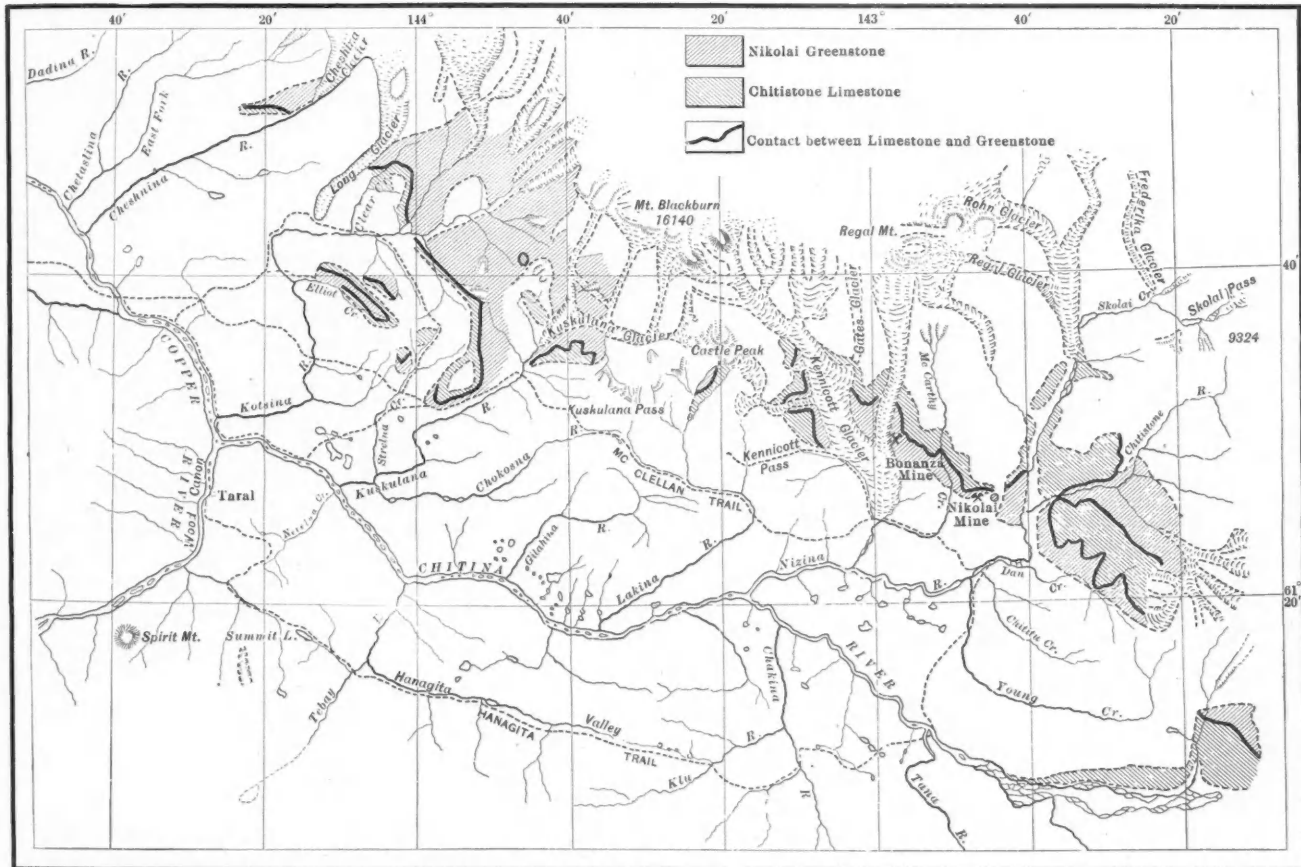
on these streams has been located for placer mining. The locators are mostly association groups that enable a few men actually present on the ground presumably provided with powers of attorney from a number of absent persons, to tie up completely many thousands of acres of alluvial deposits bearing placer gold. The result of this practice is that many intending workers are unable to acquire ground rights and the healthy growth of the placer-mining industry is being retarded in a discouraging manner.

Open-cut ground-slucing operations have been begun at several localities in the Gold Hill area, but owing to the scarcity of water, due to the unusual

ft. high. This district received considerable attention from prospectors in the winter of 1907-8. Large tracts were located as placer-mining ground on Ruby, Melozi, Big, Main, Boston, Bonanza, Beaver and Dome creeks and their tributaries. A number of holes were sunk to bed rock during the winter, and prospects of gold are reported to have been found at several places. Discovery claim, on Ruby Creek, was the only property actively worked in July, 1908.

TIN DEPOSITS

Stream tin was discovered in the York region of Seward Peninsula during the fall of 1900 as a heavy and objectionable



SOUTHERN COPPER AREA OF ALASKA
(From map of U. S. Geological Survey)

extending east and west about midway between the main courses of the Yukon and the head-waters of the Melozitna. This divide separates the region into two areas that are drained to the north and south by creeks of moderate length and volume.

The principal southward-flowing creeks, named from east to west as they join the Yukon, are Grant, Illinois, and Mason and their tributaries; those flowing northward into the Melozitna, named in the same order, are Moran, Eureka, Hudson, Langford, and Tiffany creeks and their tributaries. It is in the gravel deposits of these creeks that the placer gold is found. Practically all the alluvial ground

dryness of the summer of 1908, there has been thus far very little production of gold.

RUBY CREEK DISTRICT

The area known as the Ruby Creek district—from the name of the small stream on which gold was first discovered in the area—lies on the south bank of the Yukon, directly south and opposite the mouth of Melozitna river, about 175 miles below Tanana, or 110 miles above Nulato. For a distance of 10 miles along the south bank of the Yukon the Ruby Creek country presents rolling hills from 400 to 500 ft. high that overlook the river with bluffs 200 to 300

constituent which accumulated in the sluice boxes of the placer-gold prospectors. A. H. Brooks, of the U. S. Geological Survey, who was engaged in a hasty reconnaissance of the region, brought some of this material back to Washington, where it was identified as cassiterite.

Developments in this region have been sufficient to demonstrate, at least, that the granite-limestone contacts are not favorable places to hunt for commercial bodies of cassiterite ore. Quartz porphyry dikes, locally known as lodes, or even as quartz veins, have been prospected to some extent, owing to the fact that the original discovery of lode tin in Alaska was made on a mineralized or altered dike of this

character. The value of any such dike depends on the number of cassiterite stringers which it contains and the closeness with which they are spaced. Of itself a quartz porphyry dike has no value. The unwelcome fact should be speedily realized that few of these dikes hold out any inducements whatever as prospective tin producers.

Most of the developments throughout the region are still in the prospecting stage, and many of the open cuts have not uncovered solid bed rock. No tonnage of

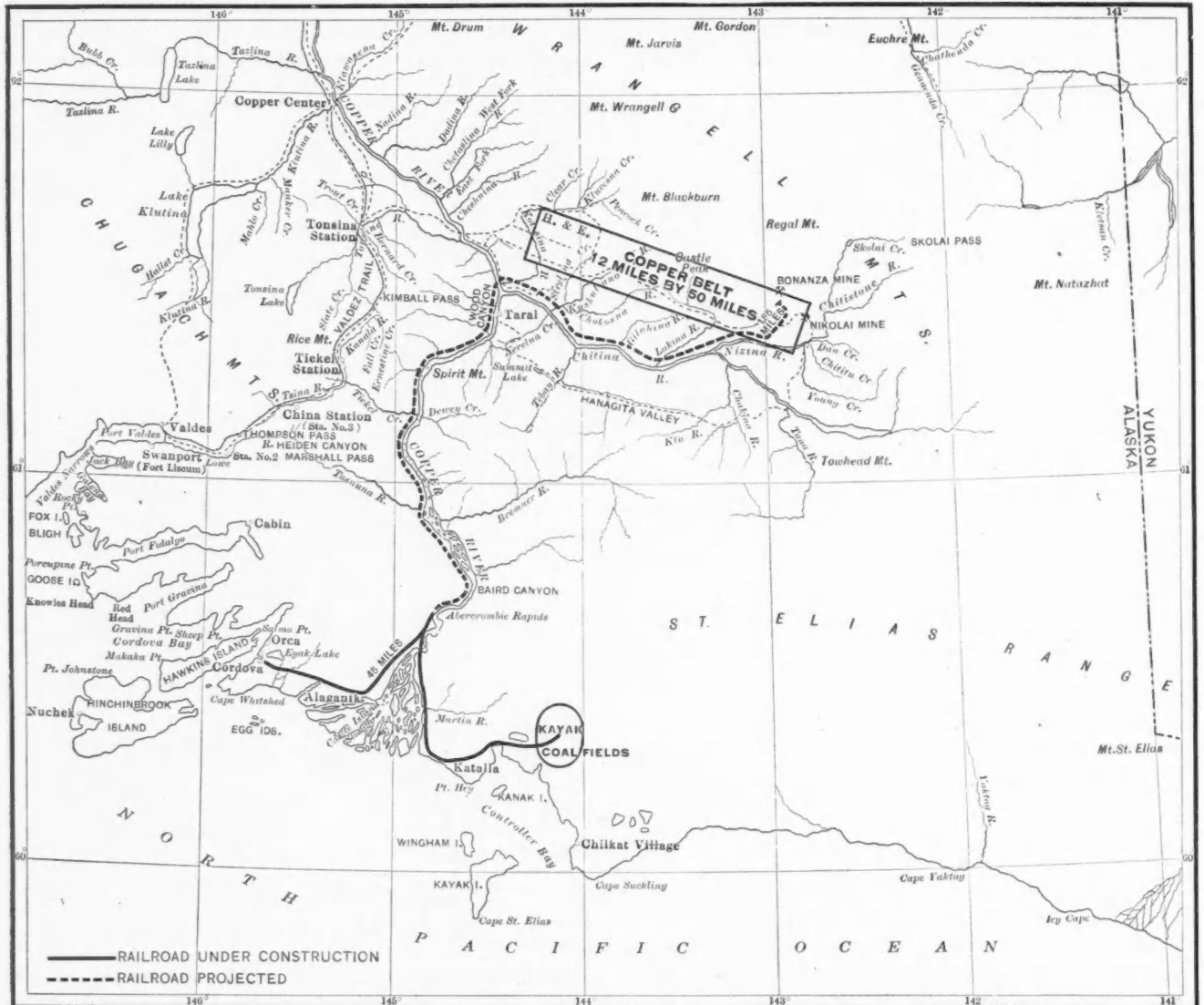
mineralization is not limited to the region at the head of Buck creek, but is more widely spread throughout the slate belt. It is probable that a great granite mass, of which the stocks at Brooks mountain, Tin creek and Cape mountain are protruding bosses, underlies the entire York region.

COPPER RIVER REGION

Active prospecting was carried on in 1908 on the head of Nabesna river, on Cross creek (or Copper creek, as it is

development work is not yet sufficiently advanced to give an idea of their extent.

The copper minerals on Copper creek are found in lavas and consist chiefly of chalcopyrite and chalcocite, but include also cuprite and native copper. The copper deposits of White river consist of copper sulphides and native copper in lava flows. Native copper is found in greatest amount near the boundary line. This region gives some promise to the prospector for gold-lode deposits, and development work on a vein of argentifer-



MAP OF MOUNT WRANGELL DISTRICT, ALASKA, SHOWING POSITION OF THE COPPER BELT AND ROUTE OF THE PROPOSED RAILROAD. (Based on map of U. S. Geological Survey)

tin-bearing rock, except at one place on Lost river, has yet been blocked out. Small holes in the ground, which give no clue to either dip, strike, or persistence of the ore rock, are held at enormous figures. The great need of the country is less desultory prospecting. The slate area deserves more careful examination, as it is possible that valuable quartz veins may exist within its confines. The distribution of stream tin in Anikovik river and its tributaries proves that the stanniferous

now called), and on White river. The White River prospects are situated in two areas—one at the head of the river, in the vicinity of Skolai glacier, the other near the international boundary line, partly, it is supposed, in Yukon Territory. Prospecting in the region northeast of the Wrangell mountains is restricted almost wholly to the search for copper. The best known copper prospects on Nabesna river are near the foot of Nabesna glacier, in the vicinity of Orange Hill, but

ous galena associated with sphalerite has been begun.

Prospecting in Chitina valley was discouraged during 1908 by the low price of copper and the consequent difficulty of obtaining financial backing, but some effective development work was done. At the Bonanza mine the season was spent in erecting a sawmill, ore bunkers, buildings for various purposes, and an aerial tram from the mine to the camp.

Development work was done on the ex-

tension of the Bonanza in the upper part of McCarthy creek valley by the owners of the Mother Lode claim and by the Houghton Alaska Exploration Company. The largest operations in the remainder of the field were those of the Alaska Consolidated Copper Company on Nugget creek, the Hubbard Elliott Copper Mines Development Company on Elliott creek, and the Great Northern Development and Alaska Kotsina Copper companies on Kotsina river.

Placer mining was active on Dan and Chititu creeks during the summer. The two hydraulic plants on Chititu creek continued operations in 1908 but experienced some difficulty in procuring labor, a difficulty encountered at the Bonanza mine also.

Probably the most important work affecting the future of the Copper River region is the construction of the railroad from Cordova to the interior. During 1908 more than 50 miles of track were laid, bringing the road to the bridge over Copper river between Childs glacier and the lake in front of Miles glacier. This road will establish communication with steamboats on the river above Abercrombie rapids and it will be possible to carry freight from the coast at Cordova to Copper Center on Copper river or to the mouth of Lakina or Nizina river on the Chitina. Construction work is also being pushed on a short piece of road connecting the Bonanza mine with Chitina river, and its completion will make it possible to carry supplies to the mine or to ship ore to the coast before the whole of the railroad up the river is completed. A branch line to the Bering river coalfields is also under way.

Arizona

BY WILLIAM P. BLAKE*

The cloud of industrial depression which hung over the country for the greater part of the year 1908 was not without a serious depressing effect upon the mining enterprises of the Southwest. With the exception of the well established copper, gold and silver mines, the mining prospects generally were closed down. But with the brightening skies of November and December there was renewed activity giving promise of prosperity for the year 1909.

GOLD

Gold, the second in value of Arizona's mineral productions, was officially reported as amounting to \$2,617,312 in value in 1907 and is believed to have equaled, but not to have exceeded that figure for 1908.

One mine, at least, was added to the list

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of producers, the Mohawk, in the Old Hat district, Pinal county, near Schultz. It ranked high as a producer for several years, but until 1907 remained closed down for a decade or more. Under the management of William Roberts, it has been reopened. The shaft was sunk from the 300- to the 500-ft. level. Drifting on the contact between granite and an eruptive rock opened up new bodies of oxidized free-milling ore. The mill of 30 stamps was started in September, and has since been satisfactorily producing gold bullion. The tailings do not run high enough to justify cyaniding. Water is not expected until a depth of 725 ft. is reached, this being about the level at which it stands in the neighboring mine, known as the Mammoth, which is idle. Like the Mammoth ore, there is a notable amount of wulfenite in it, but not exceeding 1.4 per cent., insufficient to pay for the extraction by concentration as was adopted with the tailings at the Mammoth mill on the San Pedro.

In the extreme southwest of the territory the Fortuna has ceased to be a notable producer. In the Quijotoa region, the Weldon Gold and Copper Company, under the management of Director Fitch, continued operations through the year. About 300 ft. of driving and sinking was added and rich gold and silver ore was opened up. The capacity of the mill was increased by new stamps and a cyaniding plant. The copper-bearing part of the property was reached by a shaft penetrating the ore 300 ft. below the outcrop of gossan. Shipments of oxidized ores averaged from 22 to 30 per cent. of copper. A second shaft 1000 ft. west reached a depth of 330 ft. on the footwall with the expectation of striking a body of sulphide ore.

The mines of the Congress and other gold properties of the Piedmont region of the Bradshaw mountains continued in operation. The Octave mill was started late in the year and resumed its additions to the bullion product of the territory.

Near Prescott, Yavapai county, the Bullwhacker gold-quartz mine has been worked since January, 1907. The quartz carrying coarse gold of high grade in 1908 was worked at the Oriental mill, Poland.

The Arizona Copper-Gold Mines property was worked up to Sept. 20, opening up reserves of ore ready for the crushing machinery to be added early in 1909. In northern Pinal county development work on the gold-bearing veins in the Saddle Mountain mining district, south of the Gila river, was resumed in the latter part of the year, particularly upon the mines of the Ash Creek Company. There are now 600 ft. of workings, with the shaft 100 ft. below the main tunnel level. The vein may be said to be double, being formed on both sides of an intrusive porphyritic dike. A crosscut shows the

south side vein to be 20 in. wide, assaying from 5 to 20 per cent. copper and from \$20 to \$70 in value for gold. The north vein is about 4 ft. wide and assays 4 per cent. copper.

There are several groups of similar veins all traversing andesitic rock, giving by their weathering and erosion placers of considerable value. The Ash Creek Company's ground gives access to these veins by a tunnel at a low level. A concentrating mill is needed, and projected at the river, by which rich auriferous concentrates could be taken from the mines of the district.

In the Bunker Hill district, east of Mammoth, prospecting by the Calumet & Arizona company of Bisbee, during the year, was so satisfactory that there are now three different companies and nearly 100 men at work there. The district within which there are good evidences of copper and gold ore is described as about five miles wide and 12 miles long. Machinery is on the way for the erection of a 200-ton concentrator. In Mohave county there are many producing gold properties from which no reports have been received.

Near Kingman the Gold Roads is operated by Porcy & Bailey, and the Blue Ridge by men from Pasadena, California.

The Gold Crown group, also near Kingman, in the Union Pass section, is reported to have developed promising ore-bodies, so also the Tyro groups.

At Cerbat, the Golden Gem reached in its shaft a depth of 500 ft. and cut a body of high-grade gold ore according to a late report.

In northern Yuma county the Signal mine, 20 miles north of Bouse, was opened by a shaft to a depth of 300 ft. and a large body of low-grade auriferous copper ore was reached by a crosscut on the 200-ft. level.

At Salome, Yuma county, north of the Harqua Hala mountains, the closing of the year witnessed increasing activity, and the development of the Ullimatum copper flat and the Cabralla properties in the limestone belt of Tank Pass.

At the Harqua Hala the efforts to work the fillings of the old stopes ceased and attention is now given to unwatering and sinking for new orebodies below the old works. This mine is said to have produced upward of \$7,000,000 in value above the 300-ft. level. The reopening of the old Vulture mine is reported.

SILVER

The production of this metal, third in value of Arizona's minerals, may be estimated at 2,000,000 oz. fine for 1908, or somewhat less than the figures given officially for the production in 1907 (2,511,897 oz.). The Territory was formerly celebrated as the source of many ponderous masses of nearly pure silver

from the gravelly placer deposits near Globe.

During the year 1908 the Old Stone-wall Jackson mine, supposed to be the source of much of the placer silver, was reopened and at the depth of 280 ft. a rich vein of silver is reported to have been found. There were also efforts looking toward a resuscitation of the Silver King mine in Pinal county, but active work has not resulted.

Most of the silver production is derived from the smelting of argentiferous lead ore and from the silver-bearing gray-copper ores.

ARGENTIFEROUS LEAD

The silver-lead mines of Santa Cruz county remained practically as at the close of the year 1907. The Hardshell and the Flux mines near Patagonia, Santa Cruz county, noted for their large bodies of argentiferous lead ore and carbonates suitable for smelting operations, which were under bond in 1907-1908, are still under bond. The deepest workings on the Hardshell are 500 ft., by an incline shaft. It is claimed that there are fully 100,000 tons of ore that will assay 10 per cent. lead and 10 oz. silver per ton. In crosscutting from the 500-ft. station to the ledge a large flow of water was encountered which stopped further mining operations for a time. The deepest shaft on the Flux was carried down to the 260-ft. level, opening up, by estimate of owners, 50,000 tons of ore assaying 12 per cent. lead and 6 to 8 oz. silver to the ton. The World's Fair mine is closed, and was for most of the year 1908.

During the year operations at the Salero mines were confined to the extension eastward of the lower drift on the Eureka Mabel, and westward on the same lode, and to surface surveys for patenting the Eureka and other claims beyond. Work was delayed somewhat by the uncertainty of ownership entailed by the claimants of the Baca Grant Float No. 4 and the consideration of the claims by the department of the interior. The full investigation having shown conclusively that a large part of the region covered by this Baca location was well and publicly known by publications to be mineral land prior to the location, the claim, after repeated hearings, was dismissed, and it no longer blocks mining or farming locations.

The "Constitution" or Darwin lode at Happy Camp, on the south side of Salero mountain, was under exploration during the year by sinking a vertical two-compartment shaft, which, at the close of the year, reached a depth of 300 ft. It is proposed to crosscut to the ledge at the 500- or 600-ft. level, to intersect the supposed prolongation of the shoot, or chimney, of high-grade silver-copper ore mined out above the 150-ft. level.

The Alta mine opened on a lode of argentiferous gray-copper and galena ore, similar to that of the Eureka, remained closed during the year, the transportation facilities not being favorable to the shipment of the ores to smelters.

The Tia Juana group of claims on the great quartz ledge carrying iron pyrites, chalcocite, galena, tetrahedrite and blende, which crosses the diorite ridges at the head of Josephine cañon, in Santa Rita mountains, was surveyed and patented, and will be worked when railway communication is established along the Santa Cruz valley, by which the ores and concentrates may find an outlet. The Mowry silver-lead mine, south of Patagonia, was not actively worked during 1908. The smelter remained closed down, but some exploratory drifts were run in the mine.

The Vekal silver-lead mines, 35 miles southwest of Casa Grande station, on the Southern Pacific railway, which were large producers of silver-lead ore in the years from 1885 to 1904, were reopened and the concentrating mill of 10 stamps with Wilfley tables is in operation. One shipment of a carload of concentrates was made. A double-compartment shaft was sunk to the depth of 380 ft. so as to reach and open up new orebodies at lower levels. The old workings, said to measure more than five miles in total length, are found to contain a large amount of low-grade ore suitable for profitable concentration. The Commonwealth, also known as the Pearce mine, in Cochise county, continued in successful operation under lease to Swatling & Smith. There were 34,763 tons of ore taken from the mine, crushed dry and cyanided direct. These ores were passed through a Blake crusher and four sets of Chalmers-Williams rolls, one set 15x36 in., two sets 15x30 in., and one set, finishing rolls, 10x30 in. Two additional sets were recently added to increase the capacity and to crush through 10-mesh instead of 8-mesh screens. With this plant the capacity is 150 tons in two shifts of eight hours each. By pan-amalgamation 28,912 tons of medium grade ore were treated. This was crushed by stamps. For a part of the year 30 stamps were used, but 10 stamps were dismantled in June to install more rolls, and since then only 20 stamps were used, averaging two tons to the stamp. The tailings from the pan-amalgamation process (11,040 tons) were treated by cyanide. The figures of production and treatment pertain to the months of 1908 up to November 1.

The lessees state that in 1908 they have mined and milled more ore than at any time during the life of their lease, which dates back to May, 1905. They expect to treat 200 tons daily during 1909; 150 tons of this will not average more than 5½ oz. silver and 80c. to \$1 in gold.

The mines of the Tombstone camp were continuously operated by the Tombstone Consolidated Mining Company, and more ore has been extracted and shipped from lower levels than ever before. Water at the rate of 5000 gal. per minute is pumped from the 1000-ft. level.

NEW RAILWAY FACILITIES

The construction of the Arizona & California railway across northern Yuma county from a point between Congress and Wickenburg westward to and beyond Parker on the Colorado, gave access to the rich mineral region hitherto remote and neglected. It passes by the Harqua Hala mountains, toward Quartzite, then winds northwest by the town of Bouse toward the Bill Williams Fork region and gives an outlet to the mines of the Santa Maria mining district and about Parker on the Colorado river. The early completion of this road drew renewed attention to the mining districts along its route, and active prospecting in 1908 resulted in the addition of many promising properties, bearing copper, gold and silver.

Colorado

BY GEORGE E. COLLINS*

Mining in Colorado during 1908 was on the whole in a distinctively depressed condition. The low prices for all the commercial metals resulted in a considerable lessening of output. With the exception of Cripple Creek and Telluride, both of which are essentially gold-producing camps, every district throughout the State was materially affected not only by the low metal prices, but also by the fact that the financial conditions in the Eastern States necessitated the postponement of new outlay both for equipment and for prospecting. The tonnage of ore received at the various plants of the American Smelting and Refining Company, which may be taken as a fair index of the condition of the mining industry, outside of that from purely gold-producing mines, was about 550,000 tons as compared with 796,000 tons in 1907, a decrease of approximately 30 per cent. Owing to the lower prices received for the product, the falling-off in value was still more serious.

GOLD AND SILVER

CRIPPLE CREEK DISTRICT

A reduction in the costs of treatment at the custom chlorination plants was in force during the greater part of the year and resulted in an increased tonnage. This increase, however, was mainly in shipments of very low-grade material, so that the total output was of

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less value than has been generally supposed. The minimum price for freight and treatment was \$3.50 per ton; this rate enabled the shipment of great quantities of dump material. So far, however, as can be learned at the time of writing, the shipments of ore of the better grades were decidedly smaller than during 1907, and the value of the output correspondingly reduced.

The principal producing properties were the Portland, Elkton, Golden Cycle, Strong, and Cresson; an important output was maintained by leasers working in the El Paso. Of the outside leases, the most profitable and productive was probably that on the Lucky Gus Mine; the Dante leases hardly came up to what was expected.

The drainage tunnel has made good progress, the face being now in about 4500 ft. from the portal. The footage reported during the last few months of the year has been particularly gratifying. The new mill of Stratton's Independence was completed early in the year, but owing to a variety of causes, principally financial, it has not yet been in steady operation. It is understood that these difficulties have now been straightened out so the mill should add largely to the production next year. The future of Cripple Creek depends largely on the cheap treatment of the low-grade ores. Discoveries of high-grade orebodies seem to be fewer in number each year, and it is improbable that the existing rate of production can be maintained much longer from ore of the present grade; still, the completion of the drainage tunnel and the introduction of cheaper milling methods may result in maintaining Cripple Creek as the chief gold-producing district of Colorado for many years to come.

SAN JUAN COUNTRY

The Ouray district was comparatively inactive, with the exception of the great Camp Bird mine, which maintained a large production throughout the year. It is, however, generally understood that the orebodies in that mine are approaching exhaustion. At Telluride the Tom Boy, the Smuggler-Union and the Liberty Bell maintained the same output as for some years past, but the Smuggler-Union was considerably affected by the low price of silver. At Silverton, the Gold King was shut down for several months, on account of a disastrous fire. The Silver Lake was compelled to curtail its production on account of the low values of lead, silver and copper and at present the mine is being worked only by lessees.

CENTRAL DISTRICTS

Leadville and Aspen were both seriously affected by the drop in silver. Until the drop in silver, however, the Crescentia and Reindeer shipped largely. A

considerable production of gold-bearing material was made from the territory contiguous to the Ibez properties. The Dinero tunnel was completed to the vein during the fall, and development work is now in progress. At Aspen the production, as to quantity, was not much less than in 1907. The Della S. and Durant shipped a large tonnage; in the latter case low-grade lead-silver ore, that was mined by lessees. The Percy LaSalle was shut down, but the Smuggler mill ran continuously throughout the year. At Creede also the tonnage handled was about the same as in 1907, but here again the low prices of metals must have seriously curtailed the profit margin.

NORTHERN COUNTIES

From Gilpin county the output was perhaps a little better than in 1907, but as a whole the district has been in a depressed condition. The opening-up of important orebodies in the Bobtail vein on the lowest level promises an increased production in 1909, while the resumption of work in the Newhouse tunnel is certain to lead to a revival in the district around Nevadaville. The Georgetown district was hard hit, on account of the low metal prices. Although the high-grade silver ores cannot fairly be described as approaching exhaustion, it is unfortunately true that the discoveries made of late years have been of small extent. The amount of development work done, however, is altogether inadequate, and is likely to remain so unless capital is invested from outside. An important orebody, the value in which is largely gold, has been opened up in the Capital tunnel, and a mill has been built at the entrance of the tunnel to handle this ore. At Idaho Springs, the Stanley and Larmartine mines have been producing very little ore. The Gem and Little Mattie mines, both operated on the leasing system, have been probably the largest contributors to the output. The Sun and Moon mine, on the boundary line between Gilpin and Clear Creek counties, has been opened up with a raise, from the level of the Newhouse tunnel, that connects with the lowest workings from surface. Several levels from this raise have been commenced in ore, and probably in 1909 this mine will be the largest producer in the district. The resumption of work in the heading of the Newhouse tunnel, which took place on Dec. 16, is likely to prove of great permanent importance to this district.

The well known Alice orebody, at the head of Fall river, is again being tested; the result of several careful mill-runs indicates that it is susceptible of profitable working on a large scale. There is very little of importance to report with reference to developments in Boulder and

Summit counties. The large dredging operations planned for the Breckenridge district have been delayed, as a result of the financial stringency in the East.

LEAD AND ZINC

LEADVILLE

The operations of the Western Mining Company at the Coronado and Penrose mines were suspended in December, 1907, as a result of the fall in metal prices, and the pumps were taken out. Work was, however, continued for several months thereafter by lessees, who continued shipping until the water drove them out. The Moyer and Tucson mines of the Iron-Silver Company have remained idle throughout the year. The Yak-Tunnel properties have, however, maintained a large output.

MINOR DISTRICTS

At Creede the output, as to quantity, has been fairly well maintained, but the fall in value has been seriously felt. In the San Juan, as indeed everywhere throughout Colorado, the mines producing lead and zinc depend mainly for their profit on the gold and silver in the ore, since the lead and zinc are in the nature of by-products, though often very important ones. The partial suspension of the Silver Lake mine has been already referred to; the Iowa mine, also near Silverton was disabled by a snow-slide during the winter, but has been reopened by a leasing company. On the whole, outside of Leadville, the output of these metals has been affected less than might have been expected; but, should a recovery in the value of silver be long delayed, it is probable that 1909 will witness a further falling off.

COPPER

The production of copper in Colorado is not of equal importance with that of the metals previously mentioned. It is, however, notable that the quantity, if not the value of the copper produced, has increased. This is due partly to shipments from the Leadville district, and partly to several discoveries in the San Juan; notably at the San Antonio mine in the Red Mountain district, and at the Frank Hough mine near the dividing line between Hinsdale and Ouray counties.

RARER METALS

TUNGSTEN

The demand for tungsten was very much lessened during 1908, largely because of depression in the steel industry, and the price was correspondingly reduced. For this reason the industry in Boulder county was inactive, and the value of the output for the year was probably less than \$100,000. Lately the demand seems to have revived somewhat, and mining and milling are being more ac-

tively carried on. An unusually snowy winter, however, will tend to retard production, even if the demand should be good. Nothing has been done toward the development of the sporadic occurrences of tungsten ore in the San Juan and other districts throughout the State.

VANADIUM AND URANIUM

The milling plant of the Vanadium Alloys Company at Newmire, near Telluride, was operated continuously during 1908. A new McDougall furnace is being installed, and the output will be largely increased.

The discovery of a body of pitchblende ore in the Belcher mine on Quartz hill in Gilpin county is reported. This mineral occurs in quite a number of veins including the Wood, Kirk and German, but the occurrence is pockety, as isolated lenses in gold-bearing fissure veins.

Montana

By H. K. WELCH*

Difficulties between the miners and operators about the wage scale, and the resulting strikes occurring during the last six months, had their effect upon the coal production of the State for the year 1908. At Roundup, in Yellowstone county, the Chicago, Milwaukee & St. Paul Railroad during the year developed some mines which will eventually become large producers. The Washoe Copper Company's mines at Bear Creek, Carbon county, were brought to a producing state and thoroughly modernized, although of late they have not produced to their full capacity, which is about 700 tons daily. At Red Lodge, in Carbon county, the Northwestern Improvement Company mines held first place in the State in the amount of production. Almost the entire output was used by the Northern Pacific Railway Company. At Chimney Rock some new properties of Evans & Anderson were opened up; they give every indication of becoming large producers. The mines of the Great Northern Railroad at Sand Coulee, in Cascade county, were in almost constant operation throughout the year.

COPPER

Copper is easily the first mineral in importance in the State, and Butte is the leading copper camp. While the low price of the metal, and severe floods interfering with transportation, tended to lessen the output, still little decrease will be shown from the output of 1907. In the Butte district the effects of the financial panic of 1907 kept the mines closed for the first two months of 1908, and they had barely got under way when the floods and the consequent damaging of the Boston & Montana smeltery at Great Falls caused

*Butte, Mont.

a very material curtailment of the production from the Boston & Montana mines in and around Butte. The Anaconda company, with its High Ore, Never Sweat, Anaconda, Mountain Consolidated, St. Lawrence, Bell, Diamond, Buffalo, J. I. C., Modoc and Belmont mines, with the exception of the first two months of the year, worked almost continuously. The Anaconda and St. Lawrence mines were hampered to a certain extent because of the fires smouldering in the old stopes. The High Ore, with its depth of 2800 ft., is now the deepest mine in the camp. As a result of the deepening of the Belmont shaft so as to connect it with the lower levels of the Anaconda, nearly 400 ft. haul will be saved in hoisting the ore of the latter mine. The Butte Coalition Company accomplished a great deal during the year. At its Tramway mine a new gallows frame and hoisting engine were installed and new machine shops, carpenter shops, and office buildings were erected. Through the workings of the Tramway an enormous amount of development work was done in Minnie Healy ground on the 1400-, 1500- and 1600-ft. levels. Several connections were also made with the Rarus mine.

The Cora mine of the Coalition Company is worked through the Anaconda company's Diamond mine. As a whole the mines of the company are in much better shape than ever before, both for the production of a larger quantity of ore and for more economical mining. The Boston & Montana company operated during the year the Mountain View, Leonard, Pennsylvania, and East and West Colusa mines. At the West Colusa work was somewhat retarded by the fire which has been present in the mine for more than a year. At the Leonard a new shaft was sunk and the daily output of the mine for the last few months of the year was greater than ever before.

The Butte & Boston company operated almost continuously the Silver Bow, Berkeley, and East and West Greyrock mines. The Parrot company worked the Parrot and Little Mina mines. While the showing of the Parrot mine for the year was rather poor, in the Little Mina several bodies of good ore were opened up. The Trenton Mining Company, operating the Gagnon mine, was able to obtain better ore than at any time within the last few years.

The Original Consolidated Mining Company, in which W. A. Clark is the controlling factor, was able to work throughout the year unaffected by floods or the financial panic. The Original and West Stewart mines are the principal producers of this company, and the ore is treated in the Butte Reduction works, owned by the same men. The ore in these mines has improved with greater depth. W. A. Clark also operated the

Elm Orlu and Poser mines, which are situated in the North Butte district. The North Butte company during the year sank its shaft from the 1800- to the 2200-ft. level. On the 2000- and 2200-ft. levels crosscuts were driven to the veins, and they were found to be fully as good if not better than those on the 1600- and 1800-ft. levels. The mine averaged in production about 1400 to 1500 tons daily during the year, with about 900 men employed.

At the mine of the Pittsmont company, formerly the Pittsburg & Montana company, the processes under experiment for treatment of ores proved to be a costly failure and were discarded by the new management, with Oscar Rohn in charge. Under Mr. Rohn's management the smeltery was overhauled, a new 250-ton concentrator was built and the property was put on a paying basis.

The La France Copper Company operated the Lexington mine and did considerable work on the 800-, 1000- and 1400-ft. levels. Good bodies of copper ore were opened up and with further development the property may become a large producer.

The Davis-Daly company underwent a complete reorganization after the financial panic, but continued to operate all but a very short period of the time. At the Colorado shaft, where the work was carried on more extensively than elsewhere, the shaft was sunk from the 1000- to the 1500-ft. level. The property has a favorable location and has good chances to develop into a producer of merit.

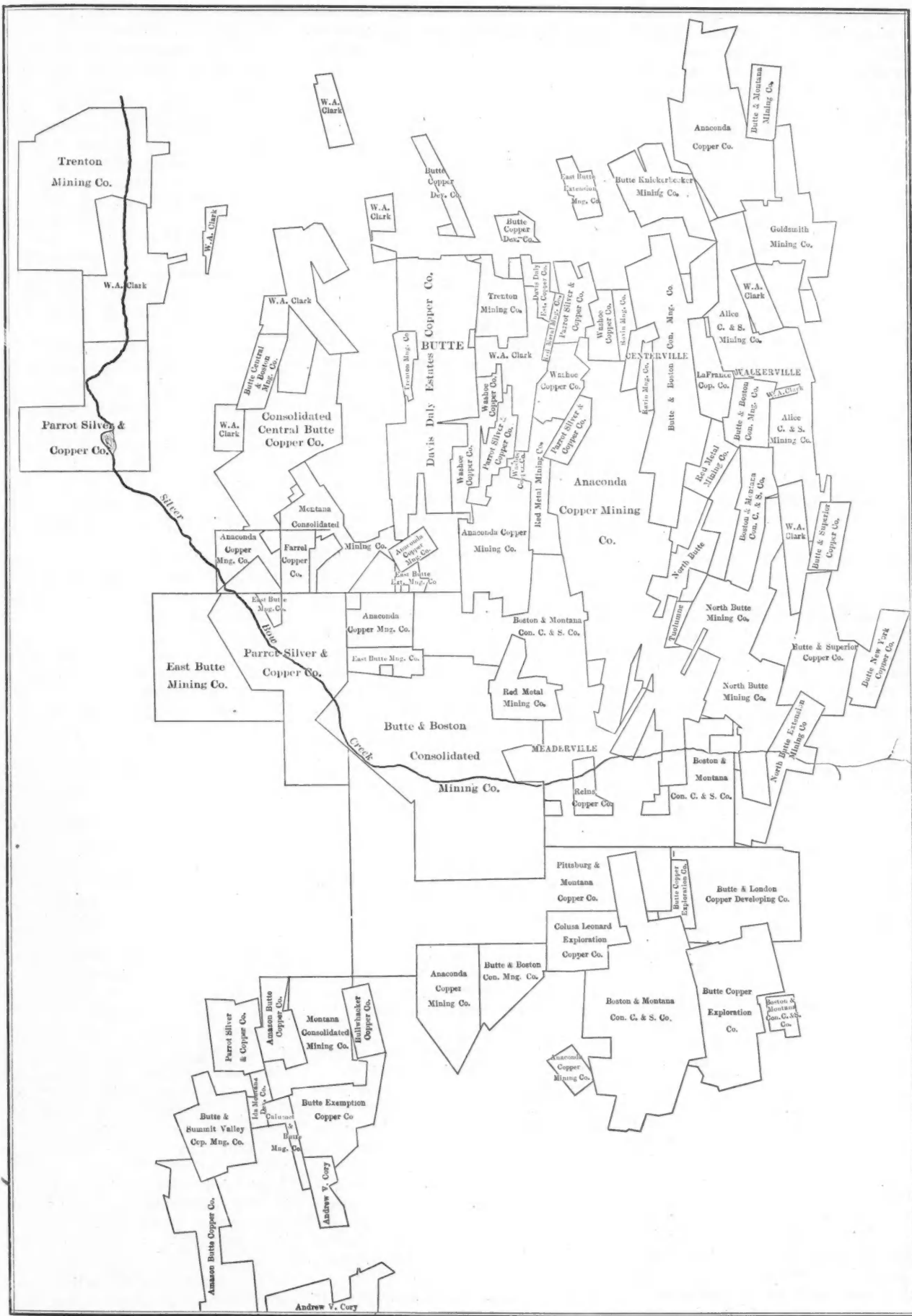
The Butte & Superior company confined its operations to the Black Rock mine in the northern section of the Butte camp. The shaft was sunk from the 800- to the 1350-ft. level. The last place at which a crosscut was run to the vein was on the 1000-ft. level, which was found to contain a small percentage of copper.

The Tuolumne Company succeeded in developing a body of commercial ore and made large strides toward becoming a regular producer. The shaft was deepened about 400 ft. during the year and is now 1200 ft. deep. The latter part of the year work was begun installing an entire new surface plant.

At the mine of the Raven company development work progressed steadily under the direction of John Berkin. The shaft was sunk an additional 400 ft. during the year and is down about 1250 ft.

The Butte & Balaklala company continued development work on the claims in Meaderville without interruption and sank the shaft from the 500-ft. to the 1150-ft. mark. Four veins were cut on the 1000-ft. level, all showing commercial ore.

The Butte-Milwaukee company resumed operations late last summer; the principal work was confined to the 300-ft. level.



MAP OF MINING PROPERTIES AT BUTTE

The Butte & London company worked but a few months in the year; when it ceased operations the shaft was down 1100 ft., and operations had cut several veins of commercial size and well mineralized. The company ran out of funds before it had an opportunity thoroughly to explore the property.

The Lewisohns sank shafts on the Granite Mountain and Flat Iron claims in the North Butte district, but discontinued the work a few months ago. Both shafts were more than 500 ft. in depth when sinking was discontinued.

In the Butte camp about 10,000 men were employed steadily and more than 16,000 tons of ore were mined and shipped daily in 1908. Of this amount the Amalgamated mines contributed about 12,500 tons; the North Butte 1450; Clark properties 1100; Coalition 1100; Pittsmont 350; and others 300 tons. The copper production for the year averaged 29,000,000 lb. per month, and for the district during the entire year the production was about 270,000,000 pounds.

In the Corbin district in Jefferson county the Boston & Corbin company's property reached a depth of 500 ft., and several bodies of commercial ore were opened up. Other properties upon which work was done are the Black Jack, Corbin-Wicks, Corbin Consolidated and Alta. The Montana Consolidated company's property near Basin was operated steadily. The formation in the Corbin district generally is very similar to that of Butte, the granite being coarse-grained and micaceous. The veins also resemble the Butte veins, with the exception that the sulphides are found nearer the surface.

At the property of the Monitor Mining Company in Missoula county, H. F. Samuels was in charge of the property and a rich mine was opened up. Several shipments of ore were made. The principal mineral in the ore is chalcopyrite. In Meagher county the Copperopolis mine, owned by the Daly estate, was worked by leasers all year and several shipments of high-grade ore were made. The shaft is down 500 ft. The Silver Fissure Mining Company carried on operations on a small scale during the year at the property near Polaris in Beaverhead county.

ZINC

The principal zinc district in Montana lies in and around Butte. In fact, the La France Copper Company's Lexington mine produced a large quantity of zinc during the year. A mill was erected on the property for the separation of the zinc product, but it did not prove to be an unqualified success and has been closed for some time. On the upper levels of the Elm Orlu and Butte & Superior properties immense bodies of zinc were discovered in a search for copper. The Comet mine, near Basin, in Jefferson

county, produced considerable zinc and much experimenting was carried on all year for the separation of this product.

GOLD AND SILVER

From a mining standpoint in Montana, gold is secondary to copper. There are, however, several districts which operated continuously for gold during the year. In the Garnet district in Granite county the Mitchell & Mussigbroad properties made several rich shipments. The Anderson & Magone properties in the same district were turned over to a new corporation, the Anderson & Magone Mining Company, which will carry on operations. In the Cable district, in Deer Lodge county, the Cable Consolidated Company operated practically all year with a small force of men. The operations were confined principally to development work.

At the Southern Cross mine operations were continued throughout the year and consisted principally of development work. A new mill was erected on the property. The Gold Coin mill and mine also ran for the last few months. At the properties of the Milwaukee Gold Extraction Company the work was uninterrupted. In the Radersburg district in Broadwater county the Keating mine made steady shipments to both the Pittsmont and to the Washoe smelter.

In the Granite district in Granite county the Granite Bi-Metallic Company operated its properties in a small way under the management of John R. Lucas and several shipments were made to the East Helena smelter. In the Ruby district in Madison county, a new gold dredge was built, making three in all, and operations were carried on all year. In Silver Bow county the British-Butte company finished the construction of a Risdon gold dredge, but the machinery has not as yet been put in operation.

New Mexico

BY REINOLD V. SMITH*

Activity in the mineral industry of New Mexico during 1908 fell short of that of former years, but the Territory was by no means alone in this respect. The principal mineral product was coal, and the demoralized metal markets did not affect this branch of the industry seriously. In fact the conditions are in many ways better than ever before. Many business changes were brought about, but the development of the great dormant mineral resources did not stop with the shipments of ores.

Three new gold camps attracted wide attention, and one of them, Sylvanite, is

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destined to become a mineral section of great merit and importance. One other, Hachita, has been periodically discovered, under different names, since the advent of man to this southern section of the country; and since the placer gold there found is in what would be considered rich gravel in California, it is likely soon to be "discovered" by men who are able to unravel the problem of recovering gold from gravel worth from 13c. to a dollar and more per yard, but where water is hard to get. Much gold has in the past come from this section, but conditions have been so unfavorable that prospectors have sought other fields of opportunity where the washing of the gravel seemed to present fewer difficulties.

In Sylvanite the parent stock of much of this placer gold has undoubtedly been discovered. Though as yet the precious metal from Sylvanite has not been shipped in sufficient quantities to attract attention by reason of its money value, nevertheless the ores appear to be of a permanent character, of good grade, and of wide distribution. At the close of the year shipments were made regularly by wagon from several of the claims.

All of the producers of coal continued production throughout the year, and improved their plants more or less to meet an expected demand for the future. The agitation of new railroad enterprises brought to light many resources unknown to the general public. One railroad, the New Mexico Central, commenced grading and laying track. The feeling is abroad in the mining world that the market conditions which prevailed last year will speedily improve during this present year, and all are preparing for an active season of production during 1909.

During the year, coal, iron, gold, natural cement, copper, lead, silver, zinc, turquoise, meerschaum and vanadium were mined and shipped. Marble, and building stone of various qualities, were produced as usual for domestic use, and a little for transport. Systematic search for oil was carried on at several points, and salt was gathered on a small scale.

COAL

Prof. A. K. Adams, of the department of geology in the New Mexico School of Mines says regarding coal in the Territory: "The vast coalfields of New Mexico, about ten million acres, have scarcely been scratched, although the annual production is more than 2,500,000 tons."

Each of the coalfields has from two to six seams of workable coal, and in many cases the coal mined is more than 5 ft. thick, practically all of it being Cretaceous. Most of the coal (two-thirds of that now mined) comes from the northern part of the territory, near Raton, and it is in this region that most systematic and scientific mining operations are carried on. This coalfield is the southern extension of

the Trinidad field of Colorado and its coal produces excellent coke.

The greatest producer was the Phelps Dodge company of Arizona, which operates coal mines and coke ovens at Dawson. The Hagan coalfield, just north of Albuquerque was developed during the year, and plans are well under way for a branch railway to connect this district with the Santa Fe railroad, and thus to make the coal more marketable. The Cerrillos district produced the only anthracite in the Territory; one seam of coal there is anthracized by a sheet of andesite near it. There were no special developments in this field, mining continuing as usual. At Carthage a short branch connects the Allaire mine with the railroad. The Western coalfields near Gallup were in active production all the year furnishing domestic and steam coal.

Surveys were made for a new railroad in the western part of the Territory; this will furnish transportation to the mines near Silver City, Cooney, and Mogollon, and also the large coalfields south and north of Gallup. If this line is completed it will open up a large area that has great mineral wealth but is as yet little known.

The Bernal mine at Carthage had a dust explosion early in January which killed 12 men, that being the only serious accident in the Territory this year.

IRON

Next to coal in importance stands copper, so far as present value is concerned. Potentially, however, the worth of iron is greater to the Territory. Up to the present time the Colorado Fuel and Iron Company has alone profited by the vast deposits of excellent iron that exist in the Territory. The properties of this company are situated in the Fierro district and at Hanover, about nine miles east from Silver City, in the southwestern part of the Territory, whence the ores are shipped over the line of the Atchison, Topeka & Santa Fé railway to Pueblo, Colo., for reduction.

At the beginning of the year the mines worked a full force of about 240 men and shipped about 500 tons a day. During the year production was reduced, but at the close of the year it was again increased, shipments being about 400 tons a day. The total product for the year was 94,000 tons.

Besides the deposits at Fierro many others of wide extent are known; for instance, those at the north end of the Sierra Oscura, in the eastern part of Socorro county, where the outcrop is traceable for a distance of 10 miles along one of the dikes, the protruding masses of ore being in places 60 ft. thick and exposed for 300 ft. and more. The deposits of Lincoln county, almost as large, lie a little farther to the east. This ore is of very good grade, the percentage of iron running up to 66.4 per cent., the sulphur down to 0.07 per cent., and the phosphorus

down to 0.09 per cent. on what is known as the Jones iron in the Oscuras. Other samples from these same fields show practically no phosphorus, only traces of sulphur, and no titanium.

COPPER

Although the production of copper during 1908 fell short of that for 1907, due entirely to the drop in the price of metal, nevertheless copper has become a decidedly important factor in the mineral industry of the Territory. Many millions of dollars' worth of development work was done in the Territory in the last two years, and the total reserves of copper thus opened up have become enormous. The most extensive development was in the southwestern and central western parts of the Territory, especially in the Burro mountains, the Organ mountains, the Mogollons and the Magdalenas. But in many other localities also development was carried on in a systematic manner. Rotary and churn drills were used in several localities, especially in the Grant county properties, and have been instrumental in developing the large deposits of the Burro mountains and elsewhere.

Geographically the copper ores are widely distributed over the Territory, commercial bodies of ore being found in 16 counties out of the total of 24. Geologically the ores have been divided by Dr. Fayette A. Jones into those from deposits in the pre-Cambrian; those from the later Tertiary series; and those of the Permo-Carboniferous and Jura-Triassic formations. Nearly all of the active producing localities are in formations belonging to post-Cretaceous time, and the ores come from porphyritic masses with disseminated copper minerals; from carbonate and oxide replacements in limestone; and from fissure and contact veins containing both primary sulphides and oxidized ores according to locality. Some of these deposits have long been known, as those at Santa Rita, which are the oldest worked copper deposits in the United States, the native copper being shipped to the City of Mexico more than 100 years ago, and mined almost continuously since. These deposits are still among the largest producers. The copper ores always carry some gold and silver, and in some of the camps, as at Pinos Altos, lead and zinc accompany them also. The ores of Grant county generally, and especially those of the Santa Ritas and Burro mountains are very pure and carry only small amounts of silver and gold, while at other localities a little farther to the north and to the east, as, for instance, the ores in the Cooney district of the Mogollon mountains, carry much silver and gold, and are always uniformly high in these metals.

The production of the Territory as a whole amounted to just about 4,900,000 lb. of copper during 1908 as near as figures at present obtainable indicate. This tonnage came principally from the camps

of Grant and Socorro counties with smaller amounts from Santa Fé, Dona Ana, Luna and Sierra counties. Among the largest producers and heaviest operators in the Southwest may be mentioned the new Savannah Copper Company, which has taken over and consolidated the properties of the Comanche Copper Company with its smelter at Silver City and its railroad to the mines, and the Copper Gulf properties; the Chemung Copper Company operating with a large force of men at Tyron; the Burro Mountain Copper Company at Leopold where the big concentrator is kept busy on 3 to 4 per cent. ores; and the Azure Mining Company, all of Grant county.

The copper ores in the Tertiary, known as the "Red Beds" occur in many places, and have again during 1908 been the subject of investigation on the part of several companies. Their form is usually carbonate and oxide, but frequently metallic, and their tenor in copper is near 2 per cent., and in places rises higher, coming nearer to 3 per cent. The problem of their reduction seems near solution at the present time.

GOLD

The unsettled condition of the copper market had its effect in the search for gold and the attention was given to the old and well known silver mines, many of which have been reopened and equipped with new or renovated mills. Gold comes from both lodes and placers. The placer production remained about the same as formerly in the northern counties. The new placers recently discovered at Hachita have not had time thus far to add materially to the production. Operations at Hachita were rather extensive, so far as prospecting was concerned, but the regular development has proceeded with caution. Dry washing was tried in this section on several pneumatic machines. It has also been tried on some of the older placer ground in Santa Fé county, but so far with no marked success.

The shipment of telluride ores from Sylvanite will, no doubt, add materially to the production of gold during 1909, but shippers had barely commenced to send out their ores regularly before the end of the year, so little additional supply can be credited to that section for 1908. The great source of the gold is the gold-quartz ore of Socorro county, and the gold-copper ores of Grant and Socorro counties. The Last Chance mine in the Mogollons, the largest individual producer of the precious metals in the Territory increased its output almost 50 per cent. during the year. The Rosedale mill, one of the best known cyanide mills in the Territory, was remodeled and enlarged and is working at full capacity again. The gold ores of the Mogollon mountains were extensively developed, and several powerful companies were organized for the purpose of exploiting that section.

Six mills are now being put into commission in the Territory, three of them being cyanide mills.

A large part of the gold produced is from the copper-gold ores and since these were cut down on account of the copper, the production fell short of that for 1907, notwithstanding the fact that the production of gold ores increased. The total production has been estimated at 10,600 oz. fine, or \$219,100.

Owing to preparations now under way in the southwestern and central western parts of the Territory together with those of the counties in the north central part, the production of gold should be more than doubled this year, even though no more than the normal amount of copper-gold is produced from Grant county during 1909. A large amount of exploration and development work is conducted in the Mogollons, Hillsboro, Jicarillo, Lordsburg, and Central districts, in the Organ mountains, and in the Sangre de Cristo mountains and Colfax and Taos counties, to develop gold properties. Most of the producing sections are in post-Cretaceous formations, the same as copper, but several prospects which show promise of becoming extensive producers are in the pre-Cambrian, as, for instance, those in the Sandias, but in this formation the ore seems to be of lower grade, averaging, perhaps, \$3 to \$4 gold per ton.

SILVER

The silver production which is estimated at 332,000 oz. fine, showed a reduction from the previous year. The silver ores are found associated with the other ores, principally lead and gold, but also frequently with copper in rather large proportion. The curtailment in the production of silver was brought about by the low production of copper and lead. In several important instances, however, systematic investigation of properties for silver alone were undertaken during the year, and encouraging results were obtained. The localities most influential in the production of silver were the Mogollons, the Organs, Pinos Altos, Steeple-rock, and the camps of the Central district, though smaller shipments went to make up the amount stated. Among the important undertakings based largely upon the silver content of the ores should be mentioned the Boston Cerrillos Mines Company, an incorporation now commencing extensive improvements on the old Cash Entry mine near Cerrillos. The Last Chance mine in the Mogollons, is by far the largest producer of silver.

LEAD

Donna Ana, Sierra, and Luna counties were the most active in the production of lead, which amounted to about 1350 tons of metal including that from the Magdalena. Development work was carried on even where shipments were suspended. The largest individual producer was the

Stephenson Bennett Consolidated Mining Company, operating upon lead-silver ores at Organ in Donna Ana county. The company is producing ore at the rate of 300 tons per day. Shipments went regularly forward from the mines in the upper Magdalenas, all carbonate ore derived from development work. The Ocean Wave mill at Herinosa was built during the year.

ZINC

The mines at Magdalena, in Socorro county continued to ship zinc carbonates, though the camps in the southern portions of the Territory were mostly closed down except for development work which was pushed with vigor in a few places. In Magdalena the leasers in the Kelly mine shipped 5300 tons in seven months, sending out a car a day at the close of the year. The Kelly has been equipped with a 100-ton concentrator using the Sanders flotation process to separate the zinc sulphides. In the Graphic systematic development work was conducted continuously, with a force of from 20 to 40 men, still further blocking out the already enormous bodies of ore exposed within the ground.

Even a cursory review of the mineral industry of New Mexico should not fail to mention the turquoise found and produced in three principal places in the Territory. The most famous locality is that of the Burro mountains. The mines at Cerrillos were reopened, and in the southwestern part of the Territory a new find commenced to market turquoise.

Natural cement, known as the "white sands," is proving a most noteworthy addition to the list of mineral products. Meerschaum is now regularly produced in Grant county, and has been found of excellent quality in three places in that county.

Texas

BY WALTER E. KOCH* AND J. K. PRATHER†

There will not be much metal mining in Texas until the legislature passes fair and equitable laws, and gives the miner an even chance as in other States. The sooner this is done, the better for Texas mining. There is some silver mining at Shafter, Presidio county, where about 300,000 oz. of silver are obtained annually from an oxidized limestone-replacement deposit; these ores also contain some lead, but it is not recovered.

From time to time miners come to El Paso with copper ores from the Gaudalupe mountains and the Sierra Blanca range to the east of El Paso. Some veins have been traced and several shafts have been sunk on copper deposits in that part

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of the State. In northern Texas copper has been found in the Permian beds.

The tin prospects on the eastern slope of Mount Franklin, about 10 miles north of El Paso, have been further developed with very gratifying results, and it is quite probable that a concentrating mill and a smelter will soon be erected. The granite masses in places have been found to be impregnated with cassiterite, which varies in color from very pale to very dark crystals. This fact doubtless has caused it to be overlooked or mistaken for other minerals, and careful and constant assaying is required since the use of a microscope with a 100-diameter object-glass is necessary to detect the various forms in which the cassiterite occurs.

Cinnabar is mined at Terlingua, in Brewster county, about 12 miles from the Rio Grande river, and about 100 miles from Marfa station. The ore is found in veins and pockets in the Cretaceous limestone, and is mined chiefly by open cuts; it is smelted in wood-fired furnaces, and the quicksilver shipped to the railroad in flasks. There are several companies owning mines in this district, but only one is reported to be producing now. Brown-hematite ore occurs in 19 counties, and in Llano county there is a deposit of magnetic and specular ore.

At Baringer Hill in Llano county the Nernst Lamp Company still continues to mine a few hundred pounds of the rare minerals, allanite, cryolite, fergusonite, gadolinite, polycrase, etc.

Coal is mined in Webb, Maverick, Houston, Shelby, Wood, Hopkins, Wise, Parker and Erath counties. Lignite is mined in Milam and Robertson counties. Some of the companies are: the Rio Grande Coal and Irrigation Company, at Minera, Webb county; the Cannel Coal Company, at Darwin, Webb county; the Carr Wood and Coal Company, near Lytle, Medina county; the Maverick County Coal Company, near Eagle Pass, Maverick county; the Bertetti Coal Company, near Lytle, Medina county; the Rio Bravo Coal Company, near Eagle Pass, Maverick county; the Glenn-Belto Coal Company, Bishop, Bastrop county; the Worley mine, Rockdale, Milam county; the Black Diamond Coal Company, Rockdale, Milam county, the Lignite Eggette and Coal Company, Rockdale, Milam county; the Central Texas Mining, Manufacturing and Land Company, near Calvert, Robertson county; the Houston County Coal and Manufacturing Company, at Crockett, Houston county; the Timpson Coal Company, near Timpson, Shelby county; the North Texas Coal Company, near Alba, Wood county; the Como Coal Company, near Como, Hopkins county; the Wise County Coal Company, near Bridgeport, Wise county; the Bridgeport Coal Company, near Bridge-

port, Wise county; the Texas Coal and Fuel Company, Rock Creek, Parker county; the J. S. Young mine, Keller, Parker county; the Texas & Pacific Coal Company, Thurber, Erath county; the Strawn Coal Mining Company, near Strawn, Palo Pinto county, and the Smith-Lee mine, near Cisco, Eastland county.

The lignite beds in Texas are Eocene in age and extend over a belt 200 miles long. The Cretaceous coals are found in the Eagle Pass coalfields which extend into Mexico, and for 8 miles north of Eagle Pass. The Carboniferous coals are found in a small area in El Paso county and in a much larger area in north-central Texas, stretching from a few miles south of the Colorado river in Concho, McCulloch, and San Saba counties in a north-easterly direction to the Red river.

Asphalt is found in the vicinity of St. Joe, Montague county, and at Muenster, Cooke county in a sandstone near the Cretaceous-Carboniferous contact. In Anderson county the asphalt occurs in the Tertiary (marine Eocene) sediments. In Uvalde county the asphalt has been developed to some extent by the Uvalde Asphalt Company. The asphalt occurs both in a bituminous limestone and in a bituminous sandstone.

Sulphur and salt have been found in El Paso county, but these deposits have not been developed as yet. Gypsum is found in northern Texas and also west of the Pecos river. Fire clay occurs associated with the coal and lignite; there are also many useful clay deposits in many widely separated parts of Texas. Heinrich Ries has published a report on the Texas clays.

Wyoming

BY HENRY C. BEELER*

As were all her sister States whose mines are developing, Wyoming was hard hit by the business depression of 1907, and some of her mines were almost put out of business for the time being. Since the election, however, many of these were reopened, and are at least doing their annual work and making preparations for an active campaign in 1909.

COPPER

Copper is the principal mineral in Wyoming, being noted in all the State camps either as the main ore or the carrier of other metals. Production was low owing to almost impossible transportation conditions, which are gradually being overcome as the old and new railroads are extended throughout the State. The only smelter in the State is at Encampment, where the Penn-

Wyoming Copper Company controls the Ferris-Haggarty and Doane-Rambler mines. The company built 44 miles of railroad from Walcott on the Union Pacific Railroad to Encampment, and ran the greater part of the year. It is now doing development work only in its two mines for a larger record during 1909. Several new strikes were made in the Encampment district, that of the West Virginia-Wyoming Company, in Battle Basin, being the most notable, as it proves the further extent of the contact ores of the region and shows the way for others.

After about six years of expensive experimenting, the Rambler Mining Company, controlling the Great Rambler mine, in the Medicine Bow range in Albany county, succeeded in separating the platinum and palladium which occurs in commercial quantity in the copper ores; during the fall of 1908 the company had a force of men reopening up the property. The building of the Laramie, Hahns Peak & Pacific Railroad from Laramie to the North Park coalfields brings transportation within a few miles of this and the adjacent mines on Lake and Douglas creeks, as well as the Shawnee and properties on French creek and the Snowy range where heavy copper indications are being quietly developed and proved.

The Williams-Luman Mine at Depass, on Copper mountain in Fremont county, is opening up the largest body of copper ore yet discovered in Wyoming. Little is heard about it as no stock is sold and none is for sale. About 2000 ft. of development work showed a huge ore-body, 80 ft. wide, the length not being proved. At 485 ft. depth, copper oxides and metallic copper were noted, as at the surface and the accompanying gold-bearing streak of about 6 or 7 ft. is much in evidence. A gas-producer plant to use lignite was installed for additional power.

The Boysen power dam in the Big Horn cañon at the west end of Copper mountain is relied upon for power for the whole adjacent mining territory, as well as for the nearby towns. As all the difficult work of installation is practically completed, the plant should be in operation by the spring of 1909.

Copper prospecting proceeded over a greater territory than ever before, and more genuine development work on better showings is the result of this systematic work. It is more generally recognized that copper is the main mineral to be found in Wyoming and the low grade of the ores, conditions of occurrence and method of development are better understood, with marked improvement in results.

GOLD

Almost all the work on gold properties

this year was development and preparation. The Miners Delight mine in Fremont county shut down owing to expense of fuel. The Popo-Agie oil and Power Company is installing a plant to supply electric power to this and the other mines of the South Pass gold district, using the oil of the Lander fields as fuel, with the plant located at the old Murphy wells.

At Centennial, Albany county, Copper mountain, the Wind River ranges, South Pass and Atlantic, in Fremont county, all reports showed activity in the gold properties but production during the year was low.

Active placers were reported from the Little Big Horn, Sheridan county, Willow Rock and Twin Creeks, in Fremont county, Green and Snake rivers in Uinta county, Snake river in Carbon county, Sundance in Crook county and Douglas and Lake creeks in Albany county. The American Gold Placer Mining Company installed a steam shovel, prepared its pits and worked up to the last workable day of the season but operations were frozen up before a cleanup was complete. Preliminary tests were satisfactory.

COAL

Coal showed the largest production, as usual, but not much increase as compared with 1907, owing to a quiet strike which tied up the mines a part of the year. New mines are opening in the newer sections of the State, and those opened in 1907 are showing a uniformly larger tonnage than was anticipated last year. The lignites of Wyoming are in great demand for local fuel and in adjacent States as the new gas producers utilizing these fuels have made their use possible in plants where formerly they were useless.

IRON

Production proceeded steadily in the Colorado Fuel and Iron Company mines at Sunrise, Laramie county, the total for 1908 exceeding that of 1907. Additional prospecting in this vicinity showed a greater area than this deposit was supposed to cover, and the presence of iron operators from eastern fields, bidding for lands, indicates that other mines and properties again have a chance of being opened up. The Bradley Peak and Rawlins deposits, in Carbon county, were also under inspection but nothing definite was given out for publication. Prospecting for iron is also going on in other sections of the State and samples submitted indicate that other commercial iron areas will be opened. A shipment of chrome iron was made from Converse county.

ASBESTOS

Asbestos will be an important item in the mineral reports of Wyoming for years to come. Commercial chrysotile

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asbestos was practically developed in 1908 by the North American Asbestos Company on Casper mountain, Natrona county. A mill will be erected in the spring of 1909 and commercial production will begin. There is no doubt as to the quantity and quality of the product; the fiber shows up to 4 in. in length, 2 in. is not uncommon, and fiber an inch long is common. Practical tests amply demonstrated the spinning and workable qualities of the fiber, though at first only the rougher grades will be regularly produced. The asbestos occurs in serpentine in granite and schist, showing up to 200 ft. wide. Solid asbestos rock was shown in the main workings, 20 ft. wide and the full width not cut at that time. A similar asbestos appears at Smith creek and Deer creek near Casper mountain, and part of this is under development by the same company.

SULPHUR

The Wyoming Sulphur Company opened up a large deposit of sulphur at Thermopolis, Fremont county, and erected a plant to treat the ore and make commercial sulphur. This is a hot-springs deposit, similar to the Cody and Sunlight deposits in the same county, but more extensive and accessible. The ground was proved by drilling and tests before the works were planned.

OIL AND GAS

More drilling was done in 1908 than for a long time in the different oil fields of the State. In the Salt Creek field in Natrona county, one gusher was struck, and the rigs were moved to another location where drilling is now going on. The Popo-Agie Oil and Power Company is drilling near the Murphy wells for oil, for fuel for the new power plant. A pipe line is contemplated from the wells to Hudson, the nearest railroad point, and additional rigs will be put into commission as soon as they can be advantageously placed.

A gas gusher burned for a year near Basin, Big Horn county, but was finally capped. Additional wells were drilled in the vicinity to furnish local consumers and further to test the fields. At Byron and Garland, in the same county, oil and gas were struck; drilling still goes on.

The Uinta county fields are more active than for several years with indications that production is to be permitted, and these high-class oils to be put on the market. High freight charges have hitherto kept the production down and stopped production.

All things considered, Wyoming held its own during 1908, and while location work and patenting of mineral, oil and coal lands all were seriously hindered and the miners were put to much unnecessary expense and trouble by the over-zealous

agents of the National Forest and Land departments, whose various reserves and "withdrawn" areas cover most of the State, general prospecting was active and productive of good results.

Vermont and New Hampshire

BY GEORGE A. PACKARD.*

Very little copper ore was mined in Vermont in 1908. The Eureka mine at Corinth was closed during the entire year, and little work was done on the nearby property which has been partially developed by the Corinth Copper Company.

At South Strafford the Vermont Copper Company continued equipping its mine. Power development has been seriously delayed by winter and spring freshets, which twice carried away the dam on the White river when in a partially completed stage. This power plant, which is located at Sharon, is now ready for operation. The station is built for 750 h. p., but the equipment so far installed includes water-wheels and generators for only 500 h. p. This is transmitted at 6600 volts, 3-phase, and the motors, locomotives, hoists and pumps, have been tested and found satisfactory. The flues and stack are completed, and the furnace will be blown in early in 1909. It is expected that between 300 and 400 tons of ore per day will be treated at the start. Plans for a sulphuric-acid plant are being prepared, and surveys for a railroad to connect with the Boston & Maine system are completed.

The old Milan, N. H., mine, from which pyrite and a little copper ore were shipped "in the '80's," has been reopened, and several carloads shipped are said to have run 5 per cent. copper, and as high as 50 per cent. silica.

South Dakota

BY JOHN V. N. DORR†

The mining industry in South Dakota has been fairly prosperous in 1908. No new properties were developed but the principal mines were in steady operation. As the production is mainly gold, the drop in the price of silver and other metals has made no difference, and the principal difficulties to be met have been the gradual decrease in value of the ore mined at many of the old properties, together with the somewhat increased cost of labor due to the adoption of the 8-hour day.

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The use of electric power has been extended, so that the only steam power in use in the northern Black Hills is at the Homestake properties; indeed there also electric power is now in use at the three stamp-mills, the slime plant and the re-grinding plant. Both the Consolidated Power and Light Company, with a steam-electric plant, and the Black Hills Traction Company, with a hydro-electric plant, are loaded to their capacity, and are planning to increase their output. It is probable that in the summer of 1909 a hydro-electric plant generating from 5000 to 7000 h. p. will be built on Spearfish creek. The saving made by the use of electric power has been a material factor in maintaining the present production.

THE HOMESTAKE COMPANY

The Homestake company has operated all its stamps continuously during the year and has made a production, as given by the State mine inspector's report, of \$6,000,000, which is considerably larger than that of any previous year. The company increased the November dividend from 50c. to 75c. per share, the largest amount ever paid, but in December it was returned to the former figure. Among the improvements made in 1908 have been the constructing of a large reservoir, the rebuilding of the foundry and the equipment of it with all modern improvements, and the installation of a re-grinding plant to handle the coarsest sands from the batteries, the reground pulp passing over plates before going to the cyanide mills. The equipment consists of six grinding pans and a 5x14-ft. tube mill. The operation of the plant should give some interesting data as to the comparative efficiency of the two mills for regrounding under conditions obtaining here. The plant has proved very successful.

SILICIOUS ORE MINES

The Mogul, the Golden Reward, the Imperial, the Lundberg, Dorr & Wilson, the Reliance and the Wasp No. 2 properties have operated their mills steadily during the year.

The Imperial company reached lower quartzite in the Dakota shaft during the summer and has drifted several hundred feet in the quartzite and found some ore. If the further prospecting of the lower quartzite should disclose orebodies as strong and rich as those found in the shale above, it will mean a much longer life to the district.

The Mogul company, operating its remodeled mill at Pluma, has averaged over 320 tons per day and reached a maximum of 388 tons in October.

The Golden Reward company, which installed a Chamberlain press for handling its slimes early in the year, has recently

let a contract for a Moore-filter installation and expects to increase the tonnage handled greatly.

The American Eagle Mining Company started a 200-ton mill during the summer, but found the mine developments were not adequate to operate this at full capacity and so closed down awaiting further development.

In the Garden City district the North Homestake Company operated its 40-stamp mill steadily during the year, and the Minnesota Mines Company, with a mill equipped with slow-speed Chilean mills, has commenced operations.

GALENA DISTRICT AND OTHER DISTRICTS

The Gilt Edge-Maid company, working a very large body of low-grade porphyry and crushing dry to 3/16-in. size, has run regularly, milling about 200 tons daily. This company is believed to have established a record for the Black Hills for low cost of mining and milling, for the cost is reported to be approximately \$1 a ton.

The Golden Crest company, also mining in porphyry near the Gilt Edge-Maid, is building a 200-ton mill to crush with stamps, regrind with tube mill and treat the whole product by the Moore process. This is the first company in the Black Hills to erect an all-slitting mill. As the ore is very soft, the cost of complete slime treatment should not exceed that of a sand-and-slime treatment, and the recovery will undoubtedly be higher.

The Branch Mint company started its 120-stamp mill, but found, as so often happens, that it had gone ahead without sufficient mine development, so the mill was shut down after a short run. The property is now leased to an operating company which is running part of the mill on an old dump, while the mine is being developed.

Considerable work has been done in the southern Black Hills during the year, and the Standly company, at Rochford, has been running its mill while doing development work that has extended the limits of its orebody. It promises to become one of the big mines of the Hills.

METALLURGY

The problem of the successful treatment of the "blue" ores of the district, which as they are worth only \$5 to \$7 per ton, are too low in grade to stand shipment to outside smelters, has received considerable attention. Renewed efforts have been made to obtain a better extraction by the use of other chemicals with cyanide. Some very promising results have been obtained, but nothing has reached a commercial basis. Roasting will give a good extraction on much of this ore, but not on all, and it is considered too costly for the grade of the ore.

The Black Hills will shortly be the place *par excellence* for the inspection of slime processes, for with the mills now building, there will be in operation four Moore plants, one Merrill sluice filter-press plant, one closed-type filter-press plant, two decantation plants, one Burt press, one Chamberlain press and a Butters plant.

In closing it may be of interest to note the influence of Black Hills practice on slime treatment. The Merrill sluicing press was first operated at the Homestake mill and the first successful installation using a submerged filter plan (a Moore plant) has been in continuous operation at the Lundberg, Dorr & Wilson mill since February, 1904.

Utah

SPECIAL CORRESPONDENCE

At the beginning of 1908 the outlook for the mining industry in the State was not bright. As in other States, the financial depression had a far-reaching effect. However, the ore market at Salt Lake was glutted all through the year owing to the closing down of the United States, Highland Boy and Bingham smelters. The smoke question was the chief cause of the closing of these smelters, although there were other contributory factors, among which might be mentioned the fact that the Bingham Consolidated practically reached the end of its ore supply.

Among the matters which attracted attention was the attitude of the Utah Consolidated in connection with its contract with the American Smelting and Refining Company for the treatment of ore. The present contract expires in March, 1910. The Utah Consolidated, before renewing its contract, began looking into the advisability of building a smelter of its own. The cost of transporting ore from Bingham to Garfield, under an old contract with the Denver & Rio Grande railroad is 40c. per ton; other companies pay only 25c. per ton. The Utah Consolidated secured options and smoke easements on 30,000 acres of land in Pine cañon, Tooele county. By building a smelter here the ore could be transported by aerial tramway, thus saving most of the amount at present paid for freight to Garfield. The American Smelting and Refining Company was opposed to the erection of another smelter, fear of a competitor being among its chief objections. There was a great deal of activity displayed on both sides; some difficulties were encountered from the fact that there were a few influential stockholders of the Utah Consolidated who were also interested in the American Smelting and Refining Company. However, before the date of expiration, Sept. 30, the Utah Consolidated

had exercised its options and had completed plans for its smelter.

Toward the end of 1908 it was announced that the Utah Consolidated had let a contract for the erection of a smelter, to be completed by April, 1910. According to the latest plans this smeltery is to be one of the constituent plants of the newly organized International Smelting and Refining Company.

BINGHAM

The Utah Copper Company completed its Garfield mill in 1908 and operated at nearly full capacity. This company owns 200 acres of mineral ground in the central part of Bingham. The area developed to date includes about 72 acres. The thickness of the orebody has not yet been determined, but the work to date shows an average depth of 310 ft. The ore averages about 2 per cent. copper, 0.15 oz. silver and 0.015 oz. gold per ton. To the depth of present development, the ground promises an average yield of 1,000,000 tons of ore per acre. Below the depth included in this estimate is a zone of lower-grade ore which averages 1.5 per cent. copper; this, as indicated by diamond drills, contains 40,000,000 tons of ore.

The company is mining from 6000 to 7000 tons of ore per day, about 80 per cent. of which is secured from open cuts. At the mine the company operates 20 locomotives, 125 dump cars of 6 yd. capacity, and six steam shovels. There are about 10 miles of standard-gauge railway laid with 65-lb. rails. The compressor plant has a capacity of 300 h.p. All repair work for locomotives and machinery is handled in a fully equipped machine shop.

The Porphyry mine of the Boston Consolidated covers about 156 acres, adjoining the Utah Copper on the south. A large proportion of this area is underlain with mineralized monzonite, similar to the ore of the Utah Copper, but containing about 1.5 per cent. copper. The equipment for stripping and milling this ore is capable of handling 15,000 tons per day. During 1908 the company put additional units into operation in the mill, and expects to be running at full capacity early in 1909.

The operations of the Boston Consolidated have not been as successful as was anticipated because the ore mined was not so high in grade as had been hoped. The high content of pyrite caused the grade of the concentrates to fall below what had been expected. This led to further prosecution of underground mining in order to get below the zone of oxidation in the quickest manner. However, there is no question as to the successful outcome of the operation.

The property of the Ohio Copper Company adjoins that of the Utah Copper on the east and the Boston Consolidated on the north, and covers an area of 120 acres. There are estimated to be 13,500,000 tons of ore above the present transportation tunnel. The copper content of the ore is

between 1.6 and 1.75 per cent., in addition to which it carries about 10c. in gold and 3c. in silver per ton. The company did little actual work in 1908, owing to Heinze's difficulties.

The Garfield plant continued to experience metallurgical difficulties, one of which pertains to the handling of the very fine concentrate produced by the Utah Copper Company and the Boston Consolidated. The inability of the smelter to handle all the tonnage offered has led to a large accumulation of unsmelted ore in the district.

The Yampa mine is an important producer of sulphide ore. The ore is practically self-fluxing, requiring only the addition of a small quantity of limestone. During 1908 there were installed at the smelter in Bingham cañon, two converter stands with six converter shells of 84x136 in. diameter. Toward the end of the year the mine was working an output of from 700 to 800 tons of ore per day. The smelter treats the tonnage of the mine and about 200 tons per day of custom ore.

PARK CITY

The unfavorable prices of lead and silver during 1908 had a depressing effect on the Park City district. The chief activity in 1908 was in development work, and several promising orebodies were uncovered. This was especially true of the properties in Thaynes cañon, near Brighton. In that section the Copper Apex, Keystone, Uintah Treasure Hill, New York, Wabash and Silver King Consolidated displayed activity.

TINTIC

The Tintic district still holds the distinction of having more dividend-paying mines than any other district in the State. Early in 1908 the mines of the district suffered much by the closing down of the Salt Lake smelters. Relief was furnished through an amicable agreement between the farmers and the lead smelters.

An outlet for the ore of several mines was furnished with the blowing in of the smelter of the Tintic Smelting Company, at Tintic, on July 24. This smelter, which is controlled by Jesse Knight and associates, has a capacity of 350 tons of ore per day. In October, operations ceased temporarily, lack of electrical power supply being given as the cause. It was also hinted that there were some metallurgical difficulties. Three lead furnaces were in operation as the close of the year. One copper furnace is nearly ready to start up, and another lead furnace is under construction.

In October, a syndicate, headed by Jesse Knight, obtained a controlling interest in the Opex group, and organized the Opex Consolidated Mines Company.

MERCUR

The Mercur gold district felt the finan-

cial depression to a less extent than did the other mining districts of the State. Little of exceptional note transpired during 1908. The Boston Sunshine Gold Mining Company reconstructed the mill of the old Sunshine mine and is adding much new equipment preparatory to cyaniding the refractory clayey ores of this once famous mine.

The dividends paid to date by the Consolidated Mercur Gold Mines Company, and the old De Lamar and Mercur companies, totals \$3,385,312.

Idaho

BY ROBERT N. BELL*

The mining industry of Idaho during 1908 has experienced a rather dull year. A large tonnage of ore was mined and treated, but owing to the low metal prices that prevailed throughout 1908 profits, as compared with previous years, were seriously curtailed. Such development work as was in progress during 1907 was stopped at the approach of the money panic, and a great deal of this work has not been resumed. This reduced the number of men employed in 1908 about the mines and mills of the State fully 20 per cent. as compared with 1907.

SHOSHONE COUNTY

In the Cœur d'Alene district, two of the principal producers, the Hecla and Morning mines were closed down for the first six months of the year owing to lack of market for their ores; the Last Chance mine was also idle for two months of the year. These properties threw out of employment 1000 men; they resumed full operation in June, and have since been employing the normal force of men and making the usual production of ore. The Hercules, Standard-Mammoth, Bunker Hill & Sullivan, and Snowstorm mines were operated continuously. At present the producing mines of this district are employing about 2000 men, while the smaller producers and development enterprises of the district provide employment for approximately 1000 more.

The notable event of 1908 in the Cœur d'Alene district was the completion of the Idaho-Northern railway up the north fork of the Cœur d'Alene river from Enaville, on the Oregon Railway and Navigation Company's road, to Murray on Pritchard creek. This will give railroad transportation to the well mineralized section of the Cœur d'Alenes, known as the north side, and is likely to result in an important increase in mineral traffic during 1909, for on the north side there are a number of very promising deposits of silver, lead, gold and tungsten.

The construction of the Chicago, Mil-

waukee & St. Paul railroad down the St. Joe river and extending through the south border of the district is approaching completion. This road will prove a great aid in the development of the numerous rich copper, gold and lead-silver prospects in that part of the district and will greatly enlarge the productive area of the Cœur d'Alene district.

At Burke, the old Tiger Poorman mine, owned by the Federal company, after being developed to a depth of 2200 ft. through a vertical shaft was closed permanently. Its famous pumping station has been dismantled, and the mine has been allowed to fill with water. On the bottom level, the oreshoot had contracted in length and width so that it was no longer profitable to work. However, the mine still contains a big, strong root of an oreshoot, and it is a pity that a winze has not been sunk in the orebody to a depth of 400 ft. or 500 ft. in order to see if the shoot did not enlarge as has been the case at great depth in other oreshoots in this district.

At Mullan, the development of the new oreshoot discovered at a depth of 800 ft. in the Star mine has disclosed another large source of high-grade concentrating lead-silver ore. This is a new oreshoot on the Morning fissure which traverses the full length of this property. The shoot is 500 ft. long and from 5 to 15 ft. wide; the ore is of about the normal grade characteristic of the silver-lead ore in this part of the district. Extensive plans for further development at great depth are being made, and this property will probably become in time a large producer.

In addition to the Star, other promising ore discoveries are the Alice mine at Ruddy gulch, the Cooney mine at Burke, the Ambergris mine at the head of Nine Mile creek, the Bear Top at Murray, and the Caledonia mine near Wardner and on the foot-wall side of the Wardner lode. At present all these properties can ship high-grade crude ore from bodies of considerable size. There are also a number of other promising properties that are being operated, and, as the old mines gradually drop out, their place will doubtless be taken by new properties that will maintain the present output of the district.

The principal producers, including the Bunker Hill & Sullivan, Last Chance, Hercules, Hecla, Standard Mammoth, Morning, Gold Hunter and Snowstorm mines, are all in splendid physical condition and producing their normal tonnage. In 1908 the total yield of these mines was approximately 1,250,000 tons.

In spite of their great depth, the big lead-silver mines continue to maintain a comparatively high-grade ore; in fact, the average yield of the ore is probably a little higher now than at any period in the history of the district. The bulk of the ore is, of course, concentrating ore and averages about 8 per cent. lead and 5 oz. silver per ton for the whole district.

*State Mine Inspector, Boise, Idaho.

The operators are seriously concerned over the proposed cut in the tariff on lead ores. Any reduction would have a large effect on the profits of the Coeur d'Alene companies, and would probably be the cause of a retrenchment in the wage scale, for while the silver in the ore is a large item in reducing the cost of producing the lead, the mines are getting very deep, and

mines had a hard struggle for existence until a depth of several hundred feet was reached. The profits figured against the total expenditures on the mines do not show more than a reasonable margin, and at several of the largest producers much of this margin would be wiped out by the removal of the present tariff rate.

An important economy has been intro-

were large owing to the crushing of much waste rock with the ore. Owing to this sorting the crude-mineral shipments of the district in 1908 became much larger than in 1907.

The Snowstorm copper mine produces nothing but shipping ore. Its lower levels developed in a magnificent manner during 1908, and the mine made the largest out-



MAP OF COEUR D'ALENE MINING DISTRICT

consequently becoming more expensive to operate than formerly.

The principal producers are nearly all in bonanza at this time, but they have involved large outlays in preliminary development and plant equipment. Several years were required to develop these mines for nearly all the veins in the district were poor at the surface, and some of the

duced at all the big mines by adding a picking plant near the portal of the main adit. The ore is roughly sorted into shipping ore, concentrating ore, and clean waste, the shipping ore being sent direct to the smelter, and the waste returned to the mine for filling. This sorting has materially increased the extraction in the mills by reducing sliming losses which formerly

put in its history, shipping a total of 100,000 tons of ore, containing slightly over 90 lb., or 4½ per cent. copper and 6.14 oz. silver per ton. The mine is paying dividends at the rate of \$45,000 per month and has ore resources for several years ahead that will yield this rate of profit if present copper prices are maintained.

WOOD RIVER DISTRICT

Several of the mining districts of Idaho have experienced a very slack year in production; this is especially true of the Wood River district. In the Wood River field an unusually light output has been made owing to the lack of market and low metal prices, but nevertheless 1908 has been a year of great preparation, as five

During 1908 the Idaho Consolidated property was equipped with a hydro-electric power plant of ample capacity.

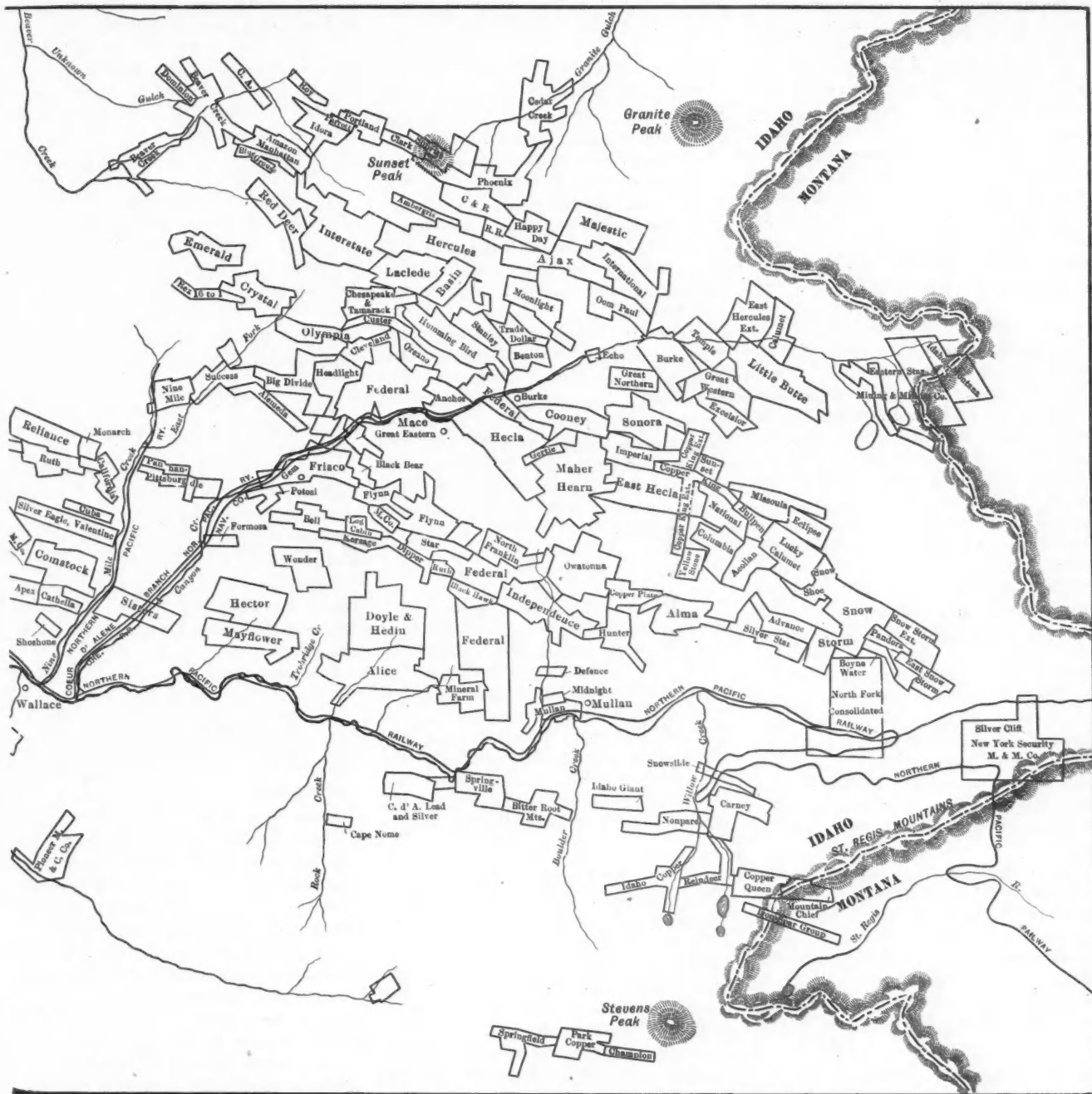
At the Independence mine, near Ketchum, a new mill having a capacity of 100 tons per day is being installed; the machinery is all on the ground. An electric transmission line was constructed from Hailey to this property; over this

erected. The future of this field is bright, and promises a largely increased yield of rich ore in 1909.

CUSTER COUNT.

In Custer county the White Knob mine, owing to lack of market for its ores, was idle during the greater part of 1908.

At Loon creek, the Lost Packer company successfully operated its 100-ton



MAP OF COEUR D'ALENE MINING DISTRICT

new mills were building in the district. Two of these, the Idaho Consolidated mill at Bellevue and the Cræsus mill, having a capacity of 100 tons per day and three miles west of Hailey, were completed. Developments on the bottom levels of the Cræsus mine, the deepest in the Wood River district, are magnificent. This argues favorably for the further development at depth on other fissure veins in this field.

the power to run the mill will be transmitted from the Cramer electric plant. The Independence has a reserve of high-grade ore estimated at 60,000 tons, and upon the completion of its mill in 1909 it should become an important producer.

A 100-ton mill is also being built at the Lucky Boy mine on Warm Springs creek, and at the Muldoon mine in the Muldoon district another 100-ton mill is being

smelter for 90 days during the summer, and produced some high-grade gold- and silver-bearing copper matte.

The Golden Sunbeam mine in the Yankee Fork district operated its 50-ton mill throughout the year and made a large output of gold bullion. This property has developed in a magnificent manner, and promises to continue a steady producer for a long time in the future.

LEMHI COUNTY

In Lemhi county the ore shipments from the lead-silver district were very light, due to low metal prices and the long wagon haul to the railroad. Several important discoveries were made during 1908, and a new independent smelting plant to treat the medium-grade ores of this district is in process of construction at Spring mountain. This should greatly encourage ore development in this part of Idaho.

At Indian creek the Ulysses mine resumed operation during 1908, and is again making an important yield of gold bullion.

The coal mines at Salmon City were developed during the year with a small force of men, and made a remarkable improvement; the local market was supplied by them with a desirable fuel, and unsuspected deposits that promise a big tonnage in the future were developed.

SILVER CITY DISTRICT

In Owyhee county the Silver City district is giving employment to a force of about 600 men. The old Delamar mine greatly increased its ore reserves and enlarged its milling capacity 50 per cent. during 1908. The Trade Dollar Consolidated mine is employing its normal force of men, but its operation has been somewhat interrupted during 1908 through tying the Boise Interurban railway onto its electric-power plant.

Considerable activity in mining development is shown in the district around Silver City that should result in important ore disclosures in 1909. The most successful new enterprise near Silver City is the Potosi mine, which has been developed to a depth of 300 ft. by three levels and is showing considerable reserves of rich ore. This property was equipped with a 20-ton mill, which began successful operation at the close of the year. The mine promises soon to develop into a good dividend payer.

The extension of the Northwestern railroad down Snake river will shortly be completed to a point 58 miles below Huntington. This brings the west slope of the Seven Devils range in close touch with railway transportation, and is already proving a great stimulus to the development of the rich copper deposits in that district.

ATLANTA DISTRICT

The Pettit mine in the Atlanta district of Elmore county was purchased from the original owners by the Bagdad-Chase Gold Mining Company, of Rochester, New York, for \$125,000. This property is equipped with a 20-stamp mill, which was profitably operated throughout 1908; 20 more stamps are being added, so that the mill will treat 150 tons a day. The Pettit mine is responding to development and is showing up a large tonnage of good milling ore.

The new mill of the Atlanta Mines company was tried out during the year, and found unsuited to the successful treatment of the extensive ore reserves of this property; the mill will require considerable remodeling in order to treat successfully this ore.

The ores of this district, on account of their mixed silver minerals, need very close treatment in order to obtain a good extraction, but the orebodies are large.

ELK CITY DISTRICT

The Elk City district, in Idaho county, has enjoyed a prosperous year and has given employment to a good many men.

The Buster mine in that district has been developed to a depth of 400 ft. on a 10-ft. fissure vein, containing ore that averages from \$10 to \$20 per ton. This mine is equipped with a 10-stamp mill and cyanide plant, that has been successfully operated throughout 1908, making a large production of gold.

In the Elk City district are many promising fissure veins, so that further work is likely to develop other producers. The district also contains some large deposits of low-grade gold ore that are likely to become mines of the Treadwell type, with proper development and equipment. It is also noted for extensive old-channel, placer deposits; some of the placers are quite favorable for dredging.

COAL

In the Fremont County coalfields, the Brown Bear mine was developed to a depth of 200 ft. during 1908. The coal is found to be of even better quality and of greater value than in the shallow levels above. This district is producing considerable high-grade bituminous coal and is supplying the local farmers; with railway transportation, the district would probably be capable of supplying the demands of the State for high-grade fuel.

PHOSPHATE ROCK

Idaho produced 5700 tons of high-grade phosphate rock during 1908. This came from the property of the San Francisco Chemical Company at Montpelier, Bear Lake county. Recent development of the phosphate deposits of this district tends strongly to confirm the opinion that this field will prove the richest and most important source of phosphate rock ever discovered in the United States.

STATISTICS

The total metal output of Idaho for 1908 based on the gross contents of the mineral shipped, is approximately: Lead, 208,196,159 lb.; silver, 7,636,271 oz.; gold, 65,175 oz.; copper, 10,080,506 lb.; zinc, 200,000 lb. The dividends distributed during 1908 by metal-mining companies operating in Idaho will approximate a total of three million dollars.

Nevada

BY WILLIAM H. SHOCKLEY*

The Nevada output for 1907 was 711,339 oz. of gold, value \$14,707,658; and 7,767,510 oz. of silver, value \$5,074,281; a total value of \$19,778,938. I estimate the production for 1908 at \$20,000,000, viz., \$15,500,000 gold, and \$4,500,000 silver. This is lower than was anticipated, the shortage being due in part to the fall in the price of silver from 55c. per oz. in January to 47.5c. in December, 1908, and in part to the fact that the Goldfield Consolidated husbanded its ore. This company produced about \$700,000 in 1908 and should make a large production in 1909 with its new 100-stamp mill. In November the Goldfield mines stopped publishing their output, so their product for the last two months of the year must be guessed at.

DIVIDENDS

I have learned of the following dividends paid by Nevada mines in 1908:

Goldfield:

Engineer's Lease	\$555,000
Florence Annex	50,000
Florence Mining Co.....	420,000
Little Florence Lease.....	750,000
Mohawk-Jumbo	200,000
Red Top Consolidated.....	20,000
Rogers Syndicate Lease.....	215,000

Comstock:

Ophir Mining Co.....	32,400
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Round Mountain:

Round Mountain Mining Co....	64,000
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Tonopah:

Tonopah Mining Co.....	500,000
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Total

\$2,806,400
Other dividends have probably been paid about which I have no information.

LABOR TROUBLES AND LABOR

At the end of 1907 a bitter strike was in progress in Goldfield and nothing but the presence of Federal troops prevented mob rule. In January, 1908, under the protection of these troops, non-union miners began work in Goldfield. The strike was called off on April 3, and Goldfield is now an open and peaceful camp. The establishment of a State police at a special session of the legislature in January preserved the peace of the State. This action of the legislature was approved by the voters at the election of Nov. 3, 1908, and this vote makes it certain that future strikes will be conducted peaceably. Though wages have been reduced to the Tonopah scale—\$4 per diem for miners—in a number of the camps there were no strikes during 1908.

The riches of Goldfield and Tonopah have drawn white men from all over the world. This mixing of races is well shown by the nationality of the miners in

*Mining engineer, Palo Alto, Cal.

the Tonopah mine: 56 German; 50 Slavonian; 25 Finnish; 20 Swedish; 150 English, Irish, American, Australian (one New Zealander).

"Highgrading," though not so prominent a business as in former years, is still carried on. Two men were killed while stealing ore in the Mohawk mine. Very bold were the "highgraders" at Manhattan when they started up an idle hoist in the dead of night and stole 26 sacks of rich ore. Even the silver ores of Tonopah have been "highgraded," four men being arrested for stealing ore from the Mac-Namara mine in October.

The State of Nevada should appoint mine inspectors. This is especially needed in some of the Tonopah mines, where there is a reckless disregard of ventilation. An unusual rescue of entombed men was that at the Alpha shaft of the Giroux mine at Ely; three men confined by a cave on Dec. 4, 1907, were extricated on Jan. 18, 1908, being fed and cheered meanwhile through a 6-in. water pipe.

In the fall of 1908 both Hazen and Rawhide were destroyed by fire.

FINANCIAL

Early in 1908 money became easier and on Jan. 11 the smelters resumed cash payments for ore purchased. Two banks with small capital failed during 1908 in Rawhide, and in December the Round Mountain Bank, capital \$25,000, closed its doors. The receiver of the State Bank and Trust Company has paid a dividend of 5 per cent. to the depositors and hopes to pay more.

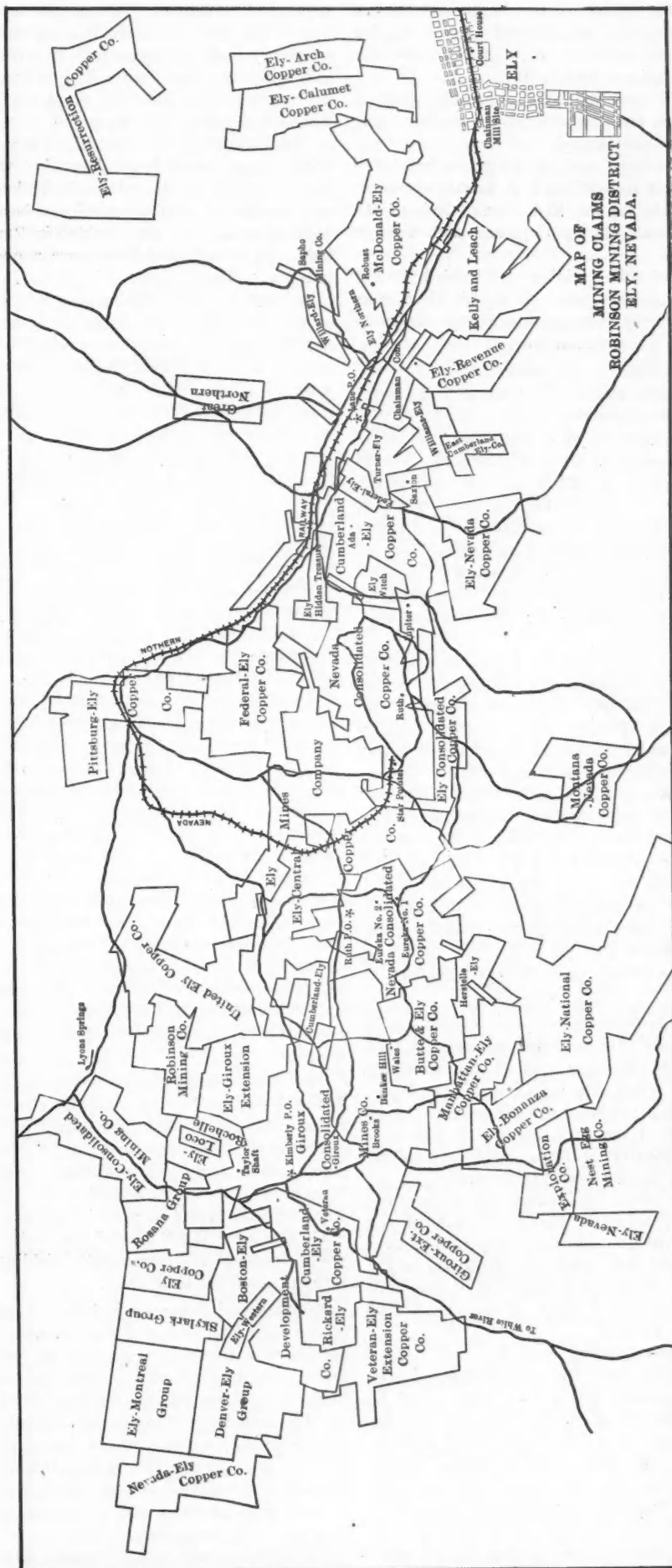
RAILWAYS

The Western Pacific is steadily constructing its line and in a year should have trains running across Nevada into San Francisco. The Bullfrog & Goldfield road was sold to the Tonopah & Tidewater in the spring. Many new railroads are projected, but no work was done on them in 1908. A branch line to the copper mines at Yerington is likely to be the first one built. Important freight reductions have been made by the Clark road in order to attract ores to the Jerome smelter.

METALLURGY

The tendency in all the Nevada gold and silver mills is toward fine grinding. The new mill of the Goldfield Consolidated will employ this process; a novelty in this mill is the treatment of the concentrates by sulphuric acid followed by cyaniding. The Greenawalt chlorination process is used in the mill of the Goldfield Chlorination Milling Company.

In southern Nevada, demands for electric power have steadily increased; 30,000 h.p. are now being developed at Bishop Creek, 113 miles west of Goldfield.



Dry washers of two kinds were tried at Manhattan and Round Mountain, but proved failures; it is stated that the ground was too moist.

Air-hammer drills, especially good in raises, are now extensively used and give great satisfaction.

Shattered rock, which cementing failed to solidify, defeated an attempt to prospect below the Red Plume shaft of the Tonopah Mining Company with a calyx drill.

Hydraulic mining is carried on at Round Mountain. At Rabbit Hole, near Lovelocks, high-pressure pumps are to be used for hydraulicking.

COPPER

In the past a small amount of copper has been produced from the ores of Nevada, 1,462,450 lb. in 1907. But 1908 marks the beginning of a big increase, and in 1909 Nevada will be an important factor in the copper market, for the Ely mines will produce a large amount of copper. The Steptoe concentrator, three units of which are already completed, is now handling 4000 tons of ore daily, and its smelter is turning out 3,000,000 lb. of copper monthly.

The mines at Yerington, Lyon county, have developed a large tonnage of copper ore. The most important company, the Nevada Douglas, owns a mile along a vein which shows ore up to 100 ft. wide. The Bluestone Mining Company reports 3,000,000 tons of 3-per cent. ore developed; and the Mason Valley Mining Company is showing its faith by building the town of Mason 3.5 miles south of Yerington. This company has 50 ft. of ore running from 3 to 10 per cent. of copper. At Ubehebe, Mina, and Luning nothing specially good has shown up. At Lodi, Nye county, a 100-ton smelter will start early in 1909.

GOLD AND SILVER

Esmeralda county is still Nevada's chief producer. Its yield was increased in 1908 by the 100-stamp mill of the Pittsburg Silver Peak Mining Company at Blair; this mill produced \$750,000 during the 10 months it ran, and should turn out more than \$900,000 in 1909. Goldfield's output was \$7,500,000 from 75,000 tons of ore. In 1909 Goldfield's product should be even larger, since the 100-stamp mill of the Goldfield Consolidated is expected to treat 600 tons daily and ship \$6,000,000 in the year. With the completion of this mill Goldfield has a daily milling capacity of over 1000 tons.

A well traveled road does not seem a promising place for prospecting, but several roadside mines have been found in Nevada during the last few years. The croppings of the first mine found at Manhattan had been worn by wagon wheels for more than 40 years. In 1908 the Lucky Boy mine near Hawthorne, and the Great Western south of Goldfield, both found close to old wagon roads, have

come into prominence through their rich ores. The Great Western is shipping its silver ore to the Belmont mill at Millers. A number of mines have been found near it; one of these, the Nevada Empress, has built a 35-ton Hathaway mill.

The Rawhide boom was faint early in 1908. A new rush began later, but was interrupted by the burning of the business portion of the town on September 4. More than 50 hoists are working in Rawhide, and it will doubtless prove a good low-grade camp.

In 1908 the Tonopah mines, in Nye county, produced about \$2,000,000 in gold and \$4,000,000 in silver. These mines have been seriously hampered by the fall in the price of silver and with a further fall many of them will be obliged to close; with silver selling for less than 50c. per oz., the Tonopah Mining Company is probably the only one that can make a substantial profit. The 100-stamp mill of the Tonopah Mining Company, at Millers, and the 40-stamp mill of the Montana Tonopah, at Tonopah, are both working ore for \$3.50 per ton. The Montana, however, is the better mill and has proved that fine grinding is superior to separate treatment of sands and slimes for the Tonopah ores.

Round Mountain has five small mills and one of the few hydraulic mines of Nevada. This is a prosperous camp. The Round Mountain Mining Company paid two dividends during 1908, and reported a profit of \$55,000 from working 14,000 tons of ore for the six months ending June 30, 1908.

In spite of its facilities for milling 160 tons of ore daily—present charges \$5 per ton—Manhattan made very little profit from its mines in 1908.

The town of Helena, 40 miles east of Tonopah, was started in November, 1908, on the strength of the Clifford mines, from which Goldfield option holders are shipping \$300 ore.

The Berlin mines, formerly owned by J. Phelps Stokes, of New York, have been recently bought by Goldfield operators.

The mines in the southern part of Nye county have proved disappointing. The Montgomery-Shoshone, heralded as the wonder of the world in 1906, is comparatively a failure; 17,798 tons of ore worked from January to June, 1908, yielding \$412,231, gave but little profit.

A disgraceful fiasco marked the career of the Gold Bar Mining Company, which did not find out that its ore was too low grade to work until after building a 20-stamp mill. This mill is now shut down and the property will doubtlessly be sold to satisfy the creditors of the company. Though the Homestake King Mining Company, a neighbor of the Gold Bar, is running its 25-stamp mill at present, it does not seem prosperous.

The Bonnie Clare mill is closed. The

Johnnie mill shut down in August, but is to start again soon. Judging by the complicated litigation over the stock of the Keane Wonder Mining Company, it ought to be a good property. Its 20-stamp mill is now running profitably. The Campbell-Smith custom mill near Beatty will start in February. The Skidoo mill is giving \$20,000 monthly.

The mines of Wonder, in Churchill county, shipped a little ore in 1908. The Nevada Hills mine at Fairview was not very prosperous during 1908; its ore was cut off by a fault.

Gold Circle, in Elko county, is improving and is to have a 40-ton mill.

In Humboldt county the new camp of Jessup was prominently mentioned by the newspapers. In the same county the old Hendra mine at Dun Glen was resuscitated by E. S. Chafey, after whom the new town of Chafey is named. He found a body of good ore from which he was able to pay \$30,000 for the mine by his ore shipments. These shipments stopped in November, and it is said that the mine is not looking so well. Seven Troughs, present population 1000, is likely to last for some years; for, though the fabulous riches reported a year ago have not materialized, much good ore has been developed. Twenty hoists are now running in this district, and the Mazuma Hills and the Kindergarten have each built a 10-stamp mill.

Rosebud, from which much was expected, has proved a "dead one."

Lincoln county is one of the large producers. The Bamberger De Lamar ran steadily in 1908, crushing 130,000 tons of \$4.75 ore. There is much activity in Searchlight; here the Quartette has just finished a 150-ton cyanide plant.

The famous Comstock mines in Storey county have had much newspaper notoriety lately. Pennsylvania capitalists have obtained control of some of these mines. Whether the stockholders will receive larger profits, or the mill men secure most of the product, as in former years, remains to be seen.

SILVER-LEAD

Non-argentiferous lead and zinc ores are mined in the Good Springs district in Lincoln county, but the bulk of the lead comes from the silver-lead ores. These ores are mined all over the State, but most of them come from the Richmond-Eureka mines in Eureka county. This county produced \$400,000 in 1908, largely from silver-lead ores. At Ward, in White Pine county, the Nevada-United is shipping 20 carloads monthly of ore containing 40 per cent. lead and 6 oz. of silver per ton. In Pioche, Lincoln county, the Nevada-Utah Mining Company is reopening the famous Raymond & Ely, and the Meadow Valley mines. This camp should make a good showing in 1909.

Zinc ore is found in quantity within 35

miles of Lovelocks. The chief producers of zinc are the Potosi and the Monte Cristo mines in the Good Springs district, Lincoln county.

MINOR MINERALS

Alum.—It is proposed to work the alum deposits of Esmeralda county.

Antimony.—A small amount of antimony ore was mined. More should be extracted in 1909, since the Chase-Andrew's Company, of New York, is building a 100-ton concentrator near Lovelocks. Antimony has been mined in former years, by the Antimony King Mining Company near Austin, and also at Battle Mountain. A 12-in. vein of stibnite was found on the 120-ft. level of the Mazuma Hills mine at Seven Troughs.

Barytes.—The deposit near Silver Peak has been studied with a view of building a mill to work it.

Borax.—This is produced in small amount by Chinese lessees near Columbus, Esmeralda county.

Coal.—William Groezinger, the discoverer of the coal beds near Tonopah (these beds were first noticed in the '60s), died in November. Many old Nevadans will recognize him under the name of "Jackass Billy." He made a small fortune by giving options on his coal mines.

Gems.—A small amount of turquoise was cut from the deposits of Lincoln and Esmeralda counties. Original Bullfrog ore is used for jewelry, as is the handsome azurite and malachite mixture found at Yerington.

Gypsum.—The Arden Plaster Company has a 150-ton mill, costing \$150,000, 10 miles south of Las Vegas.

Mercury.—In former years a few flasks of mercury were distilled from the ores of Mill City, Humboldt county. For some months past Davis & Workman have made 300 to 400 lb. of mercury daily from cinnabar found at Ione, Nye county.

Mica.—A mine of this mineral has been bought, in Lincoln county, by the American Mica Company.

Molybdenum.—Occurs in many mines as wulfenite, and is found in a wide quartz vein in Lida valley, Esmeralda county, as molybdenite.

Nickel.—The American Nickel Company was to start work on its mines near Boyer, Churchill county, in November.

Petroleum.—Prospecting wells are being driven near Buckskin in Lyon county; and near Silver Peak, and south of Rhyolite in Esmeralda county, but no oil has been produced. A Government expert has reported unfavorably as to the prospects.

Platinum.—Is found in a vein in the Bunkerville district in Lincoln county, where the ore contains 3.5 per cent. copper, 2.5 per cent. nickel, and 0.25 to 0.33 oz. of platinum.

Salt.—Is made in several counties.

Sulphur.—A few loads of sulphur were

taken from a large deposit a few miles south of Goldfield.

Tungsten.—A shipment from Lovelocks netted \$120 per ton. Several veins have been worked near Round Mountain.

Aërolite.—Easy and profitable mining was the extraction of a 4500-lb. aërolite from its sandy bed in the Quinn cañon country east of Tonopah. This is thought to be the meteor that illuminated this section of Nevada and a portion of California when it fell in 1894. I understand that an offer of \$6000 has been refused for this mass of nickeliferous iron.

California

SPECIAL CORRESPONDENCE

California was credited by the division of mining and mineral resources of the United States Geological Survey with a mineral production valued at \$56,679,436 in 1907. About 40 substances are enumerated, the most important being gold, valued at \$16,853,500; petroleum, \$14,699,956; copper, \$6,739,320; stone, \$3,134,429; clay products, \$5,740,537; asphalt, \$1,213,957; borax, \$1,121,520; and silver, \$1,049,400. Other substances of lesser total value were cement, chrome, coal, glass sand, gypsum, lead, lime, magnesite, manganese, mineral waters, natural gas, ocher, platinum, precious stones, pyrite, quicksilver, salt, slate, zinc, asbestos, infusorial earth, talc, soapstone, and a few other minor substances.

Up to the end of 1907 the value of the gold output has always exceeded that of any other single substance in California; but in 1908 the value of petroleum passed that of gold insofar as the present available statistics show. The developments in the oilfields of the State exceeded in 1908 those in the goldfields. While the unit value of gold naturally remained the same, the value of the oil produced greatly increased. The estimated average value of oil in 1907 was 37c., and in 1908 it was 48c. per bbl. of 42 gal. The gain in production of oil for 1908 was about 20 per cent., whereas the gain in value was a little over 25 per cent.

There were no specially important developments in the gold-mining industry of the State in 1908. Numerous changes were made in ownership of mines; some new ones were opened and some old ones abandoned. The reopening of long-abandoned properties continued in the principal counties. Many of the old mines of the State were given up years ago because, under the circumstances then existing, they did not pay; but under modern conditions they can be made profitable when sufficient capital is invested for proper development and suitable machinery.

In general California did better in 1908 than in 1907 because there were no general

labor strikes and no floods, although the dryness in the fall affected the yield to some extent.

In the central and northern portion of the State there were no developments of note aside from a few instances. In the southern portion new railroads brought new sections into notice and gave prospectors a chance to enter regions heretofore neglected, especially in Inyo and San Bernardino counties, where numerous discoveries were made and many new mines were opened.

In the desert regions of California, particularly those bordering on the State of Nevada there was more or less activity due to the fact that, of late, transportation facilities have been provided; prospects, hitherto worthless, have since become of some value because ores can now be shipped to reduction works. For these reasons more or less prospecting was done and both old and new claims were developed to a producing stage.

In the Mother Lode section of the State and in other older portions there were few changes. Development work continued as usual. In Siskiyou and Trinity counties of northwestern California, there was much activity in gravel mining and some new quartz enterprises were begun. In Shasta county some new smelting enterprises started in 1908 so that the copper industry should show an increased output for the year. That county is the center of the copper-mining industry.

The increased output of gold for California for 1908 is expected to come mainly from the gold-dredging industry. About 10 or 12 new dredges were installed during the year; most of these are of the largest size and have double the capacity of the old-fashioned dredge. Most of them were installed in the main dredging fields on the Feather, Yuba, or American rivers, but a number were operated in localities where but a few hundred acres of available dredging ground are known to exist. Some mergers of prominent companies took place in the dredging industry.

It is expected that when the statistics of the gold-mining industry for 1908 are completed California will show an increase of \$1,000,000 to \$2,000,000 over the production of 1907. The mines were handicapped in the fall of 1908 by a dry season, and several properties were shut down for a short period. But the deficiency due to this cause will be made up by the increased output of the dredges.

The most notable feature in 1908 was the increased output and value of petroleum. It is expected that the statistics of 1908 will show that the oil yield is valued at about \$23,000,000. The Midway oil district came to the front and Coalinga displaced Kern River as the most important field. The McKittrick district increased its yield by 2400 bbl. and the Sunset district by 1000 bbl. per day. The first

three months of the year showed little increase, but the last three months gave a very large yield. With an average price for the year of 48c. per bbl. the price went up to 63c., and is expected to reach \$1 per bbl. The great demand is for a light oil, as heavy oils are abundant.

The dividends of oil companies listed on the California Stock and Oil Exchange in 1908 amounted to only \$574,556, but the total paid by them to date is \$18,008,882.

Although all the oil companies paid \$574,556 in 1908, one gold mine, the North Star, of Nevada county, paid out \$375,000. With increased prices and output, the oil companies should be more profitable.

The production of mineral substances other than gold and oil will show little change in 1908. The structural materials of the State are coming into greater demand each year, but most of the substances will show little advance in value in 1908. The high freight rates for the heavier materials restricts production inasmuch as the consumption is largely confined to the Pacific coast, and it is impossible profitably to ship them East.

The cost of producing copper at the Burrage mine in the Bathurst mining district, New South Wales, Australia, in 1907, according to *Mineral Resources*, Bulletin No. 6, issued by Department of Mines, New South Wales, was as follows: Mining, including transportation to the mill, 11s. 4.9d.; concentrating, including transfer to calciner, 5s. 2.8d.; calcining concentrates and picked ore, 1s. 4.8d.; smelting calcined concentrates and stall-roasted ore to matte, 3s. 8.5d.; roasting matte at Burrage, 1s. 1.5d.; roasting blister copper and matte at Eskbank and refining same, 1s. 8.4d.; total, £1 4s. 6.9d. per ton of ore. The ore yielded 2.36 per cent. copper; 58,159 tons were treated during the year. The high cost of mining is due mainly to the fact that the stopes dip only 25 deg. The orebody is from 10 to 40 ft. wide.

The zinc mines at Broken Hill, Rhodesia, shipped about 16,000 tons of zinc ore to Europe in spite of the high freight charges, which amounted to \$30 per ton to the seaboard, but then exhausted the high-grade zinc carbonate ore and were left with a mixture of lead carbonate and zinc carbonate and silicate, assaying about 25 per cent. lead and 25 per cent. zinc, which cannot be economically separated by any known process. There are large deposits of the ore, occurring in a limestone formation, which are nearly pure mineral, containing only a little lime as gangue, but incapable of separation into marketable products. The ore is non-argentiferous.

The United Kingdom produced 10,194 long tons of iron pyrites in 1907 as compared with 11,140 tons in 1906. Of this amount 7394 tons came from England, 2516 tons from Ireland and 284 tons from Wales.

DIVIDENDS PAID BY MINING AND METALLURGICAL COMPANIES.

American Companies.	Location.	Paid in 1908	Paid Per Share in 1908.	Total Paid to Dec. 31, 1908.
Alaska Mexican	Alas.	\$324,000	\$1.80	\$2,040,381
Alaska Treadwell	Alas.	600,000	3.00	10,235,000
Alaska United	Alas.	117,130	0.65	423,420
Am. Sm. & Ref., com	U. S.	2,500,000	5.00	15,000,000
Am. Sm. & Ref., pfd.	U. S.	3,500,000	7.00	28,875,000
Am. Smelters, pf. A.	U. S.	1,020,000	6.00	3,455,000
Am. Smelters, pf. B.	U. S.	1,500,000	5.00	5,250,000
Anaconda	Mont.	2,400,000	2.00	43,050,000
Arizona	Ariz.	1,167,584	0.39	6,182,361
Boston & Montana	Mont.	1,800,000	12.00	52,500,000
Bunker Hill & Sull	Ida.	855,000	2.85	10,671,000
Calumet & Ariz.	Ariz.	800,000	4.00	10,300,000
Calumet & Hecla	Mich.	2,000,000	20.00	107,850,000
Camp Bird	Colo.	984,000	1.20	5,313,600
Copper Range Con.	Mich.	1,536,740	4.00	7,299,515
Doe Run	Mo.	241,186	3.00	1,765,005
Elkton, Con.	Colo.	150,000	0.06	2,191,961
Federal Sm., com	Ida.	180,000	3.00	2,618,750
Federal Sm., pfd.	Ida.	840,000	7.00	4,121,250
Florence	Nev.	420,000	0.40	420,000
Francis-Mohawk	Nev.	45,500	0.05	546,000
Hecla	Ida.	70,000	0.07	1,660,000
Homestake	S. Dak.	1,419,600	6.50	23,718,240
Intern'l Nickel, pfd.	N. Y.	534,756	6.00	1,604,288
Jamison	Cal.	31,200	0.08	331,500
Kendall	Mont.	30,000	0.06	1,275,000
Mammoth	Utah	40,000	0.10	2,220,000
Mary McKinney	Colo.	39,227	0.03	841,093
Mohawk	Mich.	250,000	2.50	1,650,000
New Idria	Cal.	110,000	1.10	1,050,000
North Butte	Mont.	1,200,000	3.00	6,400,000
North Star	Cal.	375,000	1.50	1,911,988
Old Dominion	Ariz.	146,623	0.50	720,710
Old Dominion M. & S.	Ariz.	162,000	1.00	364,500
Osceola	Mich.	192,300	2.00	7,227,950
Portland	Colo.	360,000	0.12	8,107,080
Quincy	Mich.	495,000	4.50	18,450,000
St. Joseph	Mo.	600,000	0.60	6,158,357
Snowstorm	Ida.	150,000	0.10	600,000
Standard Con.	Cal.	356,788	0.20	5,194,130
Tennessee	Tenn.	500,000	2.50	2,056,250
Tomboy	Colo.	396,000	1.32	2,016,000
Tonopah of Nev.	Nev.	500,000	0.50	4,000,000
Uncle Sam	Utah	95,000	0.19	295,000
United States, com	Utah	701,866	2.00	1,622,632
United States, pfd.	Utah	1,700,458	3.50	4,456,263
Utah Con.	Utah	600,000	2.00	7,200,000
Utah Copper	Utah	735,000	1.00	735,000
Vindicator	Colo.	225,000	0.15	1,935,000
Wolverine	Mich.	600,000	10.00	5,100,000
Totals		\$35,597,147		\$438,859,204

Foreign Companies.	Location.	Paid in 1908.	Paid Per Share in 1908.	Total Paid to Dec. 31, 1908.
Buffalo Mines	Ont.	\$108,000	\$0.12	\$ 243,000
Coniagas	Ont.	480,000	0.60	840,000
Crown Reserve	Ont.	70,000	0.04	70,000
Dos Estrellas	Mex.	675,000	2.25	3,480,000
El Oro	Mex.	777,600	0.72	4,989,600
Esperanza	Mex.	1,806,350	3.97	4,222,400
Granby Con.	B. C.	540,000	4.00	3,508,630
Guanajuato Dev., pfd.	Mex.	30,000	3.00	30,000
Guggenheim Expl.	Mex.	1,050,000	10.00	4,747,500
Kerr Lake	Ont.	360,000	0.60	850,000
La Rose	Ont.	171,505	0.15	171,505
Le Roi No. 2	B. C.	115,200	0.96	831,600
McKinley-Darragh	Ont.	280,000	0.14	280,000
Mex. Mill. and Trans., pfd.	Mex.	35,450	3.00	35,450
Mines Co. of Am.	Mex.	480,000	0.24	3,385,000
N. Y. Hond. Ros.	C. A.	270,000	1.80	2,317,000
Nipissing	Ont.	720,000	0.60	2,040,000
Peregrina, pfd.	Mex.	70,000	7.00	188,656
Pinguico, pfd.	Mex.	120,000	6.00	240,000
Securities Corp., pfd.	Mex.	14,000	7.00	42,699
Silver Queen	Ont.	225,000	0.15	345,000
Temiskaming	Ont.	225,000	0.09	225,000
Trethewey	Ont.	141,817		217,463
Totals		\$3,764,922		\$38,300,503

Industrial Companies.	Location.	Paid in 1908.	Paid Per Share in 1908.	Total Paid to Dec. 31, 1908.
Am. Ag. Chem., pfd.	U. S.	\$1,089,180	\$6.00	\$9,547,342
CambriaSteel	Penn.	675,000	0.75	8,775,000
Consolidation Coal	Md.	666,250	6.50	10,082,900
Empire[S. & I.]	N. J.	150,000	6.00	895,533
Gen. Chem., com	U. S.	296,412	4.00	2,148,987
Gen. Chem., pfd.	U. S.	600,000	6.00	6,105,000
Lehigh Coal & Nav.	Penn.	1,529,040	4.00	*15,014,890
MarylandCoal, pfd.	Md.	122,525	6.50	†2,013,997
New River Coal, pfd.	W. Va.	225,702	6.00	451,405
Penn Steel, pfd.	Penn.	1,155,000	7.00	8,662,500
Pocahontas C. C., com	W. Va.	271,200	6.00	†406,800
Pocahontas C. C., pfd.	W. Va.	168,000	6.00	168,000
Sloss-Sheff., com	Ala.	425,000	4.25	1,883,000
Sloss-Sheff., pfd.	Ala.	469,000	7.00	4,103,750
Standard Oil	U. S.	38,800,000	40.00	629,522,905
United Metals Selling	U. S.	1,125,000	22.50	5,625,000
U. S. Steel Corp., com	U. S.	10,166,050	4.00	78,765,032
U. S. Steel Corp., pfd.	U. S.	25,219,677	7.00	218,975,274
Va. Car. Chem., pfd.	U. S.	1,440,000	8.00	13,980,869
Totals		\$92,893,036		\$1,017,128,184

*Since 1894. †Since 1907. ‡Since 1890.

Review of Mining in Foreign Countries

The Year's Developments in the Mineral Industries of the Transvaal, Peru, Chile, Colombia, Mexico, Ontario and Australia

DETAILS OF GOLD PRODUCTION

The mining industries of Canada and Mexico suffered from the same adverse conditions which affected the United States in 1908. Mexico had troubles of its own arising from the declining value of silver, so many mines in that Republic being dependent upon their silver output alone. However, Mexico is rapidly attaining a high rank as a gold producer, through the further application of the cyanide process. On this account the gold production of Mexico probably increased in 1908, and inasmuch as the gold ores yield a large amount of silver, the Mexican production of the latter metal may not show any great decline. The production of gold in South Africa was the largest on record. An increased production of gold is also to be expected from Russia.

Australasia

By F. S. MANCE*

The record of the mineral industry in Australasia during the year 1908, insofar as regards the extent to which operations were affected by the fall in the prices of the industrial metals, varies little from that of other countries. The general condition of affairs thus brought about was, however, further accentuated by a persistent decline in the gold yield. The result of the year's work, especially when compared with the buoyant returns of the preceding years, consequently makes an unfavorable showing, but a closer analysis of the position makes it appear that the magnitude and extent of the operations conducted under such disadvantageous circumstances afford good grounds for satisfaction, and tend to emphasize the possibilities which, under favorable conditions, are yet likely to eventuate from the development of the mineral resources of this country.

GOLD

The gold production of Australia has for some years past shown a steady decrease, and although the falling off during the year 1908 was not so pronounced as in previous years, still the forecast indicates that a decline of about 65,000 oz. fine may be looked for, or a decrease of 1.8 per cent. on the production for the year 1907.

The following comparative statement

shows the yield for the last two years, the figures for 1908 being estimated on the basis of the production for the first ten months of that year:

	Yield 1907, Oz. Fine.	Yield 1908, Oz. Fine.
Western Australia	1,697,554	1,662,500
Victoria	695,576	684,400
Queensland	465,882	463,500
New South Wales	247,363	230,000
Tasmania	65,355	62,500
South Australia and Northern Territory	10,651	9,000
Commonwealth	3,182,381	3,111,900
New Zealand	477,312	482,500
Australasia	3,659,693	3,594,400
Value	\$75,645,854	\$74,296,248
Decrease		\$1,349,606

The position will be more clearly gaged when it is stated that the estimated production for 1908 represents a decrease of 15 per cent. on that for the year 1903, the decline from this latter year having been constant.

The State of Western Australia contributed 53 per cent. of the production of the commonwealth during the year 1908, and the indications are such as to favor the opinion that the output has reached a normal level, and that there is not likely to be a further continuation of the decline which has characterized the yield for some years past. Some of the outside fields certainly give evidence of partial exhaustion, but as against this the developments at the deep levels in the mines at Kalgoorlie, and the systematic manner in which operations are proceeding, strongly support the view to which expression has just been given. The dividends paid by mining companies in this state during the first ten months of the year totaled \$6,121,000.

The industry in Victoria cannot be viewed with equal complacency, and the gold yield for 1908 promises to be the lowest for the past 15 years. The falling off is principally due to the closing down of one after another of the deep alluvial mines, owing to the exhaustion of the deposits. The efforts made to prove the extension of these leads have involved the expenditure of very considerable sums during recent years, but so far without any measure of success. The lower grade of the ore which is being won as depth is attained on the Ballarat and Bendigo fields, the increased cost of working, and the consequent lessening of the margin between profit and loss, are all adverse

factors. As illustrating the depth to which operations have extended, it may be mentioned that the Victoria quartz mine at Bendigo has opened up a reef 4 ft. wide at a depth of 4504 ft. from the surface.

In the state of Queensland the depression of the preceding year has not in any way lifted. The government has endeavored to stimulate operations by voting a substantial sum for the purpose of carrying out deeper sinking and prospecting, and has also undertaken the construction of railways to connect the outlying mines. However, the success which has attended the operations of the Mount Morgan company, and which is referred to later on under the heading of "Copper," is a particularly pleasing feature of an otherwise disappointing year.

In New South Wales there were no developments of significance during the year, and the yield was mainly contributed by the established mines on the Cobar and Wyalong fields, and by the dredging plants. Here, as in the other eastern states, the waning productiveness of the gold mines and the absence of any developments which are likely to arrest the decadence, are matters for much concern when the future of the industry comes to be regarded.

The production of the states of Tasmania and South Australia was unfavorably influenced by the lessened output of those metals with which the gold in small quantity is found associated.

The yield of the Dominion of New Zealand, as disclosed by the returns for the first ten months of the year, gives every indication of showing a substantial gain. This is due to the increased output by the mines in the Ohinemuri district, which include the famous Waihi mine. This mine has been creating fresh records with each succeeding crushing, and the results have given a gratifying impetus to operations on the Thames field. The dredges at Otago and the West Coast, which have been important contributors in the past, furnished a lessened output during the year under review.

SILVER-LEAD

The serious fall in the prices of these metals resulted in a complete dislocation of the affairs of the companies on the Broken Hill field. Events show that the sharp decline which took place early in the year was not anticipated, and the companies were thus unable to adjust

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their internal economies in time to lessen the severity of the effects of the falling market. The companies were further handicapped by the fact that the agreement made with the miners when lead was at a top price, allowing a 12½-per cent. increase in wages, did not terminate until the end of the year, while the new customs' tariff had added considerably to the cost of supplies. The results are reflected in the report of the Broken Hill Proprietary Company for the half-year ending May, as, although the production was considerably greater, the profit for this term amounted to only \$110,919, as against \$1,501,119 for the same period in 1907, and for the first time in the company's history the declaration of the quarterly dividend had to be deferred. Several of the mines closed down, others worked fewer shifts, while development work was almost wholly discontinued, so that the number of men employed at the end of September was 6000, which shows a decrease of 50 per cent. compared with the same date in 1907. The position of affairs on the field at the time when this article was written was very unsettled, as the miners were making a determined stand against any lowering of wages, and had made a demand for the reduction of the hours of labor to 44 a week.

The output of metals was fairly well maintained, and for the financial year ending May the Broken Hill Proprietary Company raised 592,362 tons of ore and produced 74,575 tons lead, 5,315,314 oz. silver, and 1,955 oz. gold. The difficulties which some of the companies experienced in respect to the high returning charges on their concentrates sold to foreign buyers seem likely to be settled at an early date, as the Broken Hill South and the North Broken Hill companies secured an option of purchase over the Australian Smelting Company's Works at Port Kembla (N. S. W.).

The effect of the fall in the prices of the metals on the silver-lead mines of New South Wales, generally, is more fully disclosed by the returns of the exports from this state for the first nine months of the year, as the value of the silver-lead concentrates, etc., despatched totaled \$9,320,844, or \$4,158,152 less than for the same period in 1907.

In Tasmania the output from the mines at Zeehan and elsewhere was greatly restricted owing to the closing down in April of the Tasmanian Smelting Company on account of financial difficulties. The government purposes to come to the financial assistance of the company with a loan of £20,000, and it is expected that, if this be done, supplies of ore can be obtained which will enable a fair margin of profit to be realized under present conditions.

In Queensland a satisfactory increase is recorded both in the quantity and value

of the silver-lead production, the output for the nine months of this year being 730,465 oz. silver and 4712 tons lead. This yield was furnished mainly by the Chillingoe Mining Company, the chief supplies of ore being drawn from the Mungana Company's Girofla and Lady Jane mines.

ZINC

Under this heading it is pleasing to be able to record that the year witnessed satisfactory progress in respect to the operations of the several companies on the Broken Hill field. The Proprietary company's experimental spelter furnace proved so successful in actual work that the erection of nine additional furnaces was put in hand, to be completed and in operation by January, 1910. It is estimated that these furnaces will be capable of producing 8000 tons of spelter per annum,

plant was not worked full time at the close of the year.

The output of the De Bavay Company was almost doubled without any addition to the plant, the working costs were materially reduced, and a high rate of extraction was secured.

The other processes seem also to have made forward strides, but it is noticeable that those engaged in the chemical treatment of the tailings show an exceptionally high recovery when compared with mill plants, while even in mechanical details a great many advantages are apparent.

COPPER

The commonwealth statistician reports that the value of the copper exported from Australia during the first nine months of 1908 totaled only \$7,806,000, as compared with \$13,720,000 for the same period in

PRODUCTION OF MOUNT LYELL COMPANY.

Year Ending September.	Ore Treated, Tons.	METAL PRODUCED.			Dividends Paid
		Copper, Tons.	Gold, Oz.	Silver, Oz.	
1905	412,273	8,203	24,290	739,691	\$730,500
1906	394,752	9,009	23,088	703,945	1,314,900
1907	406,397	7,886	19,449	700,087	1,972,350
1908	401,983	8,641	19,532	681,262	1,095,750
	1,615,405	33,739	86,359	2,824,985	\$5,113,500

and that there is sufficient raw material on hand at present to keep them supplied for 38 years. The zinc concentrating plant of this company is at present producing at the rate of 76,000 tons of concentrates per annum averaging about 45 per cent. zinc.

The Zinc Corporation, Ltd., formed to treat the enormous heaps of accumulated tailings on the Broken Hill field, after many reverses and set-backs, also appears to have now brought operations to a successful issue. The Elmore plant, which was adopted, is stated to be doing all that was claimed for it, and high recoveries of both zinc and lead are reported. The company is at present working on a good dump of tailings purchased from the Block 10 company. The average quantity of tailings now treated monthly approximates 16,000 tons, yielding 5840 tons zinc concentrates and 410 tons lead concentrates, the assay values being: zinc concentrates, 46.5 per cent. zinc, 16.5 oz. silver, 7.4 per cent. lead; lead concentrates, 56 per cent. lead, 38.5 oz. silver, and 17 per cent. zinc. It will be interesting to see if this extraction can be maintained when the heaps of inferior tailings come to be handled.

The Potter process in use at the Sulphide Corporation's mine is stated to be securing an extraction of 90 per cent., and about 1200 tons of tailings per day are treated, the product assaying 40 per cent. zinc. A difficulty is experienced in finding a market for the concentrates, and the

1907. In the face of these figures the results secured by the Mount Lyell Company, Tasmania, as set out in the accompanying table, make a pleasing showing.

The 850-ft. level in the North Mount Lyell mine is now one of the principal sources of the ore supply. The development work undertaken at the 1000-ft. level gave particularly satisfactory results, the orebody being proved to be of considerable size, and to maintain fully its value. The accession to the ore reserves during the last half-year in this mine amounted to 169,000 tons, or 103,000 tons in excess of the output. The Mount Lyell open cut, as hitherto, supplied the pyrites for smelting purposes, and for acid making. It will be noted that the ore treated during 1908 was of a higher grade than during the preceding term, and is consequently responsible for the increased production of metals. As further evidence of the healthy position of this company it may be mentioned that the cost of producing blister copper during the last half-year was only \$3.4 per ton of ore treated.

In South Australia, the Wallaroo & Moonta Smelting Company found it necessary considerably to modify the program of operations, and as a result it is anticipated that the production of copper from the company's mines during 1908 will reach only some 5300 tons, or 1700 tons less than for the previous year. Purchased ores are estimated to have furnished an additional 300 tons as against 1720 tons in 1907. The cost of produc-

ing fine copper per ton was considerably lowered, and is approximately as follows: Mining, \$189; smelting, \$66; shipping, \$261, and other charges, \$6; total, \$522. The ore dealt with during the year is estimated at 165,000 tons. Development work was undertaken on a scale fully commensurate with the extent of ore raising, and the area of new ground opened up by the exploratory work, as a whole, showed no variation in its average value. The increasing depth of the workings necessarily tends to an advance in costs, but taken all in all the prospects must be regarded, under similar conditions, as decidedly favorable to a maintenance of the results of the present year.

In the state of New South Wales several of the mines which have been important producers in the past were closed down either wholly or in part during the year, and the value of the copper exported during the first nine months of the year amounted to \$2,131,000, or \$1,365,000 less than for the same term in the preceding year. The Great Cobar, Ltd., maintained its position as the largest producer in this state, and during the year the company completed the extensive additions to its plant, which have been in progress for some time, and carried out a large amount of development work. The lode at the 1000-ft. level has been found to improve in width, while its value exhibits no alteration. In these circumstances the returns for the year may be expected to show a well augmented production, and a higher extraction combined with economies in working costs. Of the other smaller mines, that owned by the Grafton Copper Company at Cangaï probably yielded the most satisfactory results.

While the state of Queensland naturally experienced a great reaction after the copper boom, still the attention which it was the means of directing to the important deposits of this state was productive of good results and proof of this is afforded by the output for the first nine months of 1908, which was 10,508 tons of copper, as against 9462 tons for the same months in the previous year. The Mount Morgan mine quickly gained the pride of place as the chief contributor of this state. The following statement of the production of gold and copper shows the strides made during the course of the last three financial years:

Year Ending May.	Gold, Oz.	Copper, Tons.
1906	117,197	483
1907	145,138	4,087
1908	153,091	5,561

The oxidized ore in the surface levels is rapidly becoming exhausted, but the supply of mundic ore from the inter-

mediate levels is well maintained, while development work underground has revealed the existence of larger quantities of auriferous copper ore than previously estimated by diamond drilling, the average value of that so far mined being 3.30 per cent. copper and 8.62 dwt. gold per ton. The present reduction plant is capable of dealing with 216,000 tons of this ore per annum. In the latter months of the year several extensive falls of earth occurred at the 750-ft. and 850-ft. levels, and which, unhappily, were responsible for the death of 12 men. Operations were retarded on this account, and a special board was appointed by the government to advise as to the method of conducting future operations, the present system of "pigsties" being shown to be unsafe.

At the O. K. mine the stopes in the various levels opened out well, and the ore reserves were considerably augmented. Toward the close of the year this mine contributed an output of about 140 tons of blister copper per month. The Chillagoe Mining Company maintained a satisfactory output, the chief supplies of copper ore being drawn from Ruddygore and Redcap. Important contributions were also furnished by the mines at Mount Perry, and those on the Cloncurry field.

The works of the Electrolytic Refining and Smelting Company at Port Kembla were completed and got into working order in the month of December. This company has contracts with the Mount Morgan and other mining companies for the supplies of matte, and Australia is now in a position to enter the lists as a large supplier of electrolytic copper.

TIN

Under this heading there are few developments of note to record. The industry received a set-back owing to the lower prices ruling, the extent of which is apparent when it is said that the value of the exports from the commonwealth during the first nine months of 1908 was \$3,091,000, as against \$4,428,000 for the same period in the previous year.

The Mount Bischoff Company, Tasmania, continued operations uninterruptedly, the several fresh bodies of high-grade ore opened up having proved of material benefit at a period which was regarded as a critical one in the company's history. The usual dividends were accordingly regularly declared, and the sum distributed to shareholders by this company now totals \$10,490,000.

The mines in the Derby district, including the Briseis and New Brothers Home, in the circumstances, experienced a fairly satisfactory year, and contributed about 1500 tons of tin oxide; the future prospects, however, indicate a reduction in the output. The production of tin ore from the state of Tasmania for the first

three-quarters of this year is valued at \$1,514,000, as compared with \$1,920,000 in 1907.

In New South Wales the alluvial deposits in the Tingha and Emmaville districts continue to be systematically worked, the operations of the dredges, although somewhat hampered by an insufficient rainfall, proving fairly satisfactory. Several small, but rich, lodes were also worked. The exports of tin from this state during the nine months, however, reached only a value of \$1,225,000, or \$1,050,000 below that for the same term in 1907.

In Queensland the output was much on the same scale as in the preceding year, the production to the end of September reaching 3914 tons, or within 51 tons of the output for the first nine months of 1907. The value, however, shows a drop of over \$600,000. The Walsh & Tinaroo field is still the chief center of operations, but the general results do not come up to those of last year, owing to the fact that two of the large producing mines, the Smith's Creek and Stannary Hills, suspended operations pending reconstruction of the companies. The position was somewhat relieved by the opening up of rich ore in the Vulcan mine, and the lode in this mine has now been proved to a depth of 1400 ft. The Great Northern Freehold mine at Herberton is also contributing improved returns, while the dredging industry at Stanthorpe has made good headway.

Of the tin fields in the Northern Territory little was heard during the year. Operations at the Pilbarra and Greenbushes fields in Western Australia were also unfavorably influenced by market conditions.

OTHER METALS

Mining for tungsten was adversely affected by the fluctuation in market values. The government geologist of Queensland estimated that the wolfram-bearing country of the Walsh & Tinaroo, and the Hodgkinson fields, extends over an area of 3500 square miles. Operations there were proceeding on an increasing and promising scale, as shown by the fact that during the first three-quarters of 1907 the quantity of wolfram produced by this state totaled 505 tons, but during the corresponding term this year the production, owing to the closing down of the mines, fell to 225 tons.

In New South Wales the mines at Torrington also suspended work for several months during the year.

Iron smelting now appears to have been established on a permanent basis at Lithgow (N. S. W.), the iron and steel produced being in every way satisfactory. The Federal Government, with the object of encouraging the industry, passed a bill through the House of Representatives granting a bonus of \$2.88 per ton on all

pig iron made from Australian ore, also on puddled bar iron and steel made from Australian pig iron. The total sum set apart for the purpose is \$730,500, and the annual bounty is limited to \$146,100.

COAL

The labor troubles which seriously threatened this branch of the industry in New South Wales in the early part of the year were happily averted, and the output promises to be one of the largest in the history of the state, that is if the figures of the export trade may be taken as a guide. These show that the coal exported during the nine months of the year reached a total of 4,686,553 tons and was valued at \$11,304,975, showing an increase of 461,000 tons and \$1,865,658 in value compared with the same months in 1907. The coal trade generally was exceedingly brisk during the first half of the year, after which there was a noticeable slackening off. The coke trade, while feeling the effects of the depression in metalliferous mining, was, on the whole, satisfactory.

South America

By JOHN POWER HUTCHINS*

The year 1908 was not a prosperous one for South America. Countries like Peru, Bolivia and Chile, which produce copper, silver, lead and other metals felt the hard times particularly and production suffered. The gold-producing countries were not affected. Columbia, Brazil and the Guianas about maintained their production. Ecuador is a gold producer but of inconsiderable importance.

Peru will show a larger copper production, for the Cerro de Pasco smelter operated continuously and produced about 30,000,000 lb. of copper. Silver mining suffered greatly and many of the mines are shut down. Gold mining, both placer and lode, was actively conducted in southern Peru. The extensive coal deposits are being investigated with good results and there is a likelihood of extensive developments. The coal is bituminous and coking. The coal deposits of Chile are nearly exhausted, while no coal has yet been developed in Bolivia. Peruvian coal is, therefore, in greater demand than formerly.

The Chilean copper mines generally continued operation but no new enterprises were started because of the low price of the metal, and the low exchange. Considerable interest has been taken in concentrating low-grade copper ores.

Bolivia still suffers from high cost of transportation.

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GOLD

The total gold productions of some of the countries of South America in historic times is remarkable. Colombia is credited with \$895,000,000; Brazil, \$720,000,000; Bolivia, \$199,000,000; Peru, \$119,000,000; Chile, \$33,000,000. This makes a grand total of nearly \$2,000,000,000. These figures suggest possibilities for further development and exploitation with modern methods particularly in placer mining. In South America, as in all partially developed regions, the more important mines are the placers, and nearly all the past and most of the present production is from alluvial deposits. Many of these placers are essentially one-man enterprises, but there are others which could be worked on a large scale by dredger or hydraulicking.

Gold mining in Colombia has an interesting history. Its deposits were worked by the Spaniards with slave labor soon after the discovery of America, and in 1905, with \$895,000,000, it still ranked fourth in total gold production of the world, only the United States, Australasia, Russia and Siberia outranking it. Compare the area of Colombia with those of the three regions that outrank it; then remember that most of the gold produced by Colombia came from a comparatively small part of the total area.

A very large territory in South America lies awaiting prospecting and development. There are several reasons why this area has not as yet been investigated. All of the tropical parts of the continent have at low altitudes a climate with a pernicious effect upon the health of the white man of temperate zones. His efficiency is lowered soon after arrival and usually he cannot stay in the interior for a year without a trip to the coast or the sea, or a visit to higher altitudes to recover from malaria and anaemia. Nor does a residence of several years in the tropics with vacations to healthful climate, give much, if any, immunity from malaria. A person hardened in that way may be ill less frequently than the newcomer in the tropics only because he knows how to take care of himself. Those parts of South America which lie at elevations more than 3000 ft. or in the temperate zone have no difficulty with malaria.

Lode mining is carried on in Peru, Colombia, Ecuador, British Guiana, Brazil, Venezuela, Chile, Uruguay, Argentine and Bolivia.

Colombia has a few profitable gold-lode mines. The most important of these are the Frontino and Bolivia near Remedios in the department of Antioquia. An intensive investigation of lodes has been carried on in southwestern Colombia for several years by Americans. Several promising properties are under development in this region near the boundary

line of Ecuador. Difficult transportation has been and will continue to be a serious obstacle.

Lode mining is carried on in Ecuador only in the Zaruma district, where the application of the cyanide process has made it possible to do profitable mining. A small amount of placer gold is produced on the headwaters of the Amazon river in Ecuador.

This is an extremely inaccessible region and will probably remain undeveloped for many years.

OTHER MINERALS

The nitrate deposits of Peru, Chile and Bolivia were worked as usual.

The extensive asphalt deposits of Venezuela are not worked, although the product is of high grade. There are several good reasons for this lack of activity. The limited demand is easily supplied from the more accessible though less pure deposits at La Brea on the coast of Trinidad, and the government of Venezuela has hitherto been far from stable.

Mexico

By H. A. HORSFALL*

Mining in Mexico during 1908 showed very erratic conditions. The first of the year opened with extreme depression, owing primarily to the financial panic in October of the preceding year; in the early months of the year a considerable recovery was noticed in the prevailing conditions, which was succeeded by successive periods of advance. Toward the latter part of the year, however, depressed conditions were reported and they still prevail.

The reduced prices of the various metals was the chief and primary cause of the continued depression. Copper and lead prices, however, materially advanced since the middle of the year, but silver, of which Mexico is the largest producer, continued to recede in price during the whole of the year, until at the present market price very few mines are able to show a working profit. Other matters tending to aid in the depression were the agitation of material changes in the mining laws, increased railroad freight rates on coal, ores and iron and steel products.

These conditions continue operative at the conclusion of the year, except the uncertainty in regard to the mining law. A number of large deals, which had been pending for some time were lately reported as consummated; others owing to the prevailing money conditions have been held up indefinitely. On the whole a considerable advance as compared with the preceding year was accomplished.

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GOLD AND SILVER

The gold output continued to increase at a rapid rate, notably in the districts of Guanajuato, El Oro and Dolores, as reported in previous years. The increase is partly due to the discovery of new mines, but principally to the increased use and continued improvement of the cyanide process for treating gold and silver ores. A large number of new mills using this process were put into commission during the year. Notwithstanding the general adverse conditions prevailing, the quantity of silver produced will show a material increase over previous years, new producers having come to the front and the old ones having increased their output. In prospecting greater attention was given to gold properties and many promising prospects were located.

COPPER

The complete cessation of operations at the Cananea mines at the close of the previous year was followed by the complete reconstruction of the smelting plant, and partial resumption of production, since July. The Boleo company operating in Lower California will probably lead in the amount of copper produced during the twelve months, followed by the mines at Cananea.

The starting of the 2000-ton concentrating plant at Nacozari, several new copper smelters in various parts of the country, and additions to the capacity of the older plants, will in all probability, give an increase in production in 1909.

LEAD

Notable additions to the amount of lead-silver ores produced were reported, particularly in the districts of Mapimi in the state of Durango, and Santa Eulalia in the state of Chihuahua. This is to be discounted, however, by the decreased production from the silver-lead mines of the Sierra Mojada district; late reports from this district indicate that many of the mines have resumed shipments. On the whole the production of lead will be about the same as in previous years.

TIN

A number of tin properties in the state of Aguascalientes are reported to have been purchased by Americans and are being developed. Deposits of tin ore were discovered in the state of Coahuila, near the Rio Grande river opposite Boquillo, Texas. The owners are said to contemplate extensive developments.

MERCURY

A number of properties producing quicksilver were in operation during 1908, high prices being the cause. Extensive deposits are known to exist in several

states; many of them were formerly worked.

IRON AND STEEL

Very little progress in the utilization of Mexico's resources in the manufacture of iron and steel was reported. The Monterey Iron and Steel Company has, however, been able to start up its steel plant on a large order for rails for the Mexican National railroad. The plant at the city of Durango, it is rumored, will start up again in a very short time. The manufacture of iron and steel showed very little advance in consequence of the continued shortage in the necessary fuel requirements. The recent opening of a branch of the Mexican Central railroad, from Guadalajara to the gulf coast, will in all probability, lead to increased activity in this branch of mining, for new discoveries of coal and iron ore are reported from that section.

COAL AND OIL

Coal mines in the state of Coahuila continued to produce their normal output. Reports of discoveries in other states were received, from time to time, but as yet the production has been on a limited scale. Prospecting for oil in the state of Vera Cruz was very active during the past year. The firm of S. Pearson & Son placed in operation the new refinery capable of producing 6000 bbl. per day. Prospecting in Chihuahua by the Hearst syndicate has been stopped temporarily.

OTHER MINERALS

Other mineral products of importance produced in Mexico are: antimony, sulphur, asphalt, salt, building stone, onyx of Puebla, and precious stones, of which the most important are opals and turquoise. Late reports from the statistical department of the Mexican government give the amount of Mexican and foreign capital invested in the mines and industries of that country as follows: Mexican capital, 475,509,468 pesos; American, \$336,991,000; English, £52,169,717; German, 109,817,500 marks; French, 83,757,500 francs; Austro-Hungarian, 1,000,000 florins; Spanish, 12,334,300 pesetas, and Italian, 300,000 liras.

RAILROAD BUILDING

The increase of new railroad mileage, during the year was confined principally to the states of Sonora and Sinaloa. In Sonora the branch from Nogales, Ariz., to Cananea was completed and placed in operation on Dec. 15. On July 28, 354 kilometers from Navajo, Sonora, south to Culiacan, Sinaloa, was placed in operation. At the present time the rails have been laid to Mazatlan on the coast and 54 kilometers from Culiacan south

to the Lorenzo river will be open for traffic Jan. 15, 1909.

In the state of Jalisco the Mexican Central completed and opened for traffic its branch from Guadalajara to Colima, and is building in the state of Durango, from its present terminus at Rosario, south to Inde. The Parral & Durango railroad is making additions in the state of Chihuahua and has let a contract for an extension southward from its present terminus into the mountains of Durango. Other small additions were made during the year. The Southern Pacific is building northward from Guadalajara toward the coast and recently put in operation 34 kilometers from Orendain station on the Mexican Central to Tequila, Jalisco.

CHIHUAHUA

This state ranks among the first in the number of new enterprises started during the year under review. Some of the old producers ceased operations, but new ones have arisen to replace them. The principal production, as in former years, came from the districts of Parral and Santa Eulalia. The Lluvia de Oro in the southwestern part of the state is closed down during the reconstruction of the milling plant; it produced some gold during the year. The Dolores mines continued to increase their gold production. The Rio Plata Mining Company operating at Santa Barbara in the southwestern part of the state showed a large increase of production. The Cienega gold mine, a short distance south of Morris in the district of Rayon is said to have taken out with arrastres \$12,000 in gold in a period of nine days. This mine has been worked for only a year. A number of promising gold prospects were recently located in the extreme southwest part of the state.

The Republica mine was a steady producer. The mines at Candamena are producing 20,000 oz. of silver per month. The Palmilla mine is again listed among the producers. The Watterson Gold Mining Company, Ltd., is still a constant producer. The Batopilas mines furnished their usual quota of silver. Numerous other properties are developing and sending out small shipments. The mines at Yoquivo are again working. The Reina mine near Cusiuriachic, formerly a bonanza, again started working.

The district to the east of the city of Chihuahua, along the line of the Kansas City, Mexico & Orient railroad is having a boom, and quantities of zinc ores are shipped to smelters in the United States. The gold mines at Guadalupe, formerly large producers, are being reopened. Nearly all the large properties at Parral were recently shut down. The Chihuahua smelter has three stacks in operation, and is shipping a car of lead bullion daily.

COAHUILA

Activity in zinc properties was marked during the year. The coal mines produce their usual quota. The silver-lead mines of the Sierra Mojada district are reported to be shipping an aggregate of 8000 tons per month after a long period of comparative idleness. The several smelting plants situated in this state were in continuous operation during the year.

DURANGO

The various mining camps in this state showed a very considerable amount of activity during the year and I have no doubt that the production of metallic products will show a material increase as compared with that of the preceding year. The mines in the district of Guanacavi shipped 2000 tons of ore to the smelters, and bullion and zinc precipitates to the amount of about 68,000 pesos monthly. The most active mines in the Topia district are: San Jose de los Llanitos, La Portilla, Cardena and San Ramon. In the Mapimi district the producing mines are: Ojuela, owned by the Penoles Mining Company, San Jose; El Suerte, and several others. The Boca del Cobre mines in the Nazas district were large shippers of ore to smelters. The Promontorio mine in the Papasquiario district is in operation. In the Tamazula district the Fernando Mining Company continued working during the year. The Las Reyes mine is reported to have been sold. The survey for the extension of the Durango & Sinaloa railroad, from Culiacan was completed to this district. A large number of mines in several districts are about to resume operations while many properties in various parts of the state were in process of development during the year.

GUANAJUATO

The various mines composing this camp showed increased activity during the year. At present it has a combined monthly production of more than 70,000 tons of ore with an approximate value of \$1,500,000. The principal producing companies in the Guanajuato camp are: the Guanajuato Reduction and Mines Company; Perigrina Mining and Milling Company; Guanajuato Amalgamated Gold Mines Company; Guanajuato Consolidated Mining and Milling Company; Pinguiquito Mines Company; San Matias Mining and Milling Company; El Cubo Mining and Milling Company; Guanajuato Development Company; Mexican Milling and Transportation Company, operating the San Prospero and Nayal groups; and the Santa Natalia Mining Company. Other companies are developing mines and shipping ores to smelters. At Peñon Blanco the Benito Juarez Mining Com-

pany completed and placed in operation at the close of the year, a 200-ton cyanide plant. At Jesus Maria the Amalgamated Gold Mining Company completed the foundations for a mill; at San Felipe the Providencia San Juan de la Luz is shipping high-grade ores and continues to be a large dividend payer. Other mines in various parts of the state are making shipments.

GUERRERO

The mining interests in this state, on the west coast, are still suffering from lack of transportation facilities. Guerrero, however, continued to produce a large quantity of silver, the Campo Morado district production alone being estimated at 300,000 pesos per month. The Socavon del Rey, La Borda, and La Conquistadora mines in the Taxco district are reported to be in bonanza. Considerable zinc is produced and a number of mills are under construction. General conditions are, however, in a state of depression owing to the low price of silver.

HIDALGO

The usual production from the great mines of this state continued. The districts of Pachuca, Zimapan, and Real del Monte are reported as fairly prosperous. The new mill of the Real del Monte of which the United States Smelting, Refining and Mining Company is the principal owner, is ready for operation. The Santa Gertrudis Company produces approximately two and one-half millions of pesos annually. The San Rafael is another large producer. The Blaisdell Coscotitlan Syndicate 500-ton tailings mill is ready for operation.

JALISCO

Mining in this state continued to show increasing activity during the year. Several new mills were placed in commission, and many mines increased their shipments to the smelters. The opening to traffic of 34 kilometers of new railroad by the Southern Pacific was announced on Dec. 10. The completed portion extends from Orendain on the Mexican Central to Tequila. An additional section is promised by March, 1909. Trains are now running on the Manzanillo branch of the Mexican Central from Guadalajara to Colima. Lignite of good quality has been discovered at Zapotiltic on the Mexican Central.

MEXICO

Much activity was reported from the vicinity of Toluca, principally in the districts of Sultepec, Temascaltepec, and Taxco. In Zacualpan, the Alacran, Carboncillo, and Seguranza mines are in bonanza. In the El Oro district, the El Oro Mining and Railway Company, Ltd. treated a large amount of ore with good

results. The Esperanza mine opened up ore of high value and production continued to increase. The combined value of the product of the El Oro Mining and Railway Company, the Mexican mines and La Esperanza, for the first six months of 1908 was 9,285,782 pesos.

MICHOCAN

The El Oro district lies partly in this state. The Dos Estrellas in this district is the largest producer. The Ocotes Mining and Milling Company is developing property in the Tlalpujahua district. There are several other properties which ship to the smelters.

OAXACA

The principal mining camps of this state maintained a fair production. The principal districts in the order of their importance, are Taviche, Sierra Juarez, Ocotlan and Ejutlan. Oil was found by prospectors south of Ejutlan, near the coast. A number of milling plants are in process of erection.

SAN LUIS POTOSI

Increased activity in the zinc-silver industry was noted. The production of sulphur now amounts to 2000 tons per month, which is exported to foreign countries from the port of Tampico. Exploration for oil in the Huasteca country was continued. The Tiro General mine at Charcas shipped 4000 tons of ore per month to the smelters at Aguascalientes during the early portion of the year.

SINALOA

The government reports 51 mines as working during the year with a production approximating six million pesos. Railroad building was active. Many new mining projects were started.

SONORA

Notwithstanding the general depression prevailing in the financial world, mining in this state showed a marked advancement during the year. Among the many notable achievements of the last 12 months are: The completion and placing in commission of the 2000-ton concentrating plant at Nacozari. The smelter at Fundicion, in the Alamos district, commenced operation in June. The completion of improvements and the partial resumption of smelting at the works of the Greene-Cananea company was another event of the year. Many new properties were under development, while the old producing silver and gold properties maintained, and in some instances exceeded their previous production. In the southern and central portions of the state a scarcity of labor prevailed. Railroad building was actively prosecuted, some new mileage was opened to traffic, and more is promised for the early

months of 1909. More attention was paid to prospecting for gold mines than in previous years.

ZACATECAS

In this state the mining industry passed through a period of extreme depression. The El Bote mine has rich ore; the Bohemia mines at Sombrerete are in bonanza, and other properties are developing. The Magistral smelter with a capacity of 300 tons per day was put in operation during the year. A railroad is building from Gutierrez station on the Mexican Central to Sombrerete.

TERRITORY OF TEPIC

There are a number of mines, in this territory, the property of Americans, but most of them are as yet in the development stage. Since July, prospecting was reported to be very active, particularly in the western part of the province near the line of the proposed new railroad now being built by the Southern Pacific. The producing mines in the territory are those of the Buenavista Company; those of the Castellana Consolidated Mining Company, operating the Certuchena, Rondanera Soledad and others; San Jose de Ventanas, Santa Fe, La Libertad, El Macho Rucio, Ventanas, Pinadillo, La Mexicana, Palmera, Mina del Monte and Zopilote. The San Miguel and Zapotan mines are not producing at present.

The Transvaal

By W. FISCHER WILKINSON*

During the year 1908, the mining industry of the Transvaal expanded considerably, both as regards gross production and profits. Several new mines commenced crushing and many producing companies increased during the year their reduction plant and output. Comparing the month of September, 1908, with December, 1907, there was a net increase of 242 stamps in the Witwatersrand district. The tonnage crushed per stamp was considerably increased due to increased weight and to the assistance given by tube mills. The statistics for these two months are given in an accompanying table:

INCREASE OF MILLING IN THE WITWATERSRAND

Stamps at Work.	Tons Milled.	Tube Mills.	Tons per Stamp Month.
Dec., 1907 8,383	1,349,580	67	161
Sept., 1908 8,625	1,534,755	102	178

The new companies contributing to this increase were the Aurora West United with 60 stamps, and the West Rand Consolidated Mines with 80 stamps, both of which companies made their first return

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during September. Of the old companies the Ferreira Deep added during the year 40 stamps to its reduction plant; the Durban-Roodepoort Deep, 40 stamps; and the New Kleinfontein, 20 stamps.

In October, the production was still further increased by the entry into the list of producing mines of the Jupiter and Simmer Deep, which have a joint 300-stamp mill, and of the Cinderella Deep, which has a 50-stamp mill. In November, the Geduld company, which also has a mill of 50 stamps, made its first return. At the end of the year there will probably be about 9000 stamps dropping in the Witwatersrand district.

PRODUCTION

Adding the estimated production of the outside mines, the total gold production of the Transvaal for 1908 will have in round figures a value of £30,000,000, which is, of course, a record production and represents 35 per cent. of the world's gold production, assuming that other countries maintain the production they made in 1907. The accompanying table,

TRANSVAAL GOLD PRODUCTION.

Year.	WITWATERSRAND DISTRICT.			Outside Mines Value.	Transvaal Total.
	Tons Milled.	Value.	Value Per Ton Milled, s.		
1884-9	1,000,000	£2,440,000	48.83	£238,231	£2,678,231
1890	730,000	1,735,491	47.4	134,154	1,869,645
1891	1,154,144	2,556,328	44.2	367,977	2,924,305
1892	1,979,354	4,297,610	43.4	243,461	4,541,071
1893	2,203,704	5,187,206	47.0	293,292	5,480,498
1894	2,830,885	6,963,100	49.2	704,052	7,667,152
1895	3,456,575	7,840,770	45.2	728,776	8,569,555
1896	4,011,697	7,864,341	39.2	739,480	8,603,821
1897	5,325,355	10,583,616	39.74	1,070,109	11,653,725
1898	7,331,446	15,141,376	41.3	1,099,254	16,240,630
1899	6,872,750	15,067,473	48.84	661,220	15,728,693
1900	459,018	1,510,131	65.82		1,510,131
1901	412,006	1,014,687	49.25	81,364	1,096,051
1902	3,416,813	7,179,074	42.00	74,591	7,253,665
1903	6,105,016	12,146,307	39.79	442,941	12,589,248
1904	8,058,295	15,539,219	38.46	515,590	16,054,809
1905	11,160,422	19,991,658	35.82	810,416	20,802,074
1906	13,571,554	23,615,400	34.8	964,587	24,579,987
1907	15,523,229	26,421,837	34.04	981,901	27,403,738
1908*	18,000,000	28,750,000	31.8	1,210,000	29,960,000

*The December figures are estimated. Owing to the practice on some mines of keeping large gold reserves, which may or may not be declared in December, it is not possible to make a close estimate. The gold reserves at the end of November were about 118,000 oz. of a value of £500,000.

compiled from the returns of the Chamber of Mines, shows the gold production of the Transvaal from 1884 to 1908:

Large as the figures for 1908 are, a further expansion in the early months of 1909 may be confidently awaited, as there are several companies with reduction plants in course of construction. Among these may be mentioned the Knights Central, which will start with a mill of 100 stamps, the Vogelstruis Consolidated Deep with a mill of 40 stamps, and the Bantjes with 35 stamps. The Village Deep is increasing its plant, and the Robinson is adding to its reduction plant stamps to crush 12,000 tons of Main Reef per month.

The only company that retired during the year 1908 is the Bonanza, a small property which had a life of exceptional prosperity. The mill was bought by the Robinson Central Deep mine and the stamps are now crushing ore from that

property. There are two other mines nearing exhaustion, namely the Champ d'Or and the Jubilee. It may be remarked that when mines are worked out, the mills are still available to crush ore from other mines, so that the productive power of the field as a whole does not necessarily suffer from the exhaustion of a mine.

EASTERN RAND DEVELOPMENTS

The most noticeable development of new ground that took place during the year was in the eastern section of the Rand. The successful results obtained by the New Kleinfontein, the Van Ryn, and the New Modderfontein mines, which are the most eastern producing mines, led to increased activity in this neighborhood, and the Main Reef series may now be regarded as proved without doubt as a payable ore deposit as far as Geduld. The extension of the reef farther east or south is still something of a problem; but that it will be traced farther in the near future seems certain. The Witwatersrand beds are in this district covered by a younger formation, so that the exact position of

the Reefs and of the lay of the beds has to be determined by bore holes.

The theory of the extension of the Rand formation most generally accepted is that the Main Reef takes a turn to the south, running toward the Nigel district. While there is some uncertainty as to its course after leaving Geduld, all doubt as to its position and value as far as that farm has now been cleared up. The Geduld mine is now one of the crushing mines, and active development is proceeding on the Van Dyk, the Brakpan, the Rand collieries, and the Apex.

Below Modderfontein, a new company called the Modderfontein B. Gold Mines, Ltd., was recently formed to amalgamate into one block of 1467 claims, of which 67 are north of the outcrop, the claims of the Modderfontein Extension, Ltd., North Eastern Claims, Ltd., Transvaal Land and Mines Proprietary Syndicate, Ltd., and South Eastern Claims, Ltd. This com-

pany is expected to have the reef in no place at a greater depth than 2000 ft. vertical, and the active development of the property will shortly be commenced.

On Daggafontein, another farm in this district, boring operations located the reef and a shaft is projected; and on Cloverfield the sinking of a shaft is also being taken in hand. As an example of the value of the ore met with in this district, recent development returns of the Brakpan and Van Dyk mines may be recorded. At Brakpan, No. 1 shaft is 3098 ft. deep, and three levels have been driven. In No. 1 the reef is displaced by a dike. In No. 2 level a drive of 131 ft. showed over 101 ft. low grade, and over the last 30 ft. 17.44 dwt. over 29.5 in. In No. 3 drive the ore was low grade. In No. 2 shaft the reef was cut at 3695 ft., where it averaged 16.38 dwt. over 81.75 in. In a raise put up 25 ft., the reef which was only partially exposed assayed 18.36 dwt. over 64.8 in. A dike is here met with, and on the other side assays averaged 8.5 dwt. over 52.7 inches.

On the Van Dyk the total lineal development to September 30 was 8954 ft., of which 6114 ft. were on the reef, assaying over this distance 8.47 dwt. over 30 inches.

Although none of the developing mines in the far Eastern Rand has been opened yet on a large scale, sufficient work has been done to demonstrate that good ore occurs and that the district will in the future yield a large gold production. Except for the break caused by the Witpoortje fault there is now a practically unbroken line of mines from Randfontein to Geduld, a distance measured along the line of outcrop of about 50 miles. There are a few gaps here and there in this line where there are no producing mines. Between Randfontein and the West Rand Central there is a stretch not yet developed, and in the West Rand a small length of outcrop belonging to the Roodepoort Gold Mining Company is standing idle. But this will shortly again be worked, an amalgamation with the Roodepoort United Main Reef having been announced in December. In the Eastern Rand there is an unworked piece between what was the Cason (now part of the East Rand Proprietary Company) and the New Kleinfontein. With these exceptions, the Main Reef beds have been exposed and developed over the whole distance from Randfontein to Geduld.

LABOR

The decision of the Transvaal government to terminate the employment of Chinese at the mines was referred to in last year's review. At the close of 1907 there were 37,118 Chinese employed, which number was reduced to 12,317 at the end of October. Fortunately the industrial position was not seriously affected by this large reduction of labor, owing to the

increased supply of Kafirs. It is partly due to more successful recruiting and partly to a decreased demand for this labor in other parts of South Africa, notably at the diamond mines, that the Rand has not experienced a labor famine as might have been expected. On the contrary, for the greater part of the year the demand for unskilled labor has been easily met.

It is satisfactory to be able to report that the efficiency of the native has undergone improvement, largely brought about, it is claimed, by the good example set by the Chinese. The standard of work, too, has been raised, at all events, at some of the mines. At the Simmer & Jack, for example, a 48-in. hole is now expected from hammerboys in place of a 36-in. hole, and, in the case of machine drilling, an 8-ft. hole instead of a 6-ft. hole. Greater efficiency in unskilled labor was also obtained by extending the period of engagement of natives to 12 months instead of shorter periods which had previously been customary.

While there is no great difficulty at the present time in obtaining a sufficient supply of unskilled labor, anxiety has been expressed that in consequence of the great expansion in the mining industry that is now taking place, the labor question may again become a serious problem. At a meeting of the Knights Deep mine, held in November, the chairman, a manager of one of the larger financial houses, said that the labor question was only temporarily solved, but expressed the hope that an adequate supply of native labor would be obtained from Central Africa and from Zululand and the neighboring territories, from which districts so far only a small number of natives had been drawn. There is also reason to hope that a further economy of labor may be obtained by substituting machine drilling for hand drilling, a change which is dependent on the discovery of a thoroughly reliable machine drill.

Economy in native labor is also obtained by employing unskilled whites and white apprentices on an increased scale. In some of the mills, for instance, natives are excluded, their places being filled by young white men. The extent to which unskilled white labor can be employed is regulated by considerations of cost. The low rate of native wages prevents the white man from competing successfully with the Kafir for the lowest class of manual labor; but for works where intelligence counts, it is different. Here, owing to increased efficiency, he can enter into successful competition with the Kafir, and it is satisfactory to find that those who control the mines are encouraging this competition, and are giving facilities to young men of the country to make themselves efficient miners, enabling them to find employment in positions which were formerly occupied by natives.

The total labor employed in all mines of the Transvaal, that is, including gold, coal, diamond and base metal mines, during September, was: Whites, 20,732; colored labor, 176,129; Chinese, 16,311.

LABOR EMPLOYED IN TRANSVAAL GOLD MINES.

MINES DEPARTMENT STATISTICS.

		White.	Colored.	Chinese.
1902.	{ July	8,162	32,616	
	{ Dec	10,292	45,698	
1903.	{ June	11,825	66,221	
	{ Dec	12,695	73,558	
1904.	{ June	13,413	74,632	1,004
	{ Dec	15,023	83,639	20,885
1905.	{ June	16,939	104,902	41,340
	{ Dec	18,159	93,831	47,267
1906.	{ June	17,959	90,882	52,352
	{ Dec	17,495	98,156	52,917
1907.	{ June	17,166	111,862	51,517
	{ Dec	17,697	129,618	37,118
1908.	{ June	18,181	147,557	21,460
	{ Sept.	19,077	155,171	16,311

AMALGAMATION OF COMPANIES

During the year 1908 a number of amalgamations of companies were carried through. From one end of the Rand to the other the policy of creating larger units than formerly has been adopted. Whereas the standard size for a mining block used to be 200 claims, the area now selected as a unit is 1000 claims and more. In support of the adoption of this policy, it is urged that larger units produce economy in capital expenditure and a reduction in working costs, principles which will not be contested. The differences of opinion that have arisen have not been so much on the question of the size of a mine area, but on the valuation placed on the different interests included in the amalgamation, and generally on the question whether increased area and increased life, even though accompanied by a reduced cost of working, were worth the price. Many shareholders in a producing mine sufficiently developed to allow of there being no uncertainty as to its future, prefer their property to be worked out to a finish, rather than have a speculative piece of additional ground added at a considerable increase to their capital and consequent reduction in their dividend.

Although economy in working has been the main reason put forward in support of consolidation and amalgamation, the policy has also been largely influenced by financial considerations. In some cases the deep level areas, which have been amalgamated with producing mines immediately above them, have belonged to companies which had either exhausted their working capital, or had not sufficient funds to bring them to the producing stage. The mining houses who controlled them expressed their inability to obtain the necessary capital from the shareholders, or the public, and were not prepared to finance these companies from their own funds. The Simmer Deep, the City Deep, the Knights Central, the Jupiter, and the East Rand amalgamations may be quoted as

examples of consolidation brought about largely for financial reasons. A later example is the proposed amalgamation of the South Nourse with the Nourse Mines, the latter a company which had been not long ago joined to the outcrop mine, the Henry Nourse, an amalgamation which was attended with unfortunate results for the outcrop mine.

The position at the commencement of 1908 was that many deep-level companies were in a desperate financial condition. Their funds were exhausted, or insufficient to bring them to the producing stage. Fresh capital was wanted and was not obtainable, and it was evident that even if fresh capital was obtained it would be a long time before these properties would be able to pay dividends. The adoption of the policy of amalgamation saved the situation. By consolidation with the producing mines the necessity of raising fresh capital was avoided. The shareholders in the deep mines became partners in the dividends of the producing mines, giving in return their ground and whatever cash assets they happened to possess. The producing mines received as compensation for the increase to their capital the prospect of an extended life and were enabled with the funds supplied by the deep mines to work on a larger scale and consequently at a reduced cost of working.

The arguments used in favor of amalgamation mostly employed have been the arguments of longer life and of reduced working expenses which the working of larger areas brings about. There can be no question that the working of larger units tends to economy. There will be obviously a saving in administration expenses, while economy will be gained in having larger power plants. Fewer shafts are required, and the development of a mine can be carried out more advantageously with a large than with a small area. The statistics of the working costs of the mines, which will be referred to presently, demonstrate the advantage of large units.

In principle, therefore, amalgamation into large units is sound. The question whether amalgamation or consolidation is advantageous or not depends on what valuation is put upon the various interests. And it is on this point that differences of opinion as to the justice of the amalgamations that have been carried through have arisen. Valuations are governed by many factors, some of which are arbitrary, such as the scale of operations, capital expenditure, rates of interest assumed in calculating the present value of profits, so that it is not surprising that conflict of opinion should arise as to the fairness of any scheme of amalgamation.

The question is, what is the most economical life of a mine, and the relation between capital expenditure and profits has been the subject of much discussion, and prominent engineers, such as Mr. Kötze

and Ross Brown have shown that the economic life of a given area comes inside 10 years. If that is so, the argument of long life, which deep-level interests put so much weight upon, has to be treated with caution by the producing mines. They have to decide whether the present value of the profit to be secured from the deep ground is worth the price demanded, taking into consideration the decreased cost of working that the amalgamation will bring about owing to the increased scale of operations, a result which, it may be noticed, can be secured without amalgamation by devoting some of the profits to extension of plant.

From what has been said, it will be understood that amalgamation schemes require very careful valuation work, and it is only fair to say that the Rand mining houses have, in all the most important consolidations at all events that have been carried through, employed competent engineers to value the various interests involved.

The undesirable feature in these amalgamations is that the sellers are those who practically decide the price. Valuations are made by engineers, it is true, but if the valuation does not agree with the views of the financial house, the business may be dropped. In several cases the complaint has been made that the shareholders in the producing and dividend-paying mines have been forced to become partners in ground of unproved and speculative value without any real necessity. Unamalgamated, such mines had prospects of a certain, though limited prosperous career. The Henry Nourse, the Village Deep, and the East Rand producing companies could all have been worked to a finish without amalgamation. The shareholders in these mines hear of the advantages to be gained by amalgamation, but not the disadvantages, and probably if more prominence had been given to the disadvantages, the shareholders in the dividend-paying mines would have refused acceptance of the respective schemes of amalgamation. Opposers of a scheme have not, however, the same chance of making themselves heard as the promoters, and consequently the financial house, although perhaps representing a minority interest in the producing mine, generally wins the day.

RAND FINANCE

This may be a convenient place in which to notice the methods employed to restart some of the mines whose working capital has been exhausted. The usual practice is now for the capital to be first reduced by giving the old shareholders one share for each two, three or four held before. The capital is then immediately raised and the fresh capital is offered *pro rata* to the shareholders with options over further shares at varying prices and payable at varying dates, the controlling

LIST OF RECENT AMALGAMATIONS ON THE RAND.

Date of Amalgamation	Name of Enlarged Company.	Companies Absorbed.
1906	Simmer Deep: 1034 claims.	South Geldenhuis Deep. South Rose Deep. Rand Victoria Mines. Rand Victoria East.
1907	Jupiter: 500 claims.	Simmer West.
1907	West Rand Consolidated: 1785 claims.	West Rand Mines. Violet.
1907	Randfontein Central: 477 claims.	Randfontein Block A. Mynpadiit Randfontein. West Randfontein.
1908	East Rand Proprietary Mines: 2896 claims.	Dreifontein. Angelo. Comet, Cason, H. F. Company, Angelo Deep. Dreifontein Deep (part of). Hercules, and sundry claims.
1908	Consolidated Langlaagte: 501 reef claims.	Croesus Deep.
1908	Knights Central: 893 claims.	South Knights.
1908	City Deep: 1084 claims and farm.	City Deep. South City. South Wolhuter. Wolhuter Deep. Farm Klipriversberg.
1908	Village Deep: 529 claims.	Turf Mines.
1908	Witwatersrand Deep.	Dreifontein Deep: 125 claims.
1908	Chimes West.	Benoni.
1908	Van Ryn Deep: 754 claims.	Klipfontein Deep.
1908	Modderfontein B. Gold Mines.	Modderfontein Extension. Northeastern Claims. Transvaal Lands and Mines. Proprietary Syndicate. Southeastern Claim.
PROPOSED AMALGAMATIONS NOT YET COMPLETED.		
1908	Nourse Mines.	South Nourse.
1908	Crown Reef: 1852 claims.	Crown Deep. Crown Reef. Paarl Central. Langlaagte Deep. Robinson Central Deep. South Rand and Central Deeps.
1908	Roodepoort Gold.	Roodepoort United. Main Reef.

house taking options over some of the shares. Examples of this form of reconstruction are the Bantjes and Vogelstruis Consolidated Deep.

It seems a pity that the finance of mining companies cannot be conducted on simpler lines and that the complicated system of reducing capital and then immediately raising it, coupled with all sorts of option conditions, cannot be avoided. These complicated methods of finance, approaching almost to juggling, are exceedingly puzzling and unpopular with the ordinary shareholder.

Another matter connected with Rand finance that seems worth calling attention

to, as it is something of an innovation, is the building up of a reserve fund out of profits and its investment in a new undertaking. The Jumpers mine is an example of this. This mine is nearing exhaustion, but the profits are not being fully distributed to the shareholders, but reinvested in another mine in the East Rand, the Chimes West and Benoni. It seems to me that shareholders would much prefer to make their own choice in selecting an investment for their profits. This practice of investing profits in outside properties, as well as the practice now largely prevalent of increasing the reduction plants out of profits instead of by an issue of new capital, is evidence that the Rand mining houses, having failed to get money from the public for new enterprises or for extensions, have adopted a policy of making the shareholders in the dividend-paying mines find the money.

MINING INDUSTRY COMMISSION

The report of this commission was issued in March. The commission had been appointed by the government to inquire in what direction, and how far, the use of mechanical appliances could be extended on the mines, and what effect such extended use would have upon (a) the employment of white labor, (b) the cost of production (c) the demands of the mining industry for native labor and (d) on the mining industry generally. The commissioners were also asked to report on the means best calculated (a) to increase the employment of white labor on the mines, (b) to secure the more efficient use of native labor and (c) generally to secure greater economy and efficiency in mining operations.

The commissioners were not unanimous in their findings and there was a majority report representing the views of F. H. P. Creswell, a prominent advocate of all-white labor for the mines, and a minority report, which expressed the views of the average mining man on the Rand, which are that the present condition of things do not call for any drastic changes by legislation. The government appears to share this opinion. At all events no action has been taken to carry out the principal recommendations of the majority report.

OTHER MINERALS

The following statistics of the Mines Department give the production of other minerals in the Transvaal for the statistical year 1907-1908:

	Value.
Copper ore.....	£32,400
Galena.....	21,761
Tin ore.....	81,677
Magnesite.....	900
Flint.....	12,350
Lime.....	52,474
Miscellaneous.....	17,364
	£218,926

STOPE-DRILL COMPETITION

During the latter end of 1907 a competition for machine-stope drills, promoted by the *South African Mining Journal*, was held, and excited much interest. Eight different makes of drill entered, the prize being awarded to the Gordon drill. The advantages to be gained from such trails are recognized by the mines, and a further competition on a larger scale is being organized by the Chamber of Mines to take place about April, 1909. The competition is expected to last more than six months, so that a thorough testing of the compet-

ment, but its application is limited to government land and private farms not beneficially occupied.

DIVIDENDS

The dividends paid for the first half of the year amounted to £4,085,694, of which amount £3,975,071 was paid by 42 companies in the Witwatersrand district and £110,623 by three companies in the outside districts. The second half-year will show a considerable increase; and the total dividends for the year may be expected to be about £8,500,000.

OPERATIONS OF SEVERAL MINES SELECTED AT RANDOM (CHAMBER OF MINES)

		Yield.		Costs.		Profit.	
		s.	d.	s.	d.	s.	d.
Crown Reef.....	1907	38	4	18	10	19	6
	Sept. '08	31	11	15	4	16	7
Ferreira.....	1907	49	4	21	5	27	11
	Sept. '08	44	11	17	10	27	1
Knights Deep.....	1908	26	11	16	10	10	1
	Sept. '08	25	3	13	9	11	6
New Primrose.....	1907	34	6	20		14	6
	Sept. '08	31	2	17	4	13	10
Robinson.....	1907	62	4	18	2	44	2
	Sept. '08	49	10	11	7	38	3
Simmer & Jack.....	1908	32	3	16	2	16	1
	Sept. '08	31	2	11	11	19	3
Village Main Reef.....	1907	33	5	19	1	14	4
	Sept. '08	29	6	16	2	13	4
Robinson Deep.....	1908	26	2	21	5	14	11
	Sept. '08	34	3	15	1	19	2

ing drills may be made. Entries for this competition closed on Dec. 31, 1908.

The object of the competition is to obtain a small drill, weighing less than 100 lb., that can be used in narrow stopes. The first prize of £4000 will be awarded to that drill for which the total cost, when divided by the total footage drilled by all machines of that entry during the competition, is least. There will be a second prize of £1000, besides special prizes for the drillmen. Having regard to the great saving in native labor that the discovery of a suitable drill would bring about, the competition promises to be of great importance to the industry.

METALLURGICAL AND MECHANICAL IMPROVEMENTS

In metallurgical work several improvements appeared during the year. The new stamp batteries are being equipped with heavier stamps than formerly, the latest mills having stamps weighing 1650 and 1700 lb. Appliances are being put in for dewatering sands. A 15-ft. rotary sand filter, after the designs of W. A. Caldicott, is now running at the Simmer & Jack, and others are to go up at the new Simmer Deep plant. Attention is being paid to the removal from the tailings pulp by a magnetic separator of metallic iron, which otherwise accumulates in the tube

DIVIDEND LIST OF TRANSVAAL GOLD MINING COMPANIES.

Year.	Dividends.	Year.	Dividends.	Year.	Dividends.
1887	£12,976	1894	£1,532,284	1901	£415,813
1888	112,802	1895	2,046,852	1902	2,121,126
1889	432,541	1896	1,513,682	1903	3,362,237
1890	254,551	1897	2,707,181	1904	3,928,487
1891	334,698	1898	4,864,973	1905	4,857,539
1892	901,470	1899	3,109,041	1906	5,735,161
1893	955,358	1900		1907	7,131,612

NEW GOLD LAW

A draft of a new gold law was published early in the year and met with considerable adverse criticism. The law was then referred to a select committee with the result that a gold law has been agreed to and is expected to come into force on Jan. 1, 1909. Although not entirely satisfactory from the point of view of the mining community, it has been accepted as an improvement on the old law. It is more liberal than the former law as regards prospecting. The principle of open prospecting has been agreed to by the govern-

mill. At the Robinson Deep a magnetic conveyer belt pulley is going in to pick out broken drill ends, etc., so as to keep them out of the mortar boxes. At the Bantjes mill the plates are to be placed in a separate building, while an outside stockpile and belt system will allow of reduced bin construction.

Warm solutions for slime treatment are doing well, and the system will probably be extended. At the Simmer Deep plant a large vacuum air pump, drawing 420 cu. ft. per min. has been installed and connected up to the sand-leaching pipes, so as

to drain charges thoroughly and draw large volumes of air through the sand.

Electric stamp driving is carried on at some mills, some of the mines obtaining their power from their own central station while others purchase from an independent supply company. H. C. Behr's dense-air system is at work at the Simmer Deep

Ontario

By THOS. W. GIBSON*

Silver and nickel dominated the mining industry in the province of Ontario in 1908. There have been two eras of silver production; one began with the discovery

value, but the deposits were not so rich as those of Cobalt, and the latter camp has doubtless already surpassed the Lake Superior field in production.

The second era began with the discovery of Cobalt five years ago, since which time a total output of approximately 35 million ounces of silver worth say 19½ millions



mine. The exhaust of a winding engine worked by air at a very high pressure is delivered direct into the air mains for operating machine drills.

At some of the mines centrifugal pumps are being put in to do the work of the large tailings elevator wheels which are so conspicuous all along the reef. Particulars were given in the JOURNAL of Sept. 12, 1908.

of Silver Islet in Lake Superior 40 years ago and was prolonged by the subsequent opening up of the Rabbit Mountain, Badger, Beaver, Silver Mountain and other mines on the mainland. Production came to an end, however, when silver fell from its high estate. Statistics for that period are now unobtainable, so no definite statement can be made either in ounces or

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of dollars has been made. The development of the Cobalt camp is strikingly shown by the following table:

PRODUCTION OF SILVER FROM COBALT.

Year	Production, Oz.	Value.
1904	206,875	\$ 111,887
1905	2,451,356	1,360,503
1906	5,401,766	3,667,551
1907	10,023,311	6,155,391
1908	17,000,000	8,200,000

Total 35,083,308 \$19,495,332

The figures for 1908 are based on the

output for the first nine months of the year, and are not likely to be far out of the way. For this period the production was 12,581,510 oz. The shipments for the same time amounted to 17,335 tons; consequently the average silver content of the ores shipped was 725 oz. per ton. This is an improvement over 1907, when the average had fallen to 677 oz. as compared with 1013 oz. in 1906. The improvement is, in part, due to the great richness of some of the veins opened during the year, and in part to the fact that the shipments this year included about 480 tons of concentrates, the product of the mills which several of the companies have erected to treat their low-grade ores.

The sensation of the camp in 1908 was furnished by the Crown Reserve mine. A portion of the bed of Kerr lake, containing about 23 acres, had not been staked out as a mining claim notwithstanding it was in juxtaposition to such mines as the Drummond, Kerr Lake, Lawson and Foster. In 1906 the Ontario government offered the parcel for sale to the highest bidder. The best offer received was \$52,000, which was not considered high enough. Offers were invited a second time with the condition added that the purchaser should pay 10 per cent. royalty on the value of the output at the mine. The bids this time went up to \$178,500. The buyers (a syndicate of Montreal brokers) formed a company, and for a time the shares sold for 15 to 20c. A diamond drill located a vein which for size and richness in native silver is probably not surpassed in the camp. Shares are now worth about \$2.70, and the government's decision to reserve a royalty will undoubtedly put a large sum in the treasury of the Province.

THE PRODUCING MINES

The leading mines of 1907 continued their production in 1908, and most of them increased their output. Among those were Nipissing, La Rose, Coniagas, O'Brien, Kerr Lake, Trethewey, Silver Queen, Temiskaming, Temiskaming & Hudson Bay, Townsite, Right-of-Way and others. Crown Reserve was the chief producer added during the year. Temiskaming came well to the front, and is of interest from the fact that its leading vein is in the Keewatin formation, which at Cobalt is less prolific in silver-bearing ore than the conglomerate.

Most of the ore is still shipped out of the camp for treatment, the low-grade or "screenings" going principally to Denver, Colo., where it has been found suitable for mixing with ores from certain of the Western mines. Low-grade ore in Cobalt contains 100 to 150 oz. per ton. The high-grade ore which carries up to 7000 and 8000 oz. per ton is treated principally at the Canadian Copper Company's smeltery at Copper Cliff, and the Deloro Mining and Reduction Company's works at

Deloro, both of these plants being in Ontario. The latter is owned chiefly by the proprietors of the O'Brien mine. The Coniagas smeltery at Thorald on the Welland canal, went into commission during the year, and operated on the product of the Coniagas mine.

There were no labor troubles at Cobalt in 1908, but the declining value of silver undoubtedly had a tendency to lessen production. The cost of producing silver is put by some of the leading Cobalt mines at 9 to 10c. per oz., so that even at 48 or 49c. there is a good margin of profit.

That the mines of Cobalt yielded nearly 60 per cent. more silver than those of any one State in the United States even at low silver prices is proof of the remarkable character of the deposits.

OUTLYING DISTRICTS

Extensions of the Cobalt silver field continue to be eagerly sought for and several have been found. The chief of those are: (1) South Lorrain; (2) Montreal river; (3) Everett and Miller lakes; (4) Gowganda lake.

South Lorrain is a patch of unsurveyed territory on the west shore of lake Temiskaming, and south of the township of South Lorrain proper. The formations are similar to those in the vicinity of Cobalt. Most of the promising veins have been found in the Keewatin but good silver ore has also been obtained from veins in the diabase. The chief properties in South Lorrain are the Keeley (H.R. 19), and the Haileybury Silver Mining Company.

The Montreal river runs in a southeast course for many miles before falling into lake Temiskaming, and about 40 miles northwest of Cobalt, in James township and vicinity, some good finds of silver have been made. The geology is similar to that of Cobalt except that the diabase is more prevalent, and in this the silver-bearing veins chiefly occur. Numerous claims have been staked in James, Smyth and Tudhope townships and also in Hubert, Silver, Bloom and other lakes. The Otisse, Downey, Gifford, Currie and other claims in the district and the Darby and White groups at Maple Mountain have promising showings. The last-named has been acquired by the Canadian Ores, Ltd., an English concern.

Miller and Everett lakes lie farther west in the Temagami forest reserve, and a number of excellent discoveries were made here and also at Gowganda lake, still farther west, whence some very fine samples of native silver have been brought during the year, resembling the bonanza finds made at Cobalt in 1903 and 1904. Gowganda claims most attention at the close of the year as the new silver field. "Snowshoe" staking is actively going on at present, and the coming of spring will undoubtedly see a big rush. Careful ob-

servers, comparing conditions with those at Cobalt, doubt whether the veins in any of these fields will prove so rich or permanent.

MANUFACTURE OF COBALT OXIDE

The cobalt-oxide industry suffered from the excessive supply of cobalt ore thrown on the market as a by-product from silver smelting. The world's consumption of oxide annually falls far short of the production from the mines of Cobalt, and consequently the price of oxide fell from \$2.50 to \$1.40 per lb. The only relief is on a widely extended use for cobalt, which is, at present, chiefly employed in making the color known as cobalt-blue.

NICKEL AND COPPER

The output of the nickel-copper mines of the Sudbury district for 1908 was probably slightly less than in 1907. The general slackening off in the iron and steel trades has lessened the demand for nickel, and during the last quarter of 1908 mining and smelting operations were considerably curtailed. The nickel production of 1907 was 10,972 tons; for the first nine months of 1908 it was 7760 tons. Allowing for the falling off toward the close of the year, the output for 1908 was probably not more than 10,000 tons. The copper production will be about the same as in 1907, say 7000 tons. The leading producers continued to be the Canadian Copper Company and the Mond Nickel Company. The former's works at Copper Cliff were completed and well equipped. Ore was raised mainly from the Creighton mine, which is high in nickel and from the Crean Hill, which is rich in copper. The Mond Company's plant is at Victoria Mines, and its orebodies are at the latter place and in the township of Garson. A new concern, the Dominion Nickel Copper Company, has begun work on the northern range, where it controls a number of important deposits some of which, notably the Whistle, rival in size any yet opened on the southern range. The construction of the Moose Mountain branch of the Canadian Northern railway has provided the necessary shipping facilities, and the company proposes to develop water power on the Wahnapiet river for use in its mines. The parties principally interested are Canadian capitalists.

IRON ORE

Iron ore was produced from the Helen mine at Michipicoten and several deposits of magnetite in northwestern and eastern Ontario, the total tonnage raised being probably about the same as that of 1907, which was 205,295 tons. Search for workable bodies of ore in the extensive ranges of northern Ontario met with some reward. Moose Mountain beyond doubt contains a large quantity of good ore, and at Emerald lake, Steep Rock lake.

Woman river and elsewhere, diamond drill and other work was done on promising prospects. The pig-iron product of 1908 will probably be rather less than that of 1907, owing to the stoppage of the Deseronto and Port Arthur blast furnaces.

OTHER MINERALS

In certain nonmetallic substances, older Ontario is rich. These include petroleum, natural gas, salt, mica, corundum, talc, graphite, feldspar, etc. The first three are obtained from the limestones of Devonian and Silurian age which underlie the southwestern peninsula or that part of the province north of Lake Erie and east of Lakes St. Clair and Huron. The oilfields of Petroler and Oil Springs continue to produce through thousands of wells the average yield of which is not more than one-quarter barrel per day; but the new field of Tilbury East now contributes at least 50 per cent. of the yearly output. In 1907 the total production was 27,621,851 Imp. gal. and in 1908 it was probably about the same, the greater flow of the new territory compensating for the declining yield of the older fields.

During recent years natural gas from the counties on the north shore of Lake Erie has been produced in increasing volume, and is now supplied to a number of cities and towns within reach of distribution. Chatham, St. Catharines, Hamilton, Brantford, Niagara Falls and other places are enjoying this cheap and convenient fuel, and preparations are being made to pipe gas from Kent county to Windsor and Walkerville. Gas still goes in considerable quantity from the wells in Welland to Buffalo, but the domestic consumption is increasing much more rapidly than the export. In 1907 the value of the natural gas produced in Ontario was \$756,174, and in 1908 the output, in all probability was greater.

The salt production of Ontario is about \$400,000 annually. The seat of the industry is the east shores of Lakes St. Clair and Huron, and the practice is to pump up the salt as brine and evaporate it.

Iron pyrites is abundant in eastern and northern Ontario, and the quantity raised has risen from 7469 tons in 1903 to about 19,000 tons in 1908. A good deal is exported to the United States, but a considerable part of the output is used in the manufacture of sulphuric acid at Sulphide in Hastings county.

The production of construction materials, of which Ontario contains a profusion, goes on steadily. Bricks, lime, stone and portland cement are produced in older Ontario within easy reach of market. Of portland cement the output increased from 2,033 bbl. in 1891 to 1,853,692 bbl. in 1907, and probably a larger quantity in 1908.

In all, the value of the mineral produc-

tion of Ontario during 1908 will be, say, \$28,000,000 valuing the products at their selling price at point of production.

Klondike District

BY JOHN POWER HUTCHINS*

The gold production for the Klondike district in 1908 was about \$3,300,000. This is slightly more than that of 1907. The following tabulation shows the gold production for Yukon territory, which includes Klondike and several other districts, since the discovery of gold in the Klondike. Most of the gold produced by Yukon territory has come from the Klondike.

GOLD PRODUCTION OF YUKON TERRITORY.

1896	.....	\$300,000
1897	.....	2,500,000
1898	.....	10,000,000
1899	.....	16,000,000
1900	.....	22,275,000
1901	.....	18,000,000
1902	.....	14,500,000
1903	.....	12,250,000
1904	.....	10,350,000
1905	.....	7,000,000
1906	.....	6,000,000
1907	.....	3,150,000
1908 (estimated)	.....	3,300,000

These figures show a rapid increase to a maximum output and then a gradual decrease representing a history similar to that of other placer districts. For the past three years the Klondike has been in a transition period. The one-man enterprise has had its day, and now a powerful corporation has control of several of the richest creeks. During these three years preparations have been going on to work these creeks on a large scale with dredges and other machines and a system to supply water for hydraulicking has been in the course of construction. It is expected that this will be finished early in 1909. When operations on a large scale are under way, an increase in the gold output may be expected.

DREDGING GROUND

The discovery of rich and extensive gravel deposits in the Klondike district in the future is improbable. There is no such intricate and large system of "dead rivers" as in California and the total volume of gravel in the Klondike that may be worked profitably is considerably less than the profitable dredging ground remaining in California, but which can not be mined because of anti-débris legislation. The principal deposits that will be worked are the creek beds and the "white channel."

The "white channel" is what is left of the ancient creek beds; it has a course approximately parallel to the present creeks but at an elevation from about 100 to 300 ft. above them. Where it has not been eroded, this channel usually appears

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with one rim completely removed. Locally, it is called a "bench deposit." There is one notable exception in the occurrence of the "white channel;" this is the deposit between Lovett Gulch and the Klondike river where the two rims are intact for several thousand feet.

NEW METHODS

There was little novelty in the mining methods introduced in 1908. Dredging was carried on with better results than in 1907. This was due to several causes. Steam thawing was employed on a larger and better scale, and there were fewer attempts to dredge frozen gravel. Stripping had been found insufficient to thaw gravel to bedrock unless carried to such a depth as to leave a shallow gravel section. It had been found that thawing progressed to but a slight depth into gravel below the water level. Draining the gravel with cuts will be applied.

It is expected that stripping and draining with cuts 20 to 50 ft. apart will result in progressive thawing to bedrock, after the thawing of one or more summer seasons, and that this thawed ground will remain unfrozen. It is yet to be determined whether ground thawed during the summer, no matter by what method, will not freeze again during the subsequent winter and so make it necessary to thaw it again every summer. It is certain that gravel which has been stripped, drained and thawed has frozen again on hillsides where there was a southern exposure and where thawing had progressed to a depth of above 25 ft. in one summer. It may also be observed that in many creek beds both in Yukon territory and Alaska, frozen ground is often found even where there is no muck overburden. Frozen ground is also found where gravel is dry and has no overburden of any sort.

The average temperature for the year is considerably below the freezing point. The minimum temperatures are also considerably more below than the maximum temperatures are above freezing. Whether ground thawed in the three to four months of summer will remain thawed during the eight to nine months of winter, unless in some way protected from the extreme cold, is a matter of doubt. It is possible that flooding the thawed ground will protect it from the cold of the air. There would be a penetration of superficial frost to a depth of several feet even if the ground were so flooded. Whether the fact that the heat of thawed ground is reduced by the cold of adjacent frozen ground will have any important bearing, is an important consideration.

Frozen ground has been observed to a depth of more than 220 ft. in the Klondike. This means that between this depth and the surface, the ground temperature is less than 32 deg. F.; otherwise frost would not penetrate to such depths. As

far as known, no accurate or detailed data as to ground temperatures have ever been taken in the far North. It is entirely probable that investigation will show ground temperatures considerably less than 32 deg. F. Where the average temperature of the air is about 20 deg. F. below the freezing point, it is not inconceivable that the ground may have, after exposure through geologic time, acquired a temperature below 32 deg. F.

It is to be hoped that thawing can be done as anticipated, for the same methods could be applied elsewhere with the opening of much ground, now thought undredgable because of its frozen condition, for lucrative exploitation. A considerable gold content insures success if thawing can be done cheaply.

ELECTRIC ELEVATORS

The operation of the new elevators installed during the year is as follows: Material of the creek bed is driven by hydraulicking with gravity water to a point at the base of a bucket elevator. This elevator lifts most of the material and some of the water to the sluice, the rest of the water being lifted by centrifugal pumps. The elevator and pumps are driven by electric power.

The greatest difference between this machine and those tried some years ago is in the buckets. The new buckets are more powerful and heavier and can, if necessary, excavate material that may have compacted after driving to the sump. The buckets are larger and can therefore handle larger boulders than could any of the older machines.

These elevators were installed in narrow creek beds and on bedrock for which floating dredges are not supposed to be well adapted.

The elevators must be moved occasionally, and it has not yet been determined how often this will be necessary or how large an acreage can be worked at one setting. They can not be called mobile as compared with other placer-mining machines, especially with floating dredges. There is also the difficulty of tailings disposal which is a direct result of immobility. Placer-mining machines should be easily movable for two important reasons; they must keep up with the excavation and out of the way of the tailings.

This type of machine is said to have worked well during part of 1908. The year was normal in most respects. There had been a heavy snowfall and this melted slowly, allowing considerable ground sluicing of overburden from the creek beds. The rainfall in the aggregate for the summer was about 5½ in. The time of the freezeup was normal.

LABOR AND THE MERGER

Since the merger of claims on Bonanza, Eldorado and Hunker creeks there has

been practically no winter drifting, and there has been less of this kind of mining on most of the other creeks. There were a few dumps taken out on Quartz creek where "lays" were about 65 to 70 per cent. of the output to the "layman."

The labor supply was augmented by men brought in from Vancouver, and it was ample until autumn, when the demand was greater than the supply. There were no labor troubles, although difficulty was threatened when it was thought that large numbers of cheap laborers would be brought to work for the merged interests. Wages are still high; about 40c. per hour with board is the general pay for unskilled labor.

No paying quartz mines have been developed in the district. For several years work was done on a vein on Bonanza creek, but this has been stopped. At present considerable interest is being taken in some quartz prospects on the Dome, a mountain dominating the topography near Dawson and from the flanks of which several of the richest Klondike creeks radiate.

HYDRAULIC MINING

Hydraulic mining was carried on as usual; about three times as much material, or about 3,500,000 cu.yd., was washed as in 1907. The cost of hydraulicking did not vary much. It is probable that when water from the new ditch is available, a considerable reduction will be made. A duty of 8 cu.yd. per miner's inch per 24 hours was attained some years ago where about 275 miner's inches was used. Several factors influenced this result, the most important being an 8-per cent. grade, good dump and gravel of a favorable admixture of fine material and having no large boulders. A bedrock favorable for running and maintaining cuts assisted in keeping them close to the banks at all times so that little time was lost in "driving." There will be an opportunity of making some new records in the duty of the miner's inch, when a large volume of water is applied on the White channel.

The Klondike climate, with its extreme cold and the frozen ground, is hard on earth work. It is difficult to maintain roads, dams and ditches. Thawing results in the sloughing off of material from the banks of ditches, and where the course of the ditch is over "muck" and on northern exposures the strictest vigilance is needed to prevent serious breaks.

COSTS

The cost of dredging is said to have varied from about 15c. per cu.yd. for a 7-cu.ft., close-connected bucket dredge in unfrozen ground to about 20 to 35c. for similar dredges working in ground originally frozen in part and thawed by stripping and steam thawing. An anti-

quated dredge of small capacity operating in partly frozen ground showed a cost of about 60c. per cu.yd. Thawing for dredging costs from 10 to 20c. per cu.yd. No figures are yet available for dredging solidly frozen ground, and the cost of thawing such material is not yet known. All the dredging done up to the present time has not been in what is locally called badly frozen ground.

Wood hauled in 16-ft. lengths on wheels cost about \$14 per cord. Supplied in large quantities it was sold for about \$8 per cord, where it could be rafted and floated down the Klondike river without much hauling.

Less coal was burned in 1908 than in previous years. The coal available has been found to possess poor steam-producing qualities; it makes dirty fires and much ash and clinker. One ton of coal has been found to have about the same calorific value as one cord of wood, and since wood can usually be purchased for less than coal it is generally used.

Dredging in Russia

There were 64 dredges at work in the Urals and the Yenisseisk district in 1908, according to the *Torg. Prom. Gazeta*. Of these 25 were in the Urals and 39 in the Yenisseisk jungle, Siberia. Fairly detailed reports have been received on the working of 46 of the dredges, which produced on an average 2 poods 6 funts and 67 solotniks. Their total working hours were 99,406, and they washed 594,405 cubic sajens of sand. The total production of gold and platinum was 99 poods, 28 funts, 21 zolotniks, 17 doli (52,467 oz. Troy). Compared with the preceding year, the amount of ground worked per hour has increased by nearly 15 per cent.

The California and Gulf (excluding the Corsicana) crude oils are, according to *Petroleum Review*, Aug. 15, 1908, the heaviest in the United States, but in both fields there are considerable variations in the specific gravity, especially in the California fields where considerable crude oil as heavy as 12 deg. B. and considerable as light as 30 deg. B. is found.

In 1908 two electric steel-making plants, according to the *Electrochem. and Met. Ind.*, January, 1909, were in operation in the United States. These use Héroult furnaces. In Europe there are 22 Héroult furnaces already in operation or being built; 11 Stassano furnaces; 8 Girod furnaces; 10 Kjellin furnaces, and 10 Roehling-Rodenhauser modified induction furnaces. In the United States a few small Colby induction furnaces are in operation, mainly for experimental work or for demonstrations.

Production of Other Metals and Minerals

Aluminum — Barytes — Borax — Phosphate Rock — Quicksilver —
Cyanamide — Statistics of Production — Commercial Conditions

The most important development in the aluminum industry was the cut in the price of that metal, in October, from 33c. to 22@24c. The phosphate output of Tennessee showed a marked decline in 1908. There were important changes in control of properties and several new companies were organized. The barytes industry suffered greatly through lack of demand and foreign competition.

Although the production of quicksilver was practically the same as in 1907, the average price for the year was considerably higher, notwithstanding the fact that the production in California, the chief source of the metal, exceeded the demand. The borax industry was characterized by a year of continued low prices, which caused the closing down of many of the mines in California, the only State in which the mineral is produced. With the building of the plant of the American Cyanamide Company at Niagara Falls, a new industry is introduced in North America.

Barytes in Tennessee

By A. H. FAY*

Little work was done in the barytes industry in Tennessee during 1908. The majority of the mines were closed down the latter part of 1907, and only a few of the very best properties were operated the following season. The price of the ground and floated product was low, and the demand so limited that it has been difficult to place this material on the market at a profit.

While labor is cheap in the South, the actual cost of mining is high, for the reason that the deposits are pockety, uncertain and very irregular in size, which prohibits the installation of steam shovels and a good tramway system. The majority of the workable deposits are at a distance from the railroad, necessitating an average haul of five miles by wagon over very poor roads. This freighting is usually done by the farmers living in the immediate vicinity of the mine at the rate of \$1.25 per long ton for a five-mile haul.

The mining as carried on in this section (Sweetwater) is all open-pit work, with pick, shovel and wheelbarrow. The barite occurs as nodules in a tough residual clay, and it is necessary to use some powder to break the heavy clay. The mining cost varies from 75c. to \$2 per long ton, depending largely on the amount of

ore in the clay, and the depth of the overburden. The royalty is usually 25c. per ton.

A very large percentage of the ore mined from these clay deposits has a scale of limonite inclosing the barite, which on account of the small difference in specific gravity of the two minerals, is very hard to separate by the present milling method, i.e., jigging. Unless a good separation is made before grinding, it is a very difficult matter to bleach the barite thoroughly. There is a field here for much improvement.

SWEETWATER DISTRICT

Most of the mining last year was in the Sweetwater district, the principal operators being John T. Williams & Son, W. D. Gilman & Son and R. B. Doherty. The output, however, was very small. A portion of the raw ore was shipped to St. Louis. Gilman & Son operated their plant in a small way most of the year. In addition to their plant for bleaching barytes, they have a small plant for manufacturing about one ton of barium-carbonate per day.

A little work was done in Cocke county near Wolf creek, in what is known as the French Broad district. There are at least two good properties in this county, one owned by the Commercial Mining and Milling Company, which produces a very white, crystalline ore, occurring as a vein in quartzite. The other one is owned by John T. Williams & Son and has been opened enough to insure a large tonnage of cheap ore from a 7-ft. vein between sandstone strata.

At Bristol, Tenn., John T. Williams & Son remodeled their bleaching plant; took out the bur mills and added tube mills for fine grinding. The capacity of the plant is 30 tons of finished product per day. It was in operation only about one-quarter of the year. A plant for the manufacture of barium-chloride was built which has a capacity of 10 tons of crystals per day. The crude material used in the manufacture of the barium-chloride consisted largely of jig tailings, slimes and very iron ore. The ore is mixed with coal and given a reduction roast in an 80-ft. rotary cement roaster, yielding a mixture of barium sulphide and carbonate. This is leached with hydrochloric acid, which is also manufactured at the plant. The chloride liquor is then filtered, purified by a secret process, evaporated to saturation point and then allowed to crystallize.

The barytes industry in the United States is not large, and it is a very difficult mat-

ter to compete with the foreign manufacturers. There is undoubtedly a large amount of ore in western Tennessee, North Carolina and northern Georgia, and to make the most out of these natural resources it will be necessary to evolve a more economical and efficient milling and bleaching system.

Borax

Although California is the only State in the United States which produces the borates commercially, the prices for borax have fallen so low that most of the mines have ceased operations entirely; indeed nearly all of them have been closed down for a year or more, with little expectation of starting up again for some time. In some instances the plants have been removed altogether, and the properties closed for good; this is particularly the case in the neighborhood of Daggett, San Bernardino county, where the low-grade marsh muds, or superficial deposits, were being worked. Even the old colemanite mine at Calico, for many years the most productive mine in the State, has been permanently abandoned, as it has been virtually worked out by the Pacific Coast Borax Company. Some of the companies operating in that district produced in 1907, but none of them did during 1908. The companies which were working in Ventura county also closed down their properties in 1907, and they will remain idle indefinitely, for the long haul to market makes the cost of production too expensive in that region.

Refined borax, which now sells at about four cents a pound, brought about seven cents for a long time. Some of the companies made very little profit even at the latter figure and when so marked a reduction occurred in 1907, there was nothing for them to do but quit work.

It was about August, 1907, when the Pacific Coast Borax Company reduced the prices of the manufactured product; very shortly after that all the borax properties of the State, with the exception of the Lila C. mine belonging to the Pacific Coast Borax Company in Inyo county, ceased operations. In August, 1907, this company ceased operations entirely at Daggett and Calico in San Bernardino county, removed its plant, and commenced its activities in Inyo county. This move had been contemplated for several years, during which period the mine was being developed; so when the new railroad near the mine was com-

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pleted the company concentrated its efforts at the new property. The deposit is a very extensive one, and being well developed, is in a position to make even a much larger annual output than the demand requires. The grade of ore mined is high and the facilities excellent for working, though labor is high in that region. The company being enabled to produce largely at less cost than formerly, was enabled to reduce prices, and thus put its competitors "out of business." Those companies which ceased producing in 1907 were the Western Borax Company, of Inyo county, the American Borax Company, the Western Mineral Company and Palm Borate Company of San Bernardino county, and the Columbus Borax Company and Frazier Borate Company, of Ventura county. None of these resumed operations in 1908 at former points of production, though some have exploited new fields.

There are many known borax deposits in the Death valley region; several of these are controlled by the Pacific Coast Borax Company, but others which with the present means of transportation would not pay, are still unlocated. The fact is that there has been an overproduction; so the larger companies are trying in every way to increase the use of borax products, and have done some experimenting in order to find new uses for boron compounds.

The only new properties of note are those of the Borax Properties, Ltd., a company backed by English capital, which in 1908 bought the property of the Palm Borate Company of Daggett, and also considerable other ground in that vicinity. The company has been engaged for some months in erecting a plant and carrying on extensive operations. The property has not produced any mineral, as only development has been done so far. However, the company expects before long to put its product on the market.

The Sterling Borax Company is the most prominent of the new concerns. It owns the Ventura County mines of the Stauffer Chemical Company, formerly known as the Frazier Borate Company, the mines of the American Borax Company at Daggett, and the new deposit found a year or so ago at Lang station in Los Angeles county. The refining plants at San Francisco, Chicago and New Brighton are all combined in this organization. The deposit is a vein of colemanite of good grade and is in a locality where the cost of production is cheap, as there is plenty of water available and the price of labor and of transportation is low.

The vein varies in width from a few inches to 10 ft. being like most of such veins, of a "pockety" nature and varying more or less in size. The owners of

this property state that they are able to compete in output and price with any other mining company of the State. The mine began to produce about three months ago. The product is shipped from Lang's station to Chicago, New Brighton and San Francisco, the ore being shipped crude as mined, and then refined at the points named. About 700 tons monthly have been produced thus far but this amount can be readily increased when desired.

The mines of the Pacific Coast Borax Company and the Sterling Borax Company are the only two properties in the State which produced much borax in 1908. These figures of output are not available, but it is not probable that the total yield for the year was much over 50,000 tons crude.

As stated, under present conditions, there is little or nothing in the borax-mining industry for any companies except those with extensive high-grade properties, near points of railroad transportation, and with the prevailing low prices there can be little profit even for properties with exceptional advantages.

Calcium Cyanamide

In Europe progress in the manufacture of calcium cyanamide has been rapid and satisfactory. There are 11 plants in process of construction, or in operation, the aggregate annual capacity of which is 166,000 tons. The important works at Piano d'Orta, Italy, is being enlarged to increase its production from 4000 to 10,000 tons. In France, the Société Française des Produits Azotés is producing 4000 tons per year at its work at Notre Dame de Briançon. Other works of varying capacities exist in Italy, Switzerland, Germany and England.

THE INDUSTRY IN AMERICA

The American Cyanamid Company, with offices at 100 Broadway, New York City, is the exclusive owner of the American rights for the manufacture and use of calcium cyanamide. The initial plant of this company is in course of construction at Niagara Falls, Ontario, and it is anticipated that production will begin early in the spring of 1909. Pending the completion of its plant, the company is filling orders with material imported from Norwegian works. On the basis of 10 per cent. nitrogen content, the initial capacity of the half-unit plant at Niagara Falls will be 20,000 tons per annum. This cyanamide will yield from 12 to 15 per cent. ammonia. It is the intention of the company to follow this plant with others as the demand requires.

The Niagara Falls plant will differ from some works now operating in Europe, in that it will make its product complete in-

stead of obtaining calcium carbide from outside sources. The price of the finished product will be the same as that of Chile nitrate; in Europe the prevailing price is from 5 to 10 per cent. less.

MANUFACTURE OF CYANAMIDE

In the manufacture of calcium cyanamide, calcium carbide is first made from coke and lime in an electric furnace. This product is then powdered, placed in closed retorts, and nitrogen, isolated from the air in the electric furnace, is led through it. This is the Frank & Caro process. The reaction between the carbide and the nitrogen is an exothermic one, and yields free carbon in the form of graphite, which remains distributed in the mass of material, giving it a black color. The equation for the formation of cyanamide from calcium carbide is as follows: $\text{CaC}_2 + 2\text{N} = \text{CaCN}_2 + \text{C}$. When lime and coke are employed as raw materials in place of calcium carbide, the reaction becomes: $\text{CaO} + 2\text{C} + 2\text{N} = \text{CaCN}_2 + \text{CO}$. This is a modification of the original process, on which Frank has secured a patent.

The carbide which will be manufactured by the American Cyanamid Company is expected to have about the following analysis: Nitrogen (expressed as ammonia) 12 to 15 per cent.; free carbon, 10 per cent.; calcium sulphate (land plaster), 25 per cent.; sulphides, phosphides and carbonate, 2 per cent.; iron oxide, 2 per cent. In deference to the requirements of the American trade, free lime is to be eliminated, and the nitrogen content reduced as compared with the foreign product.

Magnesite

The only important commercially utilized deposits of magnesite in the United States are in California, although small veins are found in Nevada, Arizona, Maryland, Massachusetts, and Pennsylvania. The California deposits are mainly in the Coast Range. Quite a number of deposits are known, but only a few are at present being worked; this is mainly due to the fact that the consumption on the Pacific coast is limited and that the material will not bear the cost of transportation to points in the Eastern States, where the magnesite must compete with that imported from Austria, Greece and South Africa. The domestic output, all from California, averages between 7000 and 8000 crude tons annually, worth at the points of production from \$3 to \$3.50 per ton. The present importations of crude and calcined magnesite to the United States amount in value to from \$850,000 to \$900,000 a year, and, of magnesite in the form of chemicals to between \$30,000 and \$40,000 a year. The largest quantity im-

ported comes in the form of calcined, but not purified magnesite. To make one ton of calcined material requires 2.4 tons of crude mineral. The calcined magnesite varies in value from \$12 to \$20 per ton according to the nature of the roast given the crude mineral. For the manufacture of brick, a much longer roast must be given than when the calcined mineral is to be used in the manufacture of paper from wood pulp, for which purpose most of the domestic material is utilized.

The use of magnesite in its various forms, but especially of the ordinary calcined magnesite, is increasing in the United States, as is shown by the heavier importations each year. The domestic output, however, varies but little, although more is now being used than formerly in making flooring, wainscoting, tiles, and other building material. Its use does not increase materially for furnace linings, as the imported material employed for that purpose can be obtained more cheaply than the domestic. The latter must be shipped from California by rail, while the imports all come by sea. The freight charges by rail are such that the California producers are unable to compete with the foreign at points where the largest consumption occurs. An effort is being made to induce Congress to impose a duty on foreign magnesite, but it is doubtful if this will be accomplished as the domestic producers are so few and the consumers are so many in number. Many deposits in California which are idle and undeveloped would be worked were there any hopes of finding a profitable market for the material. As it is, the few which are being worked are close to lines of transportation and are operated mainly in the interest of the manufacturers of paper from wood pulp or of liquid carbon dioxide.

Only two new deposits became productive in 1908, the one at South Tule in Tulare county, virtually owned by the Willamette Pulp and Paper Company, the other near Winchester, Riverside county, owned by the California Magnesite Company. At the Willamette company's mine, a calcining furnace was erected during 1908, and all the material produced is shipped in the form of calcined mineral, going direct to the pulp mills of the paper company. The deposit at Winchester furnished some material which is utilized in Los Angeles for manufacture of flooring, tiles, drain-boards, wainscoting, etc.

The most important producing mine in California continues to be the mine at Porterville, Tulare county, which is leased by the Willamette Pulp and Paper Company, and superintended by W. P. Bartlett. This mine is fully described, as are its calcining works, in Bulletin No.

355 U. S. Geol. Surv., by Frank L. Hess. For some years by far the largest proportion of the output of California has come from this mine. A few hundred tons per year are mined from the deposits at Cloverdale, Sonoma county, and at Red Mountain, Alameda county. Aside from the magnesite deposits mentioned, little or nothing is being done with the other known deposits of the State. There are now several factories in California which make different forms of building material from the domestic product.

The manufacturers of carbonic-acid gas, who market a liquid carbon dioxide, after calcining the material to obtain their product, dispose of the magnesia residue to the paper mills, where it is changed to a sulphite and used in the digestion and whitening of wood pulp for paper.

Phosphate Industry in Tennessee

By H. D. RUHM*

The situation in the Tennessee phosphate field during 1908 was fairly well predicted in these columns a year ago when I said "the only possible salvation of the situation as to present prices is in the policy of curtailing production, and, unless the miners get together and consolidate in some way, their shrift is short for the maintenance of recent prosperity."

No such consolidation was effected, and in the meantime the manufacturers increased the efficiency of their mining organizations to such an extent that they now seem amply able to take care of their own needs for several years to come.

This almost entirely cut out the selling of rock on the domestic market, and, with the exception of a few old contracts and a few new sales (mostly for export), shipments in 1908 were largely confined to the operations of the Virginia-Carolina Chemical Company (Charleston Mining and Manufacturing Company), the Federal Chemical Company, the American Agricultural Chemical Company and the Independent Phosphate Company with its allied interests. The shipments from points in Tennessee on the Louisville & Nashville railroad for the years 1905 to 1908, inclusive, are given below in short tons:

Year.	Domestic.	Export.	Total.
1905	285,321	110,407	395,728
1906	379,894	110,514	490,408
1907	523,686	102,996	626,682
1908	320,634	81,123	401,757

While the drop in production was sudden and startling from the high-water mark of 1907, it is still above 1905, showing that, even with all the depression in

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financial circles, shipments still exceeded the 400,000-ton mark, which has come to be considered the normal amount of rock that the Tennessee field should legitimately supply to the territory dependent upon it.

However, as the large bulk of this phosphate rock was mined and shipped by manufacturers for their own consumption, it can well be understood that 1908 was a very lean year for the miners and producers of rock who are dependent upon the sale of their output on the general market. During the year there was a marked falling off in prices. In September, 1907, the prices were for 72 per cent. domestic, \$5.25; for 75 per cent. domestic, \$6.25; for 78 per cent. domestic, \$7; 75 per cent. export, \$6.75; 78 per cent. export, \$7.50, f.o.b. mines. In September, 1908 (for what few sales could be made), the price ranged around 72 per cent., \$3; 75 per cent., \$3.50, and 78 per cent., \$4.50 for local buyers, with some small contract buying at from 25@50c. in advance of above prices.

Very little phosphate rock was sold at these prices, however, so that during 1908 the principal diminution of available supply took place in the properties of the manufacturers. Since this condition is apt to be in existence for some time to come, it seems more than likely that the largest of the present producers will sooner or later be taken over by some one or other of the organizations representing the manufacturers, so that the ideal condition bids fair to come about when all the mining will be done by manufacturers for their own use, just as most of the iron ore is mined by the steel companies.

This will enable a regular tonnage output to be depended on, making it possible to solve many problems which, on account of the intermittent character that the business has always assumed, have not presented hitherto an easy solution.

The Independent Phosphate Company under the management of T. C. Meadows made a considerable reduction in the cost of output in comparison with that of 1907, so that after paying sinking fund, interest, and providing a surplus, it paid a 10-per cent. dividend on the basis of \$3.60 per ton for rock containing 73 to 75 per cent. calcium phosphate.

The organization of the Independent Fertilizer Company was announced during November, 1908; its officers are reported to be Waldemar Schmidtman, president; T. C. Meadows, vice-president and general manager; J. H. Carpenter, treasurer. It is understood that this company has obtained control of most of the independent fertilizer companies in the United States.

This company will undoubtedly be in a more satisfactory position than any other fertilizer company in the country. Through Mr. Schmidtman, it controls enormous potash deposits in Germany, and through Mr. Carpenter and Mr. Meadows

it controls the output of the present phosphate mines of the Independent Phosphate Company, the Richland Phosphate Company, the American Phosphate Company, the Middle Tennessee Phosphate Company, T. C. Meadows & Co., the Mount Pleasant Dryer Company, Ruhm & Gregory, France & Co., the International Phosphate Company and the pyrites mines at Puyton, Ala.; through Mr. Meadows it also controls the sulphuric-acid output of the Tennessee Copper Company. With the advantages derived from these sources of raw materials the new organization will undoubtedly be able to manufacture fertilizer from \$2 to \$3 per ton cheaper than anyone else in the business, so that it can furnish the farmer with goods at the same prices as do the other manufacturers and still make a handsome margin of profit over its competitors.

During 1908 the Swan Creek railroad to the Mayfield mines of the Virginia-Carolina company was completed, and that company began supplying a large number of its factories with their blue phosphate which is said to be much superior to the Florida pebble rock, and almost as good as the high-grade Mount Pleasant rock.

The Independent Phosphate Company completed its railroad to Estes Bend and has the machinery on the ground for its plant there. The railroad to Leatherwood starts from Nashville; enough grading has been completed to warrant the expectation that the company will commence operations at Leatherwood by June 1, 1909.

The Middle Tennessee Phosphate Company completed its washer during 1908, and now has one of the best washing and drying plants in the field. The Blue Grass Phosphate Company completed its second washer and dryer, and the Jackson Phosphate Company got its dryer in operation. T. C. Meadows & Co. completed their drying plant and have all machinery ordered for the washer. The Federal Chemical Company is installing washers of improved construction at both the Century and Tennessee branches. The Richland Phosphate Company's drying plant was completed and plans for a washer are under consideration.

The Columbian Phosphate Company, after having paid 10-per cent. dividends every six months for a number of years finally worked out to the point where it was not desirable to maintain a separate organization, so it was taken over by the Petrified Bone Mining Company, an affiliated concern. Both the Maury Phosphate Company and France & Co. have plans under consideration for a washer and dryer.

A new organization known as the Franco-American Phosphate Company has under option a large amount of undeveloped phosphate property and one going concern, the Volunteer Phosphate Company, of Centerville; it is said that this company plans to build two large plants.

The demand for phosphate properties is

decidedly strong, and owners of phosphate land are still holding at high prices, although considerably lower prices prevail than were asked in 1907.

The most noteworthy development of the phosphate business during 1908 was the marked tendency to use washers for preparing all grades of rock for market. In the first stages of the phosphate business, washers were extensively used, but as the method of recovery was over screens entirely, and as nothing was recovered smaller than the oversize from screens having $\frac{1}{8} \times \frac{3}{8}$ -in. openings, it was found not only that an enormous percentage of the rock itself was ground up by the logs and screens and carried off with the waste into the settling ponds, but also that a considerable percentage of the clay formed into balls and went with the phosphate oversize from the screens. This clay, which baked into hard lumps during drying, not only decreased the resulting percentage of bone phosphate, but also increased the amount of deleterious iron oxide and alumina in the rock.

The first departure was to abandon all the machinery and to return to the old-fashioned method of simply drying in kilns on cordwood. As the mining progressed and more effort was made to save the portion of the deposit formerly wasted, mechanical dryers of the cylindrical type were brought into use and the entire deposit saved. In this method the rock was also badly pulverized, and much of it was lost with the screenings when the making of high-grade rock was attempted. By screening or by proper selection in the mine, the entire product of the dryer can be saved, but it is of only an average grade, still having a considerable amount of the clay, while a large amount of rock is left in the rejects, or in the waste bank.

Producers then set about designing machinery that would save all of the rock and eliminate all of the dirt, with the result that practically everyone has turned to the combination of washers and dryers, the finest grains of phosphate being recovered by settling in water. It has been demonstrated that the very fine granules can be concentrated so as to contain 75 per cent. or better in phosphate of lime, and that by this method the saving is nearly double that made with the old wasteful method.

The best results so far have been obtained by the Federal Chemical Company which has perfected methods to the point where it has felt justified in spending many thousand dollars in the erection of plants to do this work. The method consists in washing the lump rock over drag conveyers, with hose pipes, passing the small pieces and clay through submerged screens and then through pug mills; by this method the small clay balls are entirely eliminated. The fine waste and water is then pumped into a series of settling tanks from which the fine settlings are washed out and pumped into wet stor-

age bins; the water is then allowed to drain out for several hours, and finally the fine material is passed through cylindrical dryers.

The Charleston Mining Company uses log washers and passes the waste through hydraulic classifiers, the phosphate granules discharging at the bottom to the dryers and the clay passing out at the top to the waste ponds.

The Independent Phosphate Company and its allied companies are proceeding on a combination of the above principles, expecting to accomplish good results with a much smaller outlay of money.

The bad reputation achieved for Tennessee rock during the hurry-scurry methods of 1907 has been almost wiped out by the high-grade product shipped in 1908, and by another year it will be as easy to depend on getting uniform high-grade rock from Tennessee as it is now to get uniform low-grade rock from the Florida pebble district.

The use of Mount Pleasant raw pulverized phosphate rock for direct application to the soil and for mixing with barnyard manure received a great impetus during 1908, and more was shipped for this purpose than ever before. Farmers who have used phosphate rock in this manner for a number of years seem to get good results, and this may prove an outlet for the producer not connected with the fertilizer manufacturers.

Aluminum

The sole American producer, pursuing the stand-pat policy of the Steel Corporation, kept the price at 33c. until Oct. 1. Then the convention among the European producers expired, and there being a great excess of productive capacity in Europe and the accumulation of an immense unsold stock, active competition promptly and naturally developed, and the price fell to $13\frac{1}{2}$ @14c. The duty of 8c. per lb. on importation into this country was no longer a protection, and the American producer made successive reductions in its nominal price to 24c., which ruled at the close, but foreign aluminum could be had at 22c. The disruption of the European convention marked the appearance for the first time of aluminum as a commercial metal; not that it was not previously an article of large trade (the world's production in 1907 having been 32,500 metric tons), but previously it had not been an article of competitive buying and selling, like copper, lead, tin and the others. It is noteworthy also that in 1908 aluminum sold in Europe for less than copper, pound for pound.

The gold output of Rhodesia for September, 1908, was 48,573 oz., valued at £204,261.

Quicksilver

Reports from producers making about 75 per cent. of the production indicate approximately the same output in 1908 as in 1907. On this basis we estimate the production in 1908 at 20,000 flasks against 20,932 in 1907.

The average monthly prices of quicksilver are given in the accompanying tables.

The Dennis fine-ore furnace at Blackbutte, Oregon, is not yet in steady operation, and it is doubtful if it is adapted to large operations. In this furnace there are a series of hearths, the ore being dumped from one to the next lower. Producer gas is used for fuel, which is a desirable innovation, as no soot is produced.

The loss in the Czermak-Spirek fur-

a 30-ton Scott furnace. The shaft is said to be 300 ft. deep. There was no production. The ore contains copper, gold and silver, and the plan is to recover the mercury by a preliminary roast, treating the cinders subsequently for copper, gold and silver.

In Texas the main producers for the year were the Marfa and the Mariposa mine, in Lower Cretaceous limestone, and the Chisos mine in the overlying Eagle-Ford shales. The Chisos is still using the Tigner 10-ton furnace, although a Scott furnace was completed in April at the mine.

The Texas-Almaden company at Big Bend has a deposit in an intrusive sheet of trachyte under which there was presumed to be shale. Diamond-drill borings through the trachyte have now penetrated the shale at a depth of 600 ft., and the cores are said to look encouraging. This company has a 20-ton Scott furnace, and made a small production in their first run.

AVERAGE MONTHLY PRICE OF QUICKSILVER.
(IN DOLLARS PER FLASK OF 75 LB.)

	1907.			1908.		
	NEW YORK.	SAN FRANCISCO.		NEW YORK.	SAN FRANCISCO.	
		Domestic.	Export.		Domestic.	Export.
January.....	\$41.25	\$39.50	\$37.50	\$45.00	\$45.00	\$43.50
February.....	41.25	39.00	37.37	45.00	45.00	43.50
March.....	41.00	38.50	37.25	45.00	45.00	43.50
April.....	41.00	38.50	37.25	45.00	45.00	43.50
May.....	41.00	38.50	37.25	45.00	44.50	43.00
June.....	41.00	38.50	37.25	44.25	44.00	42.50
July.....	41.00	38.50	37.25	44.00	43.50	42.00
August.....	40.00	38.00	36.75	43.30	42.70	41.30
September.....	40.00	38.05	36.70	42.87	42.25	40.50
October.....	40.50	38.19	36.50	46.25	43.50	41.62
November.....	45.00	45.00	43.50	46.60	44.50	42.50
December.....	45.00	45.00	43.50	45.75	45.12	43.12
Year.....	\$41.50	\$39.60	\$38.17	\$44.84	\$44.17	\$42.54

Quicksilver in 1908

By H. W. TURNER*

The larger part of the domestic production of quicksilver is consumed within the United States. Shipments to Mexico are small, and those to the Orient have practically ceased, since to compete with the Spanish product would reduce the price to a low figure.

Of the domestic consumption, most of the quicksilver is used in the manufacture of vermilion, of scientific instruments, and mirrors. The consumption for amalgamation of gold and silver ores is not large. It is estimated from careful records that not more than 2/10 oz. of mercury is used up in amalgamating the gold and silver of one ton of ore, and in the Alaska-Treadwell and some Mother Lode mines the amount is less. The amount now consumed in placer mining in the United States is not great, but in Alaska it must be considerable.

METALLURGY OF QUICKSILVER

During 1908 there were no improvements of note in quicksilver furnaces. The most popular furnace is the fine-ore tile furnace built by Robert Scott, although some modifications of this have been introduced at New Idria and Oat-hill. The term *fine-ore* is used here to include both *tierra* (fines) and *gransita* (medium) grades of ore, as both are usually worked together in the same furnace. Coarse-ore furnaces, differing in detail, are in use at several of the mines, as the Newcomb furnace at New Idria, and the Maxwell furnace at the Great Eastern.

*Geologist and mining engineer, San Francisco, Cal.

naces in use at Monte Amiata, Italy, is given at 4 per cent. It is altogether probable that the losses in the best American furnaces is much more than this. Now that the grade of ore treated is becoming lower, year by year, it would appear that the subject of furnace losses should receive the attention of a competent metallurgist.

Oil fuel is used at New Almaden, but at New Idria its use has been discontinued, as at the present price of oil, wood fuel from the neighboring forest reservation is cheaper. Coke is used in the Neate coarse-ore furnaces at the St. John's. These are shaft furnaces, the coke and ore being charged in alternate layers.

CALIFORNIA

As usual, California produced the larger part of domestic quicksilver. Although many of the smaller mines were closed down, the production exceeded the demand. Notwithstanding this, prices were good. The main producers for the year were the New Idria, Napa Consolidated, New Almaden, Great Western, Helen and St. John's, with some production from the Guadalupe and the Oceanic.

At the Culver-Baer in Sonoma county a good orebody was developed, and a Scott furnace is to be erected. At the Karl mine in San Luis Obispo county, orebodies are being developed and the condensing system improved.

OTHER STATES

The new Dennis furnace at Blackbutte, Oregon, was fired up in February and soon after closed down. The Colonial company at Ehrenberg, Arizona, erected

FOREIGN COUNTRIES

Wm. Fleet Robertson, provincial mineralogist, reports that none of the prospects in British Columbia have as yet developed into working mines.

In Mexico the main production is at the Huitzoco mine in Guerrero, using a continuous furnace designed by J. W. C. Maxwell. The ore contains antimony.

At the Monte Amiata mines, Italy, the cost for mining and smelting was about \$5 per ton. In the Czermak-Spirek fine-ore furnace, the loss of the mercury is claimed to be only 4 per cent.; if true this is probably a record saving. A cinnabar deposit was found near Pereta and opened up to some extent by shafts.

In 1907, according to Rogovin, the only mines producing in Russia were those of the Bachsmut district, the product being 8055 poods, equal to about 3879 flasks of 75 lb. each.

Quicksilver ore is reported from two new localities near Spizza in Dalmatia, Austria, but the deposits do not appear to be important.

The rediscovered mines of Koniah, Asia Minor, were reported on by F. F. Sharpless and F. P. Monaci. The ore is found in limestone accompanied by secondary silica, and in part associated with stibnite. The ore averages more than 1 per cent. mercury, and is treated in a 15 Spirek shaft furnace and in an eight-ton Czermak-Spirek fine-ore furnace. These were in continuous operation since May, 1906.

Monaci states that at the Kara Bornu mine, near Smyrna, there is a quicksilver deposit of sufficient size to be quarried so that 0.25 per cent. ore is profitable. In the year 1906-7 3000 flasks were produced.

THE MINING INDEX

The editors of this paper read all the important publications of the world that relate to mining and the treatment of minerals. This index is published as a reference for all interested and to make it impossible for readers of the **ENGINEERING AND MINING JOURNAL** to miss any important article published anywhere.

We will undertake to furnish a copy of any article (if in print) in the original language, for the price quoted. Where no price is quoted the cost is unknown. These papers are not kept in stock, but must be ordered from the publisher; hence there will be some delay for foreign papers.

No accounts can be opened for these small amounts, but remittance must be sent with order. For the convenience of those making small but frequent remittances, coupons are furnished at the following prices: 20 cents each, six for \$1.00, thirty-three for \$5.00 and one hundred for \$15.00. This arrangement will be especially appreciated by foreign readers and men in distant mining camps. Where remittances are made in even dollars we will return the excess over an order in coupons upon request.

ALUMINUM

8172—**BRITISH ALUMINUM COMPANY**—The Kinlochleven Works of the British Aluminum Company. (Electrician, Dec. 4, 1908; 5 pp.) The works of this company are described together with auxiliary apparatus and equipment. Illustrated. 40c.

8173—**USE FOR ELECTRICAL PURPOSES**—Aluminum as a Factor in the Electrical Industry. (Electrician, Nov. 27, 1908; 1½ pp.) Discusses briefly the preparation and uses of aluminum and compares the physical properties of aluminum and copper wires. 40c.

8174—**USES**—Aluminum and Some of Its Uses. J. P. W. Echevarri. (Min. Journ., Nov. 14 and 21, 1908; 2 pp.) Paper before the Brit. Inst. of Metals. Describes physical and chemical properties, methods of working and application by manufacturers. 60c.

CEMENT

8175—**GERMAN MILL**—Electric Driving of a German Portland Cement Mill. Alfred Gradenwitz. (Electrical Rev., Dec. 26, 1908; 2½ pp.) Gives a description of one of the largest and most interesting German cement works, in which electric drive has been recently adopted. The works are known as the Rüdgersdorf Portland Cement Fabrik. Illustrated. 20c.

8176—**MICROSCOPIC STUDY**—Ueber Mikrographische Zementuntersuchung. Ernst Stren. (Stahl u. Eisen, Oct. 21, 1908; 6½ pp.) Describes methods pursued and gives some actual results in study of the structure of hardened cement by the microscope. 40c.

8177—**PORTLAND CEMENT**—Free Lime in Portland Cement. A. H. White. (Journ. Ind. and Eng. Chemistry, Jan., 1909; 5½ pp.) Describes tests for determining the amount of free lime in portland and other commercial cement and describes also the microscopic method of testing cement. Illustrated. 60c.

8178—**PORTLAND CEMENT**—Manufacture of Portland Cement from Materials High in Magnesia. Richard K. Meade. (Cement Age, Dec., 1908; 3½ pp.) Discusses the effect of magnesia upon the properties of portland cement and suggests the addition of calcium chloride as a retarder. 20c.

8179—**PORTLAND CEMENT**—The Effect of Magnesia on Portland Cement. Rudolph Dyckerhoff. (Cement Age, Dec., 1908; 4 pp.) This is a translation by R. K. Meade of the paper by Dr. Dyckerhoff and gives a number of experiments with cement materials high in magnesia. The results indicate that 5 or 6 per cent. of magnesia are not detrimental. 20c.

8180—**PROGRESS IN THE CEMENT INDUSTRY**—Important Discoveries in the Lime and Cement Industries. H. S. Spackman. (Cement Age, Dec., 1908; 5 pp.) Describes tests on cements using calcium aluminate as an addition to hydrated lime and argillaceous or silicious material. 20c.

COAL AND COKE

8181—**ACCIDENTS**—Fatal Accidents in Coal Mines of America. F. L. Hoffman. (Eng. and Min. Journ., Dec. 19, 1908; 4 1/8 pp.) Shows statistically how more

than 3,000 persons were killed in coal mining operations in 1907 and how 20,000 lives have been lost during the last decade. 20c.

8182—**AUSTRALIA**—Coalfields and Collieries of Australia. F. D. Power. (Aust. Min. Stand., Oct. 7, 14; Nov. 4 and 11, 1908; 11 pp.) Continuation of article previously indexed. 60c.

8183—**CANADA**—The Mining Operations of the Dominion Coal Company. F. W. Gray. (Can. Min. Journ., Dec. 1, 1908; 4½ pp.) Describes the operation and development of this company's No. 2 colliery, including a brief description of the central electric plant and the central hospital. Illustrated. 20c.

8184—**CHARCOAL**—Tests with Car Kilns. Evert Norlin. (Jernkontorets Annaler, Nov., 1908; 44 pp.) Describes test runs and experiments for the determination of the heat conditions and the output of charcoal and by-products of car kilns of the American type.

8185—**COAL CUTTING** in Northern Coalfield, England. George R. Dixon. (Eng. and Min. Journ., Dec. 5, 1908; 1½ pp.) Mining machines have increased the earning power of the men and have made their work less arduous. Compares the cost of mining. Illustrated. 20c.

8186—**COAL DUST**—British Coal-Dust Experiments. (Mines and Minerals, Dec., 1908; 1½ pp.) Describes an experimental gallery erected at Altofts and gives the results of 26 experiments with coal and stone dust. Illustrated. 20c.

8187—**COAL DUST**—Recent Demonstration of Coal Dust Phenomena. James Ashworth. (Coll. Guardian, Dec. 11, 1908; 1 p.) A paper read at a recent meeting of the North Staffordshire Institute of Min. and Mech. Engineers. Discusses a recent explosion as to whether it was caused by gas or coal dust. 40c.

8188—**COKE**—Jones and Laughlin's Coke Plant. W. A. Affelder. (Mines and Minerals, Dec., 1908; 4½ pp.) Describes the installation of 1500 coke ovens in the closely built part of the city of Pittsburgh. Illustrated. 20c.

8189—**COLORADO**—Routt County, Colorado, Coals. R. L. Herrick. (Mines and Minerals, Dec., 1908; 4½ pp.) Describes the location, geology, mines opened, different qualities of coal, thickness of seams, transportation and possible markets. Illustrated. 20c.

8190—**COMPOSITION**—Coal: Its Composition and Combustion. W. H. Booth. (Colliery Guardian, Dec. 11, 1908; 1½ pp.) Discusses the heat of combustion of carbon and hydrogen and various characteristics of coal, considering only chemical composition and combustibility. Illustrated. 40c.

8191—**ELECTRICITY** in Modern Coal Mining. Harvey J. Nelms. (Eng. and Min. Journ., Dec. 5, 1908; ½ p.) Gives certain precautions which should be adopted when electric power is used underground. 20c.

8192—**ENGLISH COLLIERY**—Notes on a Yorkshire Colliery. L. C. Ball. (Queens. Govt. Min. Journ., Nov. 14, 1908; 2½ pp.) Gives a brief description of the general design, the geology, method of working and the washery of the Cadeby colliery, located in Yorkshire. 60c.

8193—**EXPLOSION**—Facts Concerning the Marianna Explosion. Floyd W. Parsons. (Eng. and Min. Journ., Dec. 12,

1908; 4½ pp.) The fan indicator diagram shows that ventilation stopped 25 minutes before the explosion. It is claimed that the clock was slow. Gives methods of mining and ventilating this mine in which such a large loss of life occurred on November 28, 1908. Illustrated. 20c.

8194—**EXPLOSIONS**—Dust as a Factor in Mine Explosions. William N. Page. (Eng. and Min. Journ., Dec. 5, 1908; 1½ pp.) Paper before the W. Va. Min. Assn. The author believes watering coal mines is apt to be dangerous and recommends that air currents be split and auxiliary fans used. 20c.

8195—**EXPLOSIVES**—Safety Blasting Explosives. A. M. Comey. (Mines and Minerals, Nov., 1908; 4 pp.) Classes and properties of different explosives. Apparatus and methods used in testing. Illustrated. 20c.

8196—**MINE SAMPLING** and Chemical Analyses of Coals Tested at the United States Fuel Testing Plant in Norfolk, Va., 1907. J. S. Burrows. (Bull. No. 362, U. S. Geol. Surv., 23 pp.) Describes the tests of coals taken from Jamestown beds Nos. 1 to 17 inclusive. Gives chemical analysis of the coals sampled in the mine and in the car.

8197—**MINING METHOD**—Coal Mining on the Retreating System. Harvey J. Nelms. (Eng. and Min. Journ., Dec. 26, 1908; ¾ p.) Describes the general system of working on the retreating room-and-pillar plan which insures the operator of a greater amount of coal than when the seam is worked advancing on the room-and-pillar system. Illustrated. 20c.

8198—**OKLAHOMA**—The Coal Resources of Oklahoma. C. N. Gould. (Min. Wld., Dec. 12, 1908; ¾ p.) Discusses the value of Oklahoma's coal resources and describes the conditions in the district and the more important ledges. Illustrated. 20c.

8199—**RESCUE WORK**—The Mining Operations of the Dominion Coal Company. F. W. Gray. (Can. Min. Journ., Nov. 15, 1908; 5½ pp.) Continuation of article previously indexed. Describes the fire fighting organization and equipment of the Dominion Coal Company. Illustrated. 20c.

8200—**SHAFT**—Enlarging a Shaft Without Cessation of Working. M. Brien. (Min. Eng., Dec., 1908; 3½ pp.) Describes the method of enlarging No. 5 shaft of the Agrappe colliery between the 290m. and 380m. levels without interfering with the hoisting. Illustrated. 20c.

8201—**WASHERY**—The Operation of a Coal Washery in Colorado. W. F. Murray. (Eng. and Min. Journ., Dec. 26, 1908; 3 pp.) Describes the construction and method of operation including an aerial tramway used to dispose of waste. Illustrated by working drawings. 20c.

8202—**WEST VIRGINIA**—Coal Fields of West Virginia. H. H. Stoek. (Mines and Minerals, Dec., 1908; 3 pp.) Geology of the region, transportation routes, description of the coals with analyses from different seams. Illustrated. 20c.

COPPER

8203—**ALASKA**—Copper Deposits of White Horse. T. A. Rickard. (Min. and Sci. Press, Dec. 5, 1908; 1½ pp.) De-

scribes some of the copper claims in this Alaskan district. Illustrated. 20c.

8204—ALLOYS—Copper and Copper Alloys. J. T. Milton. (Iron Age, Dec. 17, 1908; 3 pp.) Discusses failure in copper tubes, annealing conditions, corrosion of copper and its alloys, the structure of copper alloys, gun metal and white metals, etc. From a paper read before the Brit. Institute of Metals. 20c.

8205—ANALYTICAL METHOD—Permanganate Method for Determining Copper. Fred G. Hawley. (Eng. and Min. Journ., Dec. 12, 1908; 3/4 p.) This method which is used in the assay offices of the Cananea Consolidated Copper Company gives satisfaction where quick results are required and many determinations are to be made. It ranks with the iodide method for accuracy. 20c.

8206—CALIFORNIA—The Blue Ledge Copper Fields. A. H. Martin. (Min. Sci., Dec. 24, 1908; 1 1/4 pp.) Describes the copper properties in this district of Siskiyou county and gives analysis of the ore. 20c.

8207—COSTS—Calumet and Hecla Costs—I. L. S. Austin. (Min. and Sci. Press, Dec. 19, 1908; 1 1/4 pp.) Describes the conditions existing at the Calumet and Hecla mine, and gives costs of working the Osceola amygdaloid lode in 1906. The actual cost of producing a pound of copper is not given. 20c.

8208—ELECTROLYTIC COPPER—Influenza Dell'ossigeno Nascente Sulla Deposizione Elettrolitica del Rame. Corrado Agnolucci. (Rassegna Mineraria, Nov. 1, 1908; 2 1/2 pp.) Discusses the effect of nascent oxygen on the electrolytic deposition of copper. 40c.

8209—LABORATORY ROUTINE in Modern Copper Smelters. H. T. Waller. (Inst. Min. and Met., Nov. 12 and Dec. 10, 1908; 7 pp.) Discussion and contributed remarks on the above paper by members, in which additional information is given.

8210—MINE WATERS. Alfred C. Lane. (Proc. Lake Superior Min. Inst., June, 1908; 90 pp.) This is an elaborate treatise on the constitution of mine waters from the copper mines of Michigan. Illustrated.

8211—NEVADA—Mining and Reduction of Ely Ores. R. I. Herrick. (Mines and Minerals, Nov., 1908; 5 1/2 pp.) Continuation of article. Describes the concentrator site and construction, methods of concentrating and smelting, power plant and costs. Illustrated. 20c.

8212—SLAGS—Alumina in Copper Blast Furnace Slags. Charles F. Shelby. (Eng. and Min. Journ., Dec. 26, 1908; 1 1/4 pp.) Discusses the article by H. E. Hooper in the JOURNAL of December 5 and contributes additional information on the subject. 20c.

8213—SMELTING at Cerro de Pasco, Peru. L. W. Strauss. (Min. and Sci. Press, Nov. 7, 1908; 7 1/2 pp.) Describes the method of smelting the ore at this smeltery which is at an altitude of 14,000 ft. above sea level. Describes also the sampling plant and the furnace charges together with the analyses of the ore, matte, slag and flue dust. Illustrated. 20c.

8214—TENNESSEE—Mining and Smelting in the Ducktown District. Edwin Higgins. (Eng. and Min. Journ., Dec. 26, 1908; 4 1/4 pp.) Describes the methods of mining and smelting at the Tennessee Copper Company's plant at Copperhill. The ore which averages 2 per cent. copper occurs in great lenses in metamorphic schist. Describes the sulphuric acid plant. Illustrated. 20c.

8215—UTAH—Ore Occurrence at Fortune Mine, Bingham. E. R. Zalinski. (Eng. and Min. Journ., Dec. 19, 1908; 4 1/2 pp.) Describes the geology, the vein system, character of ore, secondary enrichment, the impregnated quartzite together with a description of the Fortune and Mayflower veins. Illustrated. 20c.

GOLD AND SILVER

8216—AMALGAMATION METHODS. H. W. MacFarren. (Min. and Sci. Press, Dec. 12, 1908; 2 3/4 pp.) Discusses the care of plates, the use of amalgamators and the treatment of ore by amalgamation. 20c.

8217—AUSTRALIA—Wahalla and District Mines, Victoria. (Aust. Min. Stand.,

Nov. 11, 1908; 2 1/2 pp.) Describes the orebody and the workings of the Wahalla mines and gives a flow sheet of the Long Tunnel Gold Mining Company. Describes also the mines outside of the Wahalla district proper. 40c.

8218—CALIFORNIA—The Calico Gold Mine. W. H. Storms. (Am. Min. Rev., Nov. 21, 1908; 2 1/2 pp.) Describes the peculiar occurrence of a belt of gold ore, diagonally connecting two veins of silver ore. Illustrated. 20c.

8219—CALIFORNIA—The Success of the Orange Blossom Extension. Will C. Higgins. (Salt Lake Min. Rev., Nov. 30, 1908; 4 1/4 pp.) Describes the geology, operation and equipment of the mine and mill of the Orange Blossom Extension M. and M. Company which is operating claims in San Bernardino Co., Cal. 20c.

8220—COLORADO—The San Juan Region, Colorado—I and II. T. T. Read. (Min. and Sci. Press, Nov. 7, and 14, 1908; 9 pp.) Describes the history, the mines, and methods of treating the ore of this district. Illustrated. 40c.

8221—COMSTOCK LODGE—Decline and Revival of Comstock Mining. J. H. G. Wolf. (Min. and Sci. Press, Nov. 7, 1908; 2 pp.) Comments on a previous article by W. Symmes, and gives additional information, together with statistics of production, etc. 20c.

8222—COMSTOCK LODGE—Progress on the Comstock Lode. R. L. Herrick. (Mines and Minerals, Nov., 1908; 5 1/2 pp.) Difficulties which caused cutting down. Engineering and other advantages that have aided the reopening. Illustrated. 20c.

8223—CYANIDATION of Silver Ores. W. A. Caldecott. (Min. and Sci. Press, Dec. 12, 1908; 1 p.) A discussion of F. J. Hobson's article on this subject. Additional information is advanced and a number of reactions are given. 20c.

8224—CYANIDE PLANT—Home-Made Cyanide Plant. W. F. Boericke and B. L. Eastman. (Min. and Sci. Press, Nov. 21, 1908; 3/4 p.) Describes a simple cyanide plant which treats at a profit low-grade tailings, formerly thrown away, and which was built by two men at small cost of labor and supplies and a trifling initial expenditure. 20c.

8225—CYANIDING SLIME. E. B. Wilson. (Mines and Minerals, Nov. and Dec., 1908; 61 pp.) Continuation of article previously indexed. Describes the Moore and Butters' vacuum filters, the arrangement of the plants, construction and operation of the machines. Illustrated. 40c.

8226—DREDGING on the Seward Peninsula. T. A. Rickard. (Min. and Sci. Press, Nov. 28, 1908; 7 pp.) Describes the progress in dredging the auriferous sands of the Seward peninsula. Gives cost and other valuable data. Illustrated. 20c.

8227—GOLD DREDGING in California. (Eng. and Min. Journ., Dec. 12, 1908; 3/4 p.) Briefly describes the progress in gold dredging and improvements in dredges and gold savers. 20c.

8228—HYDRAULIC MINING—Examining and Fitting up a Hydraulic Mine—I. H. A. Brigham. (Eng. and Min. Journ., Dec. 26, 1908; 3 1/4 pp.) This is an abstract of a paper read before the Technical Society of the Pacific Coast. Methods of examination and the placing of pipe lines, receiving reservoirs, drain tunnels and sluices are discussed in this installment. 20c.

8229—HYDRAULIC MINING—Practical Methods of Examining and Fitting up a Hydraulic Mine. H. A. Brigham. (Journ. Assn. Eng. Soc. Oct. 1908; 50 pp.) Discusses preliminary and detailed examination, water supply, pipe lines, plant installation, sluices, drains, giants, hydraulic elevators, ditches and flumes, etc. 40c.

8230—MEXICO—Hostotipaquillo and the Lerms River. Ezequiel Ordóñez. (Min. and Sci. Press, Nov. 21, 1908; 3 3/4 pp.) Describes the conditions existing in this mineral portion of the district of Tequila of the State of Jalisco. Illustrated. 20c.

8231—MEXICO—Mining on the Setentrion. Mark R. Lamb. (Min. and Sci. Press, Dec. 5, 1908; 2 1/4 pp.) Describes a visit to the mines and prospects in this Mexican district in Chihuahua. Illustrated. 20c.

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