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# The Engineering and Mining Journal

JANUARY 7, 1911.

## Introduction

This annual statistical number of the JOURNAL is laid out upon the same plan as its predecessors, but it comprises some new features that are important. Among these are the more comprehensive treatment of many of the minor minerals and

summaries. To all of these contributors, who have collaborated in this number, we tender our thanks, and also to the many persons who have assisted in the collection of statistical information. Our thanks are due also to the producers of copper, lead, spelter and other substances, who have communicated to us the amount of their output in 1910 and have thereby enabled close approximations to the actual production in 1910 to be made by Jan. 4, our date of going to press.

The production of the more important minerals and metals is summarized in the table on this page. The details appear in subsequent pages. It will be found that in some cases our contributors give figures that do not agree with our own. The explanation of such differences will generally be that the articles of outside contributors were necessarily written and put into type before our own statistics were available. The necessity of handling the great mass of material in this huge number in a few days leaves no time for leisurely comparison and revision to effect a careful coördination of all the data. We feel sure that no one, in the light of this explanation, will be misled by any discrepancies that may be discovered. This number of 104 pages, if made up in the form of an ordinary technical treatise, would constitute a book of upward of 360 pages.

The reader of these pages will obtain the idea that 1910 was a remarkable year in the mining industry and will, perhaps, find it difficult to understand the pessimism that has prevailed. Nearly all of the important substances show increased production. In many cases the outputs were the largest on record. Consumption also was large. In the latter particular iron showed no gain, but coal, copper, lead, spelter, tin and other things improved. In copper the gain was phenomenal. Nor was the increased consumption at the expense of prices, our index number for the metals in 1910 being 115, against 115 in 1909. The troubles of which pro-

### PRODUCTION OF MINERAL AND CHEMICAL SUBSTANCES.

Substance.	Unit.	1909.	1910.
Ammonium sulphate.....	S. tons	106,500	116,000
Arsenic.....	lb.	2,015,880	2,652,000
Bromine.....	lb.	1,100,000	850,000
Coal, anthracite.....	S. tons	77,126,980	80,381,306
Coal, bituminous.....	S. tons	367,076,821	403,533,152
Coke.....	S. tons	35,076,902	35,625,865
Copper sulphate.....	lb.	45,000,000	26,356,788
Iron ore.....	L. tons	53,086,869	54,295,200
Magnesite.....	S. tons	7,942	8,000
Petroleum.....	Bbl.	182,058,458	210,636,505
Tungsten ore.....	S. tons	1,607	2,130
Zinc oxide.....	S. tons	76,600	78,000

### PRODUCTION OF METALS IN THE UNITED STATES.

Metal.	Unit.	1909.	1910.
Aluminum (e).....	lb.	15,000,000	12,000,000
Copper (a).....	lb.	1,105,336,326	1,086,151,430
Ferromanganese.....	L. tons	225,040	240,525
Gold (b).....	\$	99,673,400	96,055,214
Iron.....	L. tons	25,570,431	27,055,067
Lead (c).....	S. tons	371,502	401,524
Nickel (f).....	lb.	19,284,172	29,359,544
Quicksilver.....	Flask	20,952	21,500
Silver (b).....	Tr. oz.	54,721,500	56,438,695
Zinc (d).....	S. tons	266,462	278,380

(a) Production from ore originating in the United States. (b) The statistics for 1909 are the final and those for 1910 are the preliminary statistics reported by the director of the Mint. (c) Production of refined lead from ore and scrap originating in the United States; antimonial lead is included. (d) Total production of smelters, except those treating dross and junk exclusively; includes spelter derived from imported ore. (e) Estimated. (f) Imports for first 11 months of each year. This nickel is smelted in the United States for the production of metal, oxide and salts.

metals and an exceptionally valuable series of articles reviewing metallurgical progress. Also there are numerous articles upon mining developments by leaders of the industry, many of those that are unsigned being fully as responsible as those that are. No one can turn over the following pages without a recognition of the impressive list of contributors and the authoritativeness of their

ducers complain were due to their own previous extravagances in overextending their capacities. This was notoriously the case in iron, copper and cement. Producers were disappointed by the failure of consumptive demand to rise to their own grossly exaggerated expectations and provisions, and their inability to use to the full their new plant, in which huge amounts of capital have been invested, created unsatisfactory financial conditions.

This overextension was the direct result of the conditions leading up to the crisis of 1907, indeed was contributory to the development of that crisis. It was not appreciated that those conditions were fundamental and in 1909, long before the curative process had been sufficiently in action, the old movement of extension was resumed. In 1910 we had renewed liquidation and in the latter half of the year the usual secondary reaction in business followed.

**METAL MARKETS**

New York, Jan. 4—The year closed quietly in the metal market generally, and the new year opens with only slight changes.

**Gold, Silver and Platinum**

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
<b>Gold:</b>			
Nov. 1910..	\$1,376,011	\$ 4,313,500	Imp. \$ 2,937,489
" 1909..	15,649,281	3,863,637	Exp. 11,785,644
Year 1910..	57,444,422	54,245,886	" 3,198,536
" 1909..	122,301,517	42,003,194	" 80,298,323
<b>Silver:</b>			
Nov. 1910..	5,265,595	4,827,254	Exp. 438,341
" 1909..	4,951,483	4,694,807	" 256,676
Year 1910..	51,299,913	41,479,718	" 9,820,195
" 1909..	52,294,344	41,984,006	" 10,310,338

Exports from the port of New York, week ended Dec. 31: Gold, \$175,900; silver, \$1,418,446. Imports: Gold, \$832,863, chiefly from Cuba; silver, \$130,172, from South and Central America.

**Gold**—The price of gold on the open market in London was unchanged at 77s. 9d. per oz. for bars and 77s. 4½d. per oz. for American coin. Supplies were taken chiefly for France and Germany.

**Platinum**—The market continues quiet. Sales have been light, and there are reports of weakness in the foreign market. Dealers quote \$38.50 per oz. for refined platinum, and \$40.50@41 per oz. for hard metal, 10 per cent. iridium.

**Silver**—The market advanced this week on buying for Chinese banks and closes steady at 25¼d. in London. The outlook is for fluctuations within narrow limits.

SILVER AND STERLING EXCHANGE

Dec.-Jan.	29	30	31	2	3	4
New York....	53¾	54¾	54¾	....	54¾	54¾
London....	24½	25½	25½	25½	25½	24½
Sterling Ex..	4.8505	4.8500	4.8510	....	4.8500	4.8515

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

Copper, Tin, Lead and Zinc

NEW YORK

Dec.-Jan.	Copper.		Tin. Cts. per lb.	Lead.		Zinc.	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.		New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
29	12½ @12½	12.45 @12.55	38¾	4.50	4.35 @4.37½	5.42½ @5.47½	5.27½ @5.32½
30	12½ @12½	12.45 @12.50	38¾	4.50	4.35 @4.37½	5.42½ @5.47½	5.27½ @5.32½
31	12½ @12½	12.45 @12.50	38¾	4.50	4.35 @4.37½	5.42½ @5.47½	5.27½ @5.32½
2	.....	.....	.....	.....	.....	.....	.....
3	12½ @12½	12.40 @12.50	39¾	4.50	4.35 @4.37½	5.45 @5.50	5.30 @5.35
4	12½ @12½	12.40 @12.50	39¾	4.50	4.35 @4.37½	5.47½ @5.52½	5.32½ @5.37½

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 prices of casting copper and of electrolytic cathodes are 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.

LONDON

Dec.-Jan.	Copper.			Tin.		Lead, Span- ish.	Zinc, Ordin- aries.
	Spot.	3 Mos.	Best Sel'td	Spot.	3 Mos.		
29	56½	56½	60	174	174	13¾	24
30	56	56½	59¾	174¾	173¾	13	24
31	.....	.....	.....	.....	.....	.....	.....
2	.....	.....	.....	.....	.....	.....	.....
3	56½	57½	59¾	179¾	179¾	13½	24½
4	56¾	57¾	60	180¾	179¾	13½	24¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

**Copper**—The market is peculiar in some of its features. The leading agencies maintain their previous asking price, but while failing to get business manifest no concern respecting the situation and give no sign of weakening. Other sellers, on the other hand, have made concessions to consummate business. Although the transactions of the week have been relatively small, they have been made at lower prices. Nevertheless a better feeling is noticeable in the market. If the business effected has been

small, at least there has been a better inquiry both for domestic delivery and for export. At the close, Lake copper is quoted at 12½@12¾c., and electrolytic copper in cakes, wirebars and ingots at 12.40@12.50c. Casting copper is quoted nominally at 12¼@12¾ cents.

The London market for standard copper, which closed on Friday at £56 for spot, and £56 16s. 3d. for three months, displayed more activity and strength on Tuesday and Wednesday of this week, closing on the latter day at £56 15s. for spot, and £57 10s. for three months. It is reported that the speculative market is pretty well sold out and that sentiment is more hopeful.

The visible supply of copper in England and France—including copper afloat from Australia and Chile—on Jan. 1, 1911, was 83,838 long tons, a decrease of 2412 tons from the Dec. 1 report.

**Tin**—Supported by large orders from the United States, the London market retained its firm tone throughout last week. The only exception was Dec. 29, when the unexpected announcement by the Dutch government of an increase of 1500 tons in the quantities of Banka tin to be sold during 1911 had a depressing influence on quotations. The exceedingly favorable statistical position of the metal, which was revealed both in London and here at the beginning of business in the new year, gave the market considerable stimulus. Interests which hitherto had not put any confidence in the reports of large deliveries into United States consumption and ever decreasing shipments from the Straits, were compelled to change their opinion of the market and turned bulls. The result was an advance of about £4 10s. and an excited market. The close is cabled very strong at £180 12s. 6d. for spot, and £179 15s. for three months.

The domestic market is quoted at about 39.75 cents.

Visible stocks of tin on Jan. 1 were 17,194 long tons, a decrease of 1681 tons from the Dec. 1 statement.

**Lead**—A fair volume of business is being done from day to day at last prices, 4.50c. New York, and 4.35@4.37½c. St. Louis.

The market for Spanish lead is again a trifle lower, being quoted at £13 1s. 3d. and £13 3s. 9d. for English lead.

**Spelter**—The market is firmer. At the lower prices which have recently been current, manufacturers show a disposition to replenish their depleted supplies, and as stocks in the hands of smelters are small, they are not eager sellers. In consequence, the market appears to be sensitive upward. At the close, St. Louis is quoted at 5.32½@5.37½c. and New York at 5.47½@5.52½ cents.

The London market is firmer, good ordinaries being quoted at £24 2s. 6d., with £24 7s. 6d. for specials.



# Gold, Silver and Platinum in 1910

By Frederick Hobart

The gold production of the world, which has been increasing steadily and by considerable proportions ever since the setback given to its total by the stoppage of Transvaal production during the Boer war, increased in 1910 but with a smaller percentage of increase than in 1909. Our preliminary figures for 1910 show a total of \$468,815,067, an increase, as compared with 1909, of \$8,887,585, or 1.9 per cent. The completed figures for the year may possibly change these totals somewhat, but it is not likely that there will be any material difference in the revised figures.

The statements for the United States given herewith are the preliminary estimates compiled by the director of the Mint. For nearly all the important producers reports are for 11 months of the year, the month of December being estimated. For Russia the definite figures are for eight months, with a close estimate for the remainder of the year. Our estimates have been made on a con-

### GOLD PRODUCTION OF THE WORLD.

Country.	1909.	1910.
Transvaal.....	\$150,299,329	\$155,916,000
United States.....	99,673,400	96,055,214
Australasia.....	71,254,182	67,730,000
Russia.....	37,455,032	47,042,853
Mexico.....	22,511,966	22,850,000
Rhodesia.....	12,751,226	12,712,000
British India.....	10,725,000	10,469,000
Canada.....	10,050,000	11,250,000
China, Japan and Korea.....	9,599,800	10,000,000
West Africa.....	4,644,386	3,715,000
Madagascar.....	2,480,000	1,950,000
France.....	1,196,280	1,625,000
South and Central America.....	14,464,352	14,750,000
Other countries.....	12,822,529	12,750,000
Totals.....	\$459,927,482	\$468,815,067

servative basis, so that revisions later may slightly increase the total; but the difference will not be great.

The year 1910 did not witness the opening or development of any important new producing districts, except in Russia, where the new mines in the Lena basin and in the Amur region made a notable gain. Indeed, Russia shows the only large increase for the year. The Transvaal had only a small gain, the smallest for years; United States production decreased, as did that of Australasia; while other countries had only small changes. The changes of the year in the Transvaal are treated at length in the following pages, as are those in the principal States of the United States.

**Australasia**—The production of gold in Australasia again showed a decrease, as it has for several years past. This was most marked in Western Australia, which is the largest producer; and there the loss came chiefly from the lower grade of ore in the important Kalgoorlie district. One new district, the Southern Cross, was opened and great hopes are entertained of its future; but not enough

work has yet been done to show its real value and importance. In most of the other States, no new discoveries were made, and the gold-mining industry has suffered from a lack of prospecting and from the diversion of labor to other fields of industry. New Zealand production was nearly stationary, an increase from the quartz mines being offset by a decrease from the dredges and other placer mining.

### GOLD PRODUCTION OF THE WORLD FOR TWENTY YEARS.

1891.....	\$130,650,000	1901.....	\$260,877,429
1892.....	146,292,600	1902.....	298,812,493
1893.....	158,437,551	1903.....	329,475,401
1894.....	182,509,283	1904.....	349,088,293
1895.....	198,995,741	1905.....	378,411,054
1896.....	211,242,081	1906.....	405,551,022
1897.....	237,833,984	1907.....	411,294,458
1898.....	287,327,833	1908.....	443,434,527
1899.....	311,505,947	1909.....	459,927,482
1900.....	258,829,703	1910.....	468,815,067

**Russia** (Special Correspondence)—The completed official returns for eight months give the following production of pure gold as registered at the smelting works of the Imperial Mint: Ural, 78 poods; Tomsk, 75; Irkutsk, 228; Amur and Seacoast, 429; Lena basin, 845; Yenisei, 44; miscellaneous, 44; total mint, 1743; registered by banks from private smelting works, 877; total, 2620 poods fine gold.

The year was a satisfactory one for the Russian gold-mining industry. The returns of the large gold-mining enterprises show that the production of 1910 sur-

### SILVER PRODUCTION OF THE WORLD.

(Figures furnished by Director of the Mint.)

Country.	1909.	1910.
United States.....	54,721,500	56,438,695
Canada.....	27,878,590	32,878,590
Mexico.....	73,949,432	72,574,220
Africa.....	1,076,577	1,076,600
Australasia.....	16,359,284	16,359,284
Russia.....	132,122	158,546
Austria-Hungary.....	999,184	999,184
Germany.....	5,332,901	5,332,901
Norway.....	213,122	213,122
Sweden.....	29,373	29,373
Italy.....	786,620	786,620
Spain.....	4,767,091	4,767,091
Greece.....	829,025	829,025
Turkey.....	7,971	7,971
France.....	592,042	673,302
Great Britain.....	459,747	618,429
Servia.....	11,226	10,230
South America.....	16,038,182	16,476,928
Central America.....	2,294,272	2,294,272
Japan.....	4,278,392	4,798,351
Dutch East Indies.....	465,980	465,980
Total.....	201,215,633	217,788,714

passed that of the previous year by a large amount.

At the head of all gold-mining districts we can put the Kodaibo district, situated in the basin of the Lena, in the Irkutsk government. The Lena Gold Mining Company (Zentskaya), owned by the English company, the Lena Goldfields, Ltd., alone produced the enormous quantity of 1200 poods of gold, the production of the whole district being 1400 poods.

This improvement attracted the attention of Russian and foreign capital-

ists to the gold-mining industry, and many enterprises that had suffered from lack of money have been supplied with sufficient capital. In the same district, for the first time during its existence, there were opened gold veins in quartz, but the

### I. UNITED STATES GOLD PRODUCTION.

State or Territory.	1909	1910
Alabama.....	\$29,200	\$29,416
Alaska.....	20,339,600	16,987,990
Arizona.....	2,626,800	3,375,256
California.....	20,703,600	21,146,150
Colorado.....	21,846,600	20,408,641
Georgia.....	43,400	25,488
Idaho.....	1,344,200	992,930
Missouri.....	200	.....
Montana.....	3,750,100	3,465,364
Nevada.....	16,386,200	17,941,643
New Hampshire.....	.....	599
New Mexico.....	252,800	397,974
North Carolina.....	31,400	54,884
Oregon.....	829,000	631,173
Pennsylvania.....	6,200	2,419
Philippine Islands.....	247,600	90,357
Porto Rico.....	600	1,013
Kansas.....	.....	11,163
South Carolina.....	7,400	31,566
South Dakota.....	6,573,600	5,183,070
Tennessee.....	4,300	3,514
Texas.....	400	475
Utah.....	4,213,300	4,243,907
Virginia.....	4,000	558
Washington.....	429,000	711,359
Wyoming.....	3,900	3,990
Oklahoma.....	.....	15,090
Miscellaneous.....	.....	299,225
Totals.....	\$99,673,400	\$96,055,214

industrial importance of this discovery is not yet determined.

The quartz gold mining improved also in the Tomsk district (West

### II. UNITED STATES SILVER PRODUCTION.

State or Territory.	1909.	1910.
Alabama.....	200	264
Alaska.....	198,600	126,480
Arizona.....	2,523,600	2,835,641
California.....	2,304,900	3,530,246
Colorado.....	8,846,300	8,747,777
Georgia.....	200	286
Idaho.....	6,755,900	6,686,016
Illinois.....	900	1,727
Michigan.....	217,600	268,642
Missouri.....	15,200	32,900
Montana.....	12,034,500	11,519,059
Nevada.....	10,119,200	9,346,256
New Hampshire.....	3,000	854
New Mexico.....	324,200	683,111
North Carolina.....	400	1,215
Oregon.....	69,600	62,848
Pennsylvania.....	.....	7,867
Philippine Islands.....	3,000	1,523
Porto Rico.....	.....	2
Kansas.....	.....	4,113
South Carolina.....	.....	11
South Dakota.....	196,300	113,460
Tennessee.....	65,300	75,714
Texas.....	408,100	365,854
Utah.....	10,551,100	11,242,301
Virginia.....	6,400	34
Washington.....	75,200	176,816
Wyoming.....	1,800	1,363
Oklahoma.....	.....	66,476
Miscellaneous.....	.....	539,839
Totals.....	54,721,500	56,438,695

Siberia), where many new veins have been discovered and development begun.

The Amur railway has opened new and large gold placer fields, which have already attracted many prospectors.

On the Imperial Domains, in the Baikal region, production greatly increased, being equal to 500 poods, but from this district much gold escaped registry, being carried abroad by the Chinese miners.

Gold mining in the Ural district re-

mained stationary, showing no improvement.

Gold dredging developed gradually. New dredges have been proposed for installation: two in the Seacoast district on the Kolchan mines, near Nikolaievsk; one was ordered from the Engineering Company of New York. Four dredges were started in the Kodaibo district; one dredge of the Werf-Conrad pattern has been installed by the Angara Gold Mining Company, in the Seacoast district.

#### GOLD AND SILVER PRODUCTION IN THE UNITED STATES

We have received from the director of the Mint his preliminary statement of

gold and silver production, based on the returns from the mints and assay offices. Comparisons are made with the revised and completed figures for 1909. The gold output showed a decrease last year of \$3,618,186, or 3.6 per cent.; the losses being mainly in Alaska, Colorado and South Dakota. California, Nevada and Utah showed gains. California stands at the head of the list for 1910, changing places with Colorado, which was first for several years. Nevada stands third, passing Alaska, which drops to fourth place. South Dakota holds the fifth place, while Utah is sixth, Montana seventh and Arizona—with a considerable gain—is eighth. The causes of these changes are ex-

plained in the reviews on the following pages. The figures are given in the tables on the preceding page.

The silver production for 1910 showed an increase of 1,717,195 oz., or 3.1 per cent., over the previous year. Montana held the first place as a silver producer, but it was very closely followed by Utah. Nevada advanced to the third place. Colorado fourth and Idaho fifth. The chief increases were in Utah, California and Arizona. Montana and Nevada both decreased their output. In the other States there were no marked changes. The greater part of the silver came, as usual, from the great copper and lead-producing States.

# Gold and Silver Movement in 1910

By Frederick Hobart

A problem presenting much interest and also many difficulties in the way of a solution is the final disposition of the precious metals mined and added to the world's stocks year by year. These metals are not consumed or used as are the metals of construction—such as iron, copper, lead, zinc and others. Gold, especially, is not used, but is added to stocks in use or circulation, except that portion which is employed in the arts. Even that does not disappear, and is not consumed, but is for the most part put into forms which are preserved, and which can on occasion be put into metallic form and used again. An unknown quantity is lost, it is true, by fire, wreck and similar causes, but this cannot be a very great proportion of the total mined. In modern times a large part of the world's gold is held by national treasuries and by banks, and can be traced by their records. In 1910, however, as in many previous years, the increase in what may be called the visible stocks of gold in no degree approached the quantity mined. There is no space here, however, to discuss this question, which has been, and continues to be, the subject of unending controversy.

#### THE GOLD MOVEMENT

While 1910 was a year of active business and trade in most of the commercial world, there was not as active a demand for gold as in the previous year. Supplies were absorbed, but there was less competition for them among the leading commercial nations. The United States parted with less of its gold than in 1909, though its exports again exceeded its imports. The movement for the 11 months ended Nov. 30 was as follows:

	1909.	1910.	Changes.
Exports.....	\$122,301,517	\$57,444,422	D. \$64,857,095
Imports.....	42,003,194	54,245,886	I. 12,242,692
Excess, exp.	\$80,298,323	\$ 3,198,536	D. \$77,099,787

A considerable part of the imports are from Mexico, South America and other countries where our people have mining interests. The commercial movement to and from Europe was comparatively small. For most of the year our bankers were not in a position to demand gold; while London and Paris was not disposed to lend it. At the close of the year the exchange position indicates that we may import gold early in the new year.

The movement through the port of San Francisco—which is of interest as it includes the direct exports to China—was as follows, for the 11 months ended Nov. 30:

	Coin.	Bullion.	Total.
Imports:			
Gold.....	\$1,943,174	\$2,201,866	\$4,145,040
Silver.....	790,347	865,102	1,655,449
Exports:			
Gold.....	10,000	1,970,208	1,980,208
Silver.....	31,000	6,480,397	6,511,397
Excess:			
Gold.....	I. 1,933,174	I. 231,658	I. 2,164,832
Silver.....	I. 759,347	E. 5,615,295	E. 4,855,948

The exports show decreases of \$24,924,009 gold and \$712,595 silver, as compared with the previous year.

The offices of the United States Mint service sold in 1910 \$38,474,398 worth of gold bars for use in the industrial arts, which compares with \$34,486,063 in 1907 the next highest record. The amount of new gold used in the arts in the United States in 1910, was over \$40,000,000, including coin.

The imports and exports of gold in Great Britain for the 11 months were as follows:

	1909.	1910.	Changes.
Imports.....	£48,870,126	£53,908,384	I. £5,038,258
Exports.....	43,101,383	47,272,938	I. 4,171,555
Excess, imp.	£ 5,768,743	£ 6,635,446	I. £ 866,703

The considerable gain in imports was offset to a large degree by the increase in exports.

The Treasury Department estimates the

gold in the United States in December as follows:

In treasury, held against certificates.....	\$910,354,669
In treasury, current balances.....	189,351,933
In banks and circulation.....	601,492,185
Total.....	\$1,701,197,787
Total, December, 1909.....	1,692,759,176

The increase in 1910 was \$8,438,611. The uncertain quantity in this estimate is the amount in circulation, which is apt to be overestimated, in the absence of certain deductions which do not appear in public records and are hard to trace; such as gold carried abroad by individuals, coin melted for jewelry, and other similar causes.

The specie holdings of the great European banks at the close of December were as follows, reduced to dollars:

	Gold.	Silver.
Bank of England.....	\$164,319,645	
Bank of France.....	657,733,600	\$165,443,800
Bank of Germany.....	185,296,250	67,933,000
Bank of Russia.....	740,410,000	30,450,000
Austria-Hungary.....	277,550,000	60,285,000
Spain.....	82,090,000	153,910,000
Italy.....	196,070,000	17,250,000
Netherlands.....	57,350,000	9,960,000
Belgium.....	27,376,665	13,688,335
Sweden.....	22,365,000	
Switzerland.....	31,180,000	
Norway.....	8,950,000	
Total.....	\$2,446,690,930	\$518,920,135
Total, Dec., 1909.....	2,444,629,940	534,252,015

The Bank of Spain, alone of all the European banks, carries a large silver reserve. The Bank of France reported a large amount in silver coin, but that amount is small in comparison with its gold. The Bank of Russia includes in its statement gold bills on foreign banks, and to that extent there is a certain duplication. The Bank of Russia also acts as agent for the Imperial Treasury, which to some extent explains the large amount of its gold reserve.

The specie holdings of the Associated Banks of New York at the close of December were reported through the Clear-



ing House at \$239,495,000, which compares with \$230,401,000 at the close of 1901. These holdings include silver as well as gold.

The stock of coined silver in December is estimated as follows: Silver dollars held against certificates, \$488,190,000; silver dollars in Treasury balances and circulation, \$76,593,508; subsidiary silver, \$156,456,852; total, \$721,330,360; the total is an increase of \$424,056 only during the year.

THE SILVER MOVEMENT

The accompanying table shows the average monthly prices of bar silver in London and New York for two years.

Month.	New York.		London.	
	1909.	1910.	1909.	1910.
January.....	51.750	52.375	23.843	24.154
February.....	51.472	51.534	23.706	23.794
March.....	50.468	51.454	23.227	23.690
April.....	51.428	53.221	23.708	24.483
May.....	52.905	53.870	24.343	24.797
June.....	52.538	53.462	24.166	24.651
July.....	51.043	54.150	23.519	25.034
August.....	51.125	52.912	23.588	24.428
September.....	51.440	53.295	23.743	24.567
October.....	50.923	55.490	23.502	25.576
November.....	50.703	55.635	23.351	25.680
December.....	52.226	54.428	24.030	25.160
Total.....	51.502	53.486	23.706	24.670

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

The table shows that silver prices in 1910 were generally on a higher level than in 1909. With occasional small recessions prices continued to rise through the year, the highest monthly averages—55.635c. in New York and 25.680d. in London—being reached in November. From that point there was a drop in December. The extreme fluctuations—between February and November—were 4.181c. in New York and 1.990d. in London.

As is usually the case the demand for silver has rested largely upon the amount taken by the Far East. China was a heavy buyer early in the year, but the demand quieted down, and much smaller quantities were taken until late in the year, when buying from that country revived and some large amounts were taken in London. At times, however, China not only ceased to buy silver, but sold some to India. The total taken by that country in London was some £500,000 less than in 1909, but this was partly made up by purchases from Australia.

India was a pretty steady buyer of silver throughout the year, though the government took none for coinage, the stock of rupees having been sufficient without making additions. Owing to generally good crops the demand from the Indian buyers was fairly large. This was not always reflected in the London buying, as there was a strong speculation in the white metal by native banks and operators. At times this group held large

stocks and used them to raise and lower prices. Several times there were exchanges of silver between these operators and the Chinese banks. At the close of the year stocks were reduced to a point much lower than they had been at an earlier date. The demand for silver was helped in some degree by the high price of tin; though this cause has not been so much a factor in the market since the change in the currency of the Straits Settlements, two years ago.

It is anticipated that the Indian government will be obliged to increase its stock of coined rupees before long, and will therefore become a buyer of silver. The Chinese government has adopted a new scheme of currency reform which will call for the purchase of a large quantity of silver; but Chinese reforms are slow in action, and it may be a year or two before this becomes operative.

Imports of silver into Great Britain for the 11 months ended Nov. 30 were valued at £13,163,535 and exports at £12,300,190; the excess of imports being £863,145. Most of the silver taken by Great Britain is really only in transit, handled through the London market.

Shipments of silver from London to the East from Jan. 1 to Dec. 22 are reported by Messrs. Pixley & Abell as in the accompanying table.

	1909.	1910.	Changes.
India.....	£6,567,600	£6,858,000	I. £ 290,400
China.....	1,930,000	1,424,000	D. 506,000
Straits.....	114,600	.....	D. 114,600
Total.....	£8,612,200	£8,282,000	D. £ 330,200

The Straits Settlements dropped out of the silver market last year as completely as Japan did some years ago.

Apart from the sales to the East there was a fair demand for the white metal. France and one or two other countries in the Latin Monetary Union made considerable purchases for coinage. Russia was also a buyer, to a small extent for coinage, but more largely, in all probability, for use in its Eastern possessions. Purchases by the United States Government during the year were limited to 200,000 oz., bought for coinage into fractional currency at the Denver mint. This silver was bought in December, at 54.88c. per oz., delivered, and was the first silver bought by the Government since March, 1909.

The takings of silver for use in the arts were generally good in 1910, though it is impossible to get at the exact quantity. This varies considerably from year to year, but in 1910 most of the large manufacturers had a fairly prosperous year. Apart from the use of silver for household ware and decorative purposes, an appreciable quantity is now used in photography in preparing sensitive plates and similar ways. This use of the metal is an actual consumption since it is used up and disappears, and does not continue to be preserved and kept for years, like household ware and ornaments.

The movement of silver in the United States for 11 months ended Nov. 30 was as follows:

	1909.	1910.	Changes.
Imports.....	\$52,294,344	\$51,299,913	D. \$ 994,431
Exports.....	41,984,006	41,479,718	D. 504,288
Net excess...	\$10,310,338	\$ 9,820,195	D. \$ 490,143
App. oz.....	20,021,000	18,390,000	D. 1,631,000

The approximate quantities of the net imports are calculated on the average price of silver in New York. The imports of silver are largely in the form of base bullion which comes to this country to be refined and passed on elsewhere.

Platinum

The production of platinum in the United States in 1910 was limited to about 500 oz., about the same as in the preceding year. Most of this was obtained through the mint, where a certain quantity is recovered every year as a by-product in the refining of gold and silver bullion, mainly from California. A much smaller quantity is saved in treating the nickel-copper mattes brought here from the Sudbury district in Ontario to be refined.

AVERAGE PRICES OF PLATINUM. IN DOLLARS PER OUNCE TROY.

	New York, Refined Platinum.	Russia, Crude Metal—83 Per Cent. Platinum.	
		St. Petersburg.	Ekaterinburg.
January....	\$29.00	\$22.79	\$20.68
February....	28.75	23.77	21.81
March.....	29.13	23.72	22.75
April.....	29.25	24.90	24.06
May.....	29.55	24.50	23.69
June.....	31.38	24.05	24.50
July.....	33.00	28.67	27.82
August....	33.00	27.20	28.20
September...	33.63	27.93	28.20
October....	37.50	30.45	30.46
November...	39.44	32.05	31.96
December...	38.75	32.34	32.34
Average for the year	\$32.70	\$26.96	\$26.37

Imports into the United States for the 11 months ended Nov. 30 were 105,340 oz. in 1909, and 111,670 oz. in 1910; an increase of 6330 oz. A large part of these imports is crude metal, which is refined here. Most of the imports are Russian platinum, usually received here from Paris, where the control of the Russian industry rests. There was an increase in the receipts from Colombia; but these are still rather irregular, and the Russian platinum is the chief reliance.

The accompanying table gives the prices of refined platinum in New York and of crude metal in Russia; the latter being reduced to our weights and currency. Hard metal ruled generally at \$2 @2.50 per oz. higher than refined platinum for 10 per cent. iridium alloy.

# Arkansas Diamond Field in 1910

By John T. Fuller\*

Contrary to expectations, the progress forecasted for these fields in the review for 1909 did not materialize during 1910. It was confidently expected by the companies in the field that sufficient working capital would be found to develop the mines, and that the development would be well under way by the close of 1910. It has proved a difficult task to persuade the average investor that genuine diamonds actually exist in America and that these Arkansas fields show great promise of being a profitable venture. On the other hand the large investors held off due to the fact that the owners refuse to consider any offer involving the surrender of a controlling interest in the property.

## NEWSPAPER REPORTS OF NEW DISCOVERIES WERE BASELESS

The situation in 1910 remained practically the same as in 1909. There were several new discoveries of diamonds and new pipes reported in the daily press, all of which proved, on investigation, to be

\*General manager, Arkansas Diamond Company, Murfreesboro, Ark.

cases of mistaken identity or clumsy fakes.

The total number of diamonds taken from the whole field during the year was 200, all of which came from the one pipe in sections 21 and 28 T-9-S, R-25-W.

The total diamonds, to date, from the entire field amount (as far as can be reliably determined) to 1200 stones weighing approximately 574 carats. Of this number 1179 stones came from the pipe in sections 21 and 28, and 21 stones from the pipe in section 14 owned by the American Diamond Mining Company.

## ARKANSAS DIAMOND COMPANY

This property in sections 21 and 28 was visited during the year by representatives of an English syndicate. A provisional agreement for the development of the property was signed by both parties, but at a subsequent meeting in London, this agreement was not ratified owing to difference over the details of the transaction.

During the year 145 loads (of 16 cu. ft.) were washed in the small test plant at the mine, from which 142 diamonds,

weighing 53.56 carats, were obtained, thus making an average of 0.369 carat per load. In addition to this 44 stones, weighing 20.5 carats, were picked up on the surface. The total recovery for the year was therefore 186 stones weighing 74.06 carats. The total recovery to date from this property is 1000 stones of all colors and weights from 1/16 to 6 carats.

## OTHER COMPANIES

The Kimberlite Diamond Mining and Washing Company, with property in section 14 T-8-S, R-25-W, sunk several pits from 20 to 30 ft. deep and put down a number of bore holes. In the early spring this company made some test washings on a small scale, using a hand jig followed by riffles. No diamonds were reported. Neither the Ozark nor the American company did any work beyond putting down a few bore holes. Seven diamonds were picked up on the surface of the Ozark company's property.

At present the outlook for great progress in these fields during 1911 is not promising although I am confident of ultimate success.

# Antimony in 1910

The market for antimony during 1910 was dull and quiet, chiefly owing to the lack of large purchases by the railroads, and until these consumers come back into the market low prices may continue to prevail. As shown by the statistical table accompanying this article, Cookson's antimony opened in January at a premium of over 1/2c. over the U. S. brand, with an average price of 8 1/2c. for the month. However, the price fell with comparative regularity during 1910, and ends at a little under 8c. with about the 0.3c. difference which may be expected between Cookson's and the nearest competing brands.

At present there is no antimony ore being smelted in the United States, and there was no production of antimony ore in 1910 except small lots for sample purposes. In 1908 there were 360 tons produced, 95 tons in 1909, and while there are no reliable statistics available, it is believed the 1910 production fell short of 75 tons. This evidently justifies the comment made in the JOURNAL in January, 1909, that if antimony mines could not be developed with the metal at 25c. per lb., it was useless to expect them to be developed because of a 1 1/2c. tariff on metallic antimony and 1c. on ore, with antimony selling at 8@9c.

per lb. It becomes more and more evident, therefore, that the tariff is simply in the interests of the producers of antimonial lead.

AVERAGE PRICES OF ANTIMONY.  
(IN CENTS PER POUND.)

	1909.			1910.		
	Cookson's.	U. S.	Ordinaries.	Cookson's.	U. S.	Ordinaries.
January	8.202	8.075	7.675	8.500	7.988	7.738
February	8.125	8.000	7.531	8.469	7.969	7.578
March	8.047	7.843	7.500	8.359	7.938	7.313
April	8.250	8.031	7.718	8.438	7.938	7.438
May	8.387	8.150	7.887	8.438	7.938	7.438
June	8.312	8.062	7.893	8.241	7.938	7.438
July	8.375	7.875	7.375	8.175	7.938	7.400
August	8.525	8.125	7.625	8.278	7.938	7.328
September	8.687	8.125	7.506	8.313	7.938	7.313
October	8.537	8.012	7.500	8.263	7.900	7.400
November	8.437	7.937	7.687	8.922	7.656	7.188
December	8.437	7.937	7.687	8.625	7.438	7.063
Year	8.360	8.015	7.466	8.252	7.876	7.386

## STATUS OF METALLURGY OF ANTIMONY

So far as known, there were no radical improvements in the metallurgy of antimony during 1910, the fire processes still depending on reduction of liquated antimony sulphide by scrap iron, or catch-

ing and reducing previously volatilized oxides. There are also some wet processes, but all, both wet and fire, have the common objection, from the American standpoint, that they depend upon a plentiful supply of cheap labor for their successful working. The Betts process, in use by the United State Metals Refining Company, has not proved effective for the production of metallic antimony, the antimony being marketed as antimonial lead.

## ANTIMONY OXIDE

The Harshaw, Fuller & Goodwin works at Elyria, Ohio, are still the only manufacturers of antimony oxide in the United States; they operate, it is understood, on Chinese regulus. The oxide has a limited use as a substitute for tin oxide in ceramic and enamel work, selling at about 8c. per pound.

As said above, the outlook for metallic antimony is by no means bright, nor will it probably become so until the railroads alter the policy of doing a little less repair work than should be done, together with no new construction. The use of antimony oxide and antimony sulphide will probably increase largely in this country for pigment purposes, and for non-poisonous match compounds.



# The Copper Industry in 1910

The American refineries in 1910 produced about 1,445,000,000 lb. of copper. This figure is based on the report of the Copper Producers Association, for the first 11 months of the year, to which we have added an estimate for December. As usual, we have collected the smelter statistics, the meaning of which we do not now need to describe. Reports from every smelter in North America show a total of 1,334,534,797 lb. of blister and Lake copper. Excluding the production (32,771,683) that did not come to American refineries, and adding the imports (December estimated) of blister copper coming from countries other than Canada and Mexico (141,530,-

## PRODUCTION OF COPPER IN THE UNITED STATES. (IN POUNDS.)

State.	1909.	1910.
Alaska	4,057,142	5,450,000
Arizona	292,042,829	297,081,605
California	53,357,451	45,141,043
Colorado	10,487,940	8,867,401
Idaho	7,770,010	5,317,039
Michigan	227,247,998	219,000,000
Montana	313,838,203	288,449,425
Nevada	51,835,309	63,778,000
New Mexico	5,134,506	5,700,000
Utah	100,438,543	127,906,115
Wyoming	89,654	200,000
Southern States and East	22,837,962	17,039,356
Other States	3,746,895	2,176,446
Totals	1,105,336,326	1,086,151,430

to some extent explains the maintenance of the high rate of refinery production in 1910; and they show also that the curtail-

lotted to New Mexico. In all of the other cases we believe the figures to be fairly close. It is to be noted, however, that errors in the figures for any State do not imply an error in the total, but merely that some copper has been credited to one that ought to have been to another.

## PRODUCTION OF COPPER IN NORTH AMERICA.

United States	1,105,336,326	1,086,151,430
Mexico	126,169,962	131,765,910
Canada	47,677,361	50,408,276
Cuba	6,627,028	7,779,986

It may be noticed that the total sum of the American, Canadian and Mexican production falls short of the total smelter production. The difference is accounted

## PRODUCTION OF BLISTER COPPER IN NORTH AMERICA IN 1910 (a).

Company.	January.	February.	March.	Company.	July.	August.	September.
Arizona, Ltd.	2,646,000	2,658,000	2,886,000	Anaconda			22,200,000
Balaklala	981,278	989,102	1,263,733	Arizona, Ltd.	2,910,000	2,620,000	2,672,000
Boleo (Mexico)	2,644,800	2,331,832	2,148,383	Balaklala	1,100,000	nil	nil
British Col. Copper Co.	656,473	683,234	891,419	Boleo (Mexico)	2,272,600	2,039,520	2,061,300
Copper Queen	7,888,000	7,109,044	8,888,039	British Col. Copper Co.	574,172	642,341	622,702
Calumet & Ariz.	2,331,000	2,024,000	2,820,000	Copper Queen	8,771,735	7,796,559	6,903,759
Cananea (Mexico)	3,500,000	3,586,000	3,700,000	Calumet & Ariz.	2,705,000	2,580,000	2,535,000
Detroit	2,166,158	1,486,400	1,698,975	Cananea (Mexico)	4,500,000	3,526,000	3,565,000
East Butte	559,776	513,425	573,080	Detroit	1,800,000	2,100,000	2,128,000
Granby	2,077,985	1,958,294	2,059,257	East Butte	1,268,055	1,202,930	625,840
Imperial	850,000	750,000	825,000	Granby	1,671,000	1,430,315	1,120,732
Moctezuma (Mex.)	2,113,000	1,818,159	1,921,449	Imperial	800,000	400,000	nil
Nevada Con.	3,800,000	5,115,723	5,339,466	Moctezuma (Mexico)	1,958,637	1,630,204	2,211,435
Old Dominion	2,130,000	2,035,000	2,674,000	Nevada Con.	6,896,429	6,052,621	5,151,208
Shannon	1,510,696	1,526,000	1,468,000	Old Dominion	2,000,000	2,693,000	2,262,000
Superior & Pittsburg	2,166,000	1,864,000	2,370,000	Shannon	2,207,000	1,546,000	1,418,000
Utah Copper Co.	4,745,066	5,913,465	7,853,288	Superior & Pittsburg	2,224,000	2,520,000	2,125,000
Butte District (estimated)	19,250,000	13,758,620	24,000,000	Utah Copper Co.	8,677,000	7,440,035	7,077,035
Lake Superior (estimated)	19,260,127	18,250,000	19,250,000	Butte District (estimated)	23,750,000	23,750,000	
Imports, bars, etc.	24,305,526	14,093,381	20,178,202	Lake Superior (estimated)	19,000,000	18,800,000	16,700,000
Imports in ore and matte	7,053,522	6,063,764	6,181,476	Imports, bars, etc.	17,714,034	13,324,788	24,303,859
				Imports in ore and matte	6,637,836	13,031,254	5,782,067

Company.	April.	May.	June.	Company.	October.	November.
Arizona Ltd.	2,340,000	2,610,000	2,802,000	Anaconda	22,100,000	21,000,000
Balaklala	1,109,311	1,148,762	1,226,000	Arizona, Ltd.	3,004,000	3,010,000
Boleo (Mexico)	2,777,800	2,735,680	2,115,314	Balaklala	928,360	
British Col. Copper Co.	340,061	nil	407,040	Boleo (Mexico)	2,278,454	
Copper Queen	8,135,000	8,009,855	8,513,477	Brit. Col. Copper Co.	702,154	917,994
Calumet & Ariz.	2,400,000	1,778,000	2,490,000	Copper Queen	7,060,796	7,372,776
Cananea (Mexico)	4,262,000	4,300,000	4,280,000	Calumet & Ariz.	1,990,000	1,930,000
Detroit	1,930,000	2,035,639	2,017,000	Cananea (Mexico)	3,576,000	3,658,000
East Butte	705,609	993,890	987,209	Detroit	1,757,836	1,840,939
Granby	1,915,475	1,866,625	1,677,257	East Butte	948,369	618,191
Imperial	800,000	700,000	800,000	Granby	1,184,234	1,410,261
Moctezuma (Mex.)	1,785,000	2,274,000	1,706,210	Imperial	nil	nil
Nevada Con.	5,822,351	6,164,493	6,186,832	Moctezuma (Mexico)	1,791,108	1,654,235
Old Dominion	2,325,000	2,174,000	2,092,000	Nevada Con.	5,250,000	5,200,000
Shannon	1,288,000	1,326,000	1,528,000	Old Dominion	2,345,000	2,754,000
Superior & Pittsburg	2,130,000	2,276,000	2,245,000	Shannon	1,286,000	1,420,000
Utah Copper Co.	7,902,643	8,862,913	8,358,496	Superior & Pittsburg	2,095,000	2,100,000
Butte District (estimated)	25,000,000	24,850,000	23,750,000	Utah Copper Co.	7,582,219	7,468,515
Lake Superior (estimated)	16,250,000	19,250,000	18,000,000	Lake Superior (estimated)	18,500,000	20,400,000
Imports, bars, etc.	21,180,396	24,850,919	20,817,978	Imports, bars, etc.	24,292,368	24,835,954
Imports in ore and matte	12,527,371	6,487,243	5,579,618	Imports in ore and matte	5,173,277	5,542,270

(a) This table includes only the production of those companies reporting monthly, and consequently does not represent the total production of American mines.

225) we get a total of 1,443,293,339 lb. as the supply of crude copper to American refineries in 1910. Comparative figures for 1909 and 1910 are as follows:

Year.	Crude (a)	Refined (b)
1909	1,438,509,583	1,405,619,519
1910	1,443,293,339	1,444,782,901

(a) Includes Lake copper. (b) Includes Lake copper and pig copper.

The full meaning of these figures we shall not undertake to discuss at the present time. Broadly speaking, they show that the refiners carried over a rather large stock of crude copper, which

ment by the smelters in 1910, which, as compared with their maximum production of that year, was at the rate of about 10,000,000 lb. per month, did not effect any reduction as compared with the total for 1909.

In the following tables and special articles we give details of the production and many other statistical data. The distribution of the American production according to States of origin at this early date can be made only approximately. Most doubt is attached to the figure al-

for by foreign ores smelted here and by domestic scrap and junk resmelted.

## CONSUMPTION

The domestic deliveries, estimating December, were 766,000,000 lb., against 705,000,000 lb. in 1909. Over periods of such length the deliveries may be taken as equivalent to consumption. If anything, the manufacturers had larger supplies in their yards at the beginning of 1910 than at the end.

IMPORTS OF COPPER INTO THE UNITED STATES IN FIRST 10 MONTHS OF 1910. (IN POUNDS.)

Country.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.
British North America.....	768,194	519,329	1,118,828	947,090	458,252	959,052	(b) 789,593	(b) 786,979	(b) 962,746	(b) 1,013,264
Cuba.....	113,075	25,430	194,010	51,038	92,755	125,289	795,648	928,325	1,366,400	658,560
Germany.....	1,541,120	488,849	1,480,106	2,024,314	2,101,158	1,171,709	77,656	5,633	32,626	135,416
Other European.....	3,701,864	965,143	4,508,928	1,383,697	3,515,461	5,262,184	2,120,198	3,917,795	2,063,359	1,630,220
British North America.....	3,535,268	991,342	3,245,497	3,377,269	1,764,761	1,689,602	(c) 846,816	(c) 2,558,275	(c) 661,842	(c) 874,587
Mexico.....	8,270,000	6,710,948	6,626,119	7,065,015	8,855,007	5,840,842	(c) 846,816	(c) 2,558,275	(c) 661,842	(c) 874,587
Spain.....	92,640	12,131	2,350	37,034	55,876	52,777	513,817	4,320,430	392,510	569,801
Other countries (a).....	22,778	18,209	2,490	7,467	2,294	2,294	2,007,925	4,320,430	302,582	569,801
Total.....	4,952,241	1,505,269	3,306,784	2,995,292	2,529,468	557,473	6,637,836	13,031,254	5,782,067	5,173,277

(a) Includes all countries for which data are not elsewhere given; (b) Canada; (c) Chile.

PIGS, INGOTS, PLATES, BARS AND OLD, IMPORTED FROM:

Country.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.
France.....	55,836	4,829	100,631	76,280	67,655	81,749	.....	.....	.....	.....
Germany.....	113,075	25,430	194,010	51,038	92,755	125,289	.....	.....	.....	.....
United Kingdom.....	1,541,120	488,849	1,480,106	2,024,314	2,101,158	1,171,709	.....	.....	.....	.....
Other European.....	3,701,864	965,143	4,508,928	1,383,697	3,515,461	5,262,184	.....	.....	.....	.....
British North America.....	3,535,268	991,342	3,245,497	3,377,269	1,764,761	1,689,602	(b) 2,372,604	(d) 2,208,245	(d) 3,675,855	(b) 2,043,790
Mexico.....	8,270,000	6,710,948	6,626,119	7,065,015	8,855,007	5,840,842	(b) 2,372,604	(b) 2,327,285	(b) 2,176,586	(b) 2,043,790
Cuba.....	92,640	12,131	2,350	37,034	55,876	52,777	.....	.....	.....	.....
Other West Indies and Bermuda.....	22,778	18,209	2,490	7,467	2,294	2,294	.....	.....	.....	.....
Peru.....	4,952,241	1,505,269	3,306,784	2,995,292	2,529,468	557,473	.....	.....	.....	.....
Other South American.....	221,196	535,167	174,882	15,870	448,127	1,983,495	(c) 263,466	(c) 167,493	(c) 167,493	(c) 669,721
Japan.....	793,874	700,731	249,412	2,559,999	3,960,299	1,983,495	(c) 877,929	1,004,100	744,947	5,690,524
Australia and Tasmania.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Other Countries (a).....	915,634	1,085,313	265,213	1,587,121	1,439,379	4,048,564	.....	662,289	179,782	2,394,030
Total.....	24,305,526	14,093,381	20,178,292	21,180,396	24,850,919	20,817,978	17,714,034	13,324,788	24,303,859	24,292,368

(a) Includes all countries for which data are not elsewhere given; (b) Canada; (c) Chile; (d) Spain.

The exports in 1910 were about 701,000,000 lb., against 681,000,000 in 1909. From what we can learn the unreported stocks at Hamburg and Rotterdam were reduced during the first six months and increased again during the last six months. As between beginning and end of 1910 there was probably no great change. Summarizing all the data it is clear that the world's consumption of copper in 1910 was larger than the production. The statistical position is consequently good, but at the end of the year many persons were obsessed by the haunting fear of a retraction in consumption. We do not wholly share that fear and are rather inclined to be conservatively optimistic.

MINING

The situation at Butte, at Cananea and in Arizona, Michigan, Utah and Tennes-

REFINERY STATISTICS.

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export.
Year, 1909.....	1,405,403,056	705,051,591	680,942,620
I, 1910.....	116,547,287	78,158,387	81,691,672
II.....	112,712,493	66,618,322	37,369,518
III.....	120,067,467	62,844,818	40,585,767
IV.....	117,477,639	67,985,951	31,332,434
V.....	123,242,476	59,305,222	45,495,400
VI.....	127,219,188	53,363,196	65,895,948
VII.....	118,370,003	56,708,175	59,407,167
VIII.....	127,803,618	67,731,271	61,831,780
IX.....	119,519,983	64,501,018	75,106,496
X.....	126,469,284	67,814,172	68,186,912
XI.....	119,353,463	60,801,992	67,424,316
XII.....	116,000,000	60,000,000	67,000,000
Year 1910.....	1,444,782,901	765,832,524	701,327,419

	United States.	Europe.	Total.
I, 1910.....	141,766,111	244,204,800	385,970,911
II.....	98,463,359	248,236,800	346,700,139
III.....	107,187,992	254,150,400	361,338,392
IV.....	123,824,874	249,625,600	373,450,474
V.....	141,984,159	246,870,400	388,854,559
VI.....	160,425,973	239,142,400	399,568,373
VII.....	168,386,017	232,892,800	401,278,818
VIII.....	170,640,678	222,320,000	392,960,677
IX.....	168,881,245	218,444,800	387,326,045
X.....	148,793,714	211,276,800	360,070,514
XI.....	139,261,914	198,060,800	337,322,714
XII.....	130,389,069	193,200,000	323,589,069
I, 1911.....	119,389,669	187,797,120	307,186,189

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. The figures for production in December, 1910, and for stock in the United States on January 1, 1911, are estimated.

see is so admirably and authoritatively summarized in special articles in this issue that we need not refer to it in this introductory article except in a passing way. Broadly speaking, the keynote of developments at Butte, Cananea, Lake Superior and elsewhere has been economy, and the results have already been noteworthy. On the other hand, the "porphyry" mines have not been able to live up to the promises of very cheap copper, or if they have it has been by the mining of the richer and more easily extractable ore, and in some cases the methods of bookkeeping are under sus-



picion. In the early part of 1910 some of the "porphyry" people were talking about 10c. copper and the survival of the fittest. Toward the end of the year the conviction seemed to be growing that among the great copper-producing groups no one really had any preponderating advantage. This paved the way for "harmony" dinners.

As to the new production of 1911, Miami will begin toward the end of January and Ray Consolidated later on. The Chino mill is expected to be ready about the end of July and Braden is also due about that time, but all of them are likely to be more or less delayed and all will begin on a relatively small scale. Utah Copper Company will also complete its enlargements in 1911 and possibly a little copper may come from Copper River. Katanga copper is promised in 1911, but no one worries much about this. The quantity of new copper that will actually reach market in 1911 is not likely to be very large.

On the other hand the fact that the arithmetic of the copper industry comprises subtraction as well as addition was demonstrated by the disclosures of 1910 respecting Granby, North Butte, Calumet & Arizona and Highland Boy. Before long the outputs of these mines will necessarily begin to dwindle.

SMELTERIES AND REFINERIES

At the middle of 1910 the production rose nearly to the refinery capacity. The latter is now being increased, as described in a subsequent article. As for the smelters, new plants of 1910 were Tooele and Tezuitlan. Humboldt resumed. The North American Lead Company went into hands of a receiver and shut down. Colusa-Parrot, at Butte, was bought by Anaconda, which closed it. The Clara Consolidated, of Arizona, produced a few carloads of copper.

World's Production of Copper

We have received data, by cable and otherwise, from most of the important foreign countries that enable us to make a reasonably close estimate of the world's

WORLD'S PRODUCTION OF COPPER. (IN METRIC TONS.)

Country.	1909.	1910.
United States.....	501,372	492,675
Mexico.....	57,230	59,769
Canada.....	21,626	22,865
Cuba.....	3,006	3,529
Australasia.....	34,952	43,000
Chile.....	42,726	41,500
Peru.....	16,257	20,500
Japan.....	42,987	41,000
Russia.....	18,035	23,500
Germany.....	23,500	24,800
Africa.....	15,185	16,000
Spain and Portugal.....	53,023	49,500
Other countries.....	24,317	25,000
Totals.....	854,316	863,638

production of copper in 1910. In the cases of the United States, Cuba, Canada we have had complete returns from the producers. For Aus-

tralia, Germany and Spain we have had reports from many of the important producers, while for many of the countries we have the aid of the regular commercial statistics of shipments and arrivals. For Russia we have the official figures for the first seven months. Only for Japan and "Other Countries" do we entirely lack specific data.

It will appear from the above estimate that the world's production in 1910 was about 1 per cent. larger than in 1909. The visible supply of copper in Europe and America at the beginning of 1910 was 175,075 metric tons; at the end, 103,934. Consequently a world's consumption considerably in excess of production is indicated.

Electrolytic Copper Refining Capacity

The accompanying table gives the approximate annual capacity in pounds of the active electrolytic refineries of the United States at the end of each year:

ELECTROLYTIC COPPER REFINERIES OF THE UNITED STATES.

Works.	Location.	1909 Capacity, Pounds.	1910 Capacity, Pounds.
Nichols Copper Company.....	Laurel Hill, N. Y.....	330,000,000	330,000,000
Raritan Copper Works.....	Perth Amboy, N. J.....	320,000,000	320,000,000
American Smelting and Refining Company.....	Perth Amboy, N. J.....	144,300,000	144,000,000
U. S. Metals Refining Company.....	Chrome, N. J.....	144,000,000	180,000,000
Baltimore Copper Smelting and Rolling Company.....	Baltimore Md.....	200,000,000	240,000,000
Balbach Smelting and Refining Company.....	Newark, N. J.....	48,000,000	48,000,000
Boston & Montana Copper Company.....	Great Falls, Mont.....	48,000,000	48,000,000
Tacoma Smelting Company.....	Tacoma, Wash.....	28,000,000	28,000,000
Calumet & Hecla Mining Company.....	Buffalo, N. Y.....	25,000,000	25,000,000
Totals.....		1,287,000,000	1,363,000,000

The Calumet & Hecla Mining Company, at its Buffalo works, refines only Lake copper. The refineries of the Mountain Copper Company, North American Lead Company and the old works of the Anaconda Company were idle in 1910. The Baltimore refinery is to be increased to capacity for 288,000,000 lb. per annum.

Production of Copper in Australasia

The production of four of the important copper mines of Australia during the first 10 months of 1910, representing all of the large producers of that commonwealth except Wallaroo & Moonta, is given in the following table:

	Mount Morgan.	Mount Lyell.	Great Cobar.	Great Fitzroy.
Jan.....	1,317,120	1,386,560	1,200,000	.....
Feb.....	1,256,640	1,391,040	1,200,000	.....
March.....	1,216,320	1,729,280	1,254,400	.....
April.....	1,355,200	1,585,920	1,211,840	362,860
May.....	1,337,280	1,393,280	1,218,560	347,200
June.....	1,305,920	1,500,800	1,128,960	304,640
July.....	1,223,040	1,460,480	1,458,240	401,600
Aug.....	595,840	1,404,480	1,386,560	452,480
Sept.....	1,226,720	1,308,160	1,276,000	436,800
Oct.....	1,514,240	1,225,280	1,942,080	427,840
Totals..	12,248,320	14,385,280	13,276,640	2,733,360

The Cobar, Fitzroy and Lyell copper comes to the United States for refining.

The total production of copper in Australasia in 1909 was 34,953 metric tons, against 40,123 tons in 1908.

The Copper Market in 1910

During 1907-9 the world's consumption of copper lagged behind the production, and in consequence, stocks piled up until at the end of 1909 the visible supply amounted to about 386,000,000 lb. During 1910 the consumption overtook the production. Complete figures are not yet available, but we estimate that while the consumption increased about 10 per cent., the production increased less than 2 per cent. The visible supply at the end of 1910 has been decreased to about 307,000,000 lb., which is equivalent to a little over two months' supply.

In Europe the increased consumption has been due principally to the great activity in electrical branches. In the United States, owing chiefly to the dearth of capital, large enterprises could not be financed, and it is noteworthy that not-

withstanding their absence, the consumption in this country nevertheless increased and this presages a still further increase whenever these enterprises can be undertaken.

The consumption of copper in the United States was remarkably large in

AVERAGE PRICES OF COPPER.

	NEW YORK.				London.	
	Electrolytic		Lake.		1909.	1910.
	1909.	1910.	1909.	1910.		
January.....	13.893	13.620	14.280	13.870	61.198	60.923
February.....	12.949	13.332	13.295	13.719	57.688	59.388
March.....	12.387	13.255	12.826	13.586	56.231	59.214
April.....	12.561	12.733	12.933	13.091	57.363	57.288
May.....	12.893	12.550	13.238	12.885	59.338	56.313
June.....	13.214	12.404	13.548	12.798	59.627	55.310
July.....	12.880	12.215	13.363	12.570	58.556	54.194
August.....	13.007	12.490	13.296	12.715	59.393	55.733
September.....	12.870	12.379	13.210	12.668	59.021	55.207
October.....	12.700	12.553	13.030	12.788	57.551	56.722
November.....	13.125	12.742	13.354	12.914	58.917	57.634
December.....	13.298	12.581	13.647	12.863	59.906	56.069
Year.....	12.982	12.738	13.335	13.039	58.732	57.054

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

view of the general lagging of trade during 1910 and particularly the depression in the iron and steel business. It reflects a constantly increasing demand in the way of electrical conveniences, and in the building trade, and we can therefore look

with confidence for a large augmentation of the consumption as soon as bonds of public utility companies and of development enterprises can again be readily sold. As 1910 draws to an end it is hoped that these conditions are approaching, and while the market closes in a somewhat depressed state, the outlook for 1911 is encouraging, rather than the opposite. We have well in mind the certainty that during 1911 the production will experience a still further increase, due to shipments from the new Arizona properties, but unless there be a general recession in business, a further increase in copper consumption may be expected, and moreover, after the properties now under development are producing, there is no further large production in sight, so that in the long run we expect to find consumption again outstripping the production.

Throughout 1910 the market was dominated by the presence of large stocks, which encouraged the manufacturers to work with smaller supplies in their own yards than usual. While during the year at various times they replenished their supplies, when the market showed signs of advance, the year closed with less material in the hands of the manufacturers than they usually carry.

January opened with Lake copper at  $13\frac{3}{4}$  @  $14c.$ , and electrolytic at  $13\frac{3}{4}$  @  $13\frac{3}{4}$ . There had been a large buying movement during the fall of 1909, due principally to the rumors of a contemplated merger of some of the important American producers. As this did not materialize, buyers held off. As the improvement in business generally which had been expected was also not forthcoming, and as the security markets became very weak, the copper market relapsed into dullness. This continued till toward the end of February, when the large sellers met the situation by reducing the price to  $13\frac{1}{4}$  @  $\frac{3}{8}c.$ , and buyers' supplies being again depleted considerable business was done. The stocks of copper in the United States and Europe, which during December and January had declined, began to increase again and this acted as a damper on the buying movement. Speculative sentiment at London which had been quite optimistic during the fall and early winter changed, and the London standard market declined below the parity of the American market for electrolytic copper, so that the electrolytic copper in European warehouses began to move into consumers' hands. Considerable pressure to sell developed on this side, and at the end of March the price of electrolytic copper had declined to 13 cents.

While the European statistics for March showed a decrease of 6,000,000 lb., those of the United States showed an increase of over 16,000,000 lb., and there remained nothing for the producers to do but either to reduce their price

or curtail their production. The largest Lake producer adopted the former alternative; the electrolytic producers followed suit, and at about 13c. for Lake copper and  $12\frac{3}{4}c.$  for electrolytic some large transactions were made. Toward the end of April the market again turned weak, the demand having subsided. The price of electrolytic slumped steadily until it reached  $12\frac{3}{8}c.$  The European markets continued below the American market, and copper moved out of the warehouses abroad. Thus while stocks in the United States kept on increasing, those in Europe were decreasing.

Toward the middle of May the excellent consumption abroad began to make itself felt. The European buyers were encouraged to take hold more aggressively at the lower prices established, and considerable business ensued, the market advancing to  $12\frac{5}{8}$  @  $12\frac{3}{4}$ .

In June the market sagged back to  $12\frac{1}{4}c.$  There was a good volume of busi-

AVERAGE MONTHLY PRICES OF  
COPPER MANUFACTURES.  
(IN CENTS PER POUND.)

	1909.		1910.	
	Copper Wire.	Sheet Copper.	Copper Wire.	Sheet Copper.
Jan. ....	15.650	20.000	15.35	18.50
Feb. ....	15.0625	18.675	15.25	18.75
Mar. ....	14.3125	17.30	14.75	19.50
Apr. ....	14.250	16.50	14.75	19.50
May. ....	14.500	16.70	14.10	18.50
June. ....	15.000	17.00	14.19	18.50
July. ....	15.000	17.50	14.00	18.50
Aug. ....	15.000	17.50	14.00	18.50
Sept. ....	14.750	17.50	14.00	18.50
Oct. ....	14.500	17.50	14.00	18.50
Nov. ....	14.937	18.00	14.25	18.50
Dec. ....	15.250	18.50	14.25	18.50
Year. ....	14.851	17.72	14.41	18.69

ness. The leading interest remained out of the market, and the other sellers succeeded in disposing of their product. However, the buying was chiefly of the "hand to mouth" character. By the end of June, however, it looked as if the buyers would have to come to the views of the leading interest, as the others appeared to be pretty well sold out, and the demand persisted.

July opened with electrolytic at  $12\frac{1}{4}c.$ , but after the first week a weakish tendency developed following the action of the largest seller, which for the first time in many months met the market but was promptly undercut. Toward the middle of the month electrolytic was on the basis of  $12\frac{1}{8}c.$  On July 21, the indications as to a probable curtailment of production induced some buyers to come into the market and rather large transactions were consummated at a slight advance. The market improved decidedly in tone and the month closed at  $12\frac{3}{4}c.$ , firmly held.

During August manufacturers realized that the fundamental position of the metal was changing for the better. As a matter of fact, during this month the stocks in the United States decreased for the first time since January. The hand to

mouth policy, which they had pursued successfully for so long, was dropped and sales were made for delivery over the remainder of the year. At the close of the month business was done at  $12\frac{3}{4}c.$ , delivered, 30 days.

During September a considerable amount of scepticism prevailed as to whether the curtailment had really taken place, and buyers once more held aloof, but as producers' books were well filled there was no pressure from first hands. The market went off somewhat by offers from second hands and closed with electrolytic selling at 12.30 cents.

Early in October the publication of the figures of the Producers' Association for September, showing a decrease in stocks of 20,000,000 lb., had a decided effect upon the market both in this country and in Europe. Both sellers and speculators took hold largely and a good business resulted at better prices. The European consumers were the first to buy, and then the domestic manufacturers followed. At the end of the month a large quantity changed hands at  $12\frac{3}{4}$  @  $12\frac{3}{8}$  cents, delivered, 30 days.

During November and early December the market hovered around these figures, but buyers held aloof, and toward the end of December the price fell off to about  $12\frac{1}{2}c.$ , net, cash.

## Copper in Katanga

The report of the directors of Tanganyika Concessions at the beginning of December states that the greater part of the smelting plant for the Star of the Congo has now been shipped, and that the railway will shortly put that mine into communication with Beira. Smelting has continued steadily at Kansanshi, where there are now about 1500 tons of smelted copper awaiting transport. A further section of the Benguela railway—up to 323 km.—was completed in October, and a contract has been made for the continuation of the line. In order to finance this railway, arrangements have been made with the Zambesia Exploring Company—which at the date of the report had advanced some £213,000—for a further advance of £100,000. It is expected that smelting will be begun at the Star of the Congo mine before the end of 1911.

## Copper Sulphate

Returns from all of the concerns making copper sulphate as a by-product show an output of 26,356,788 lb. in 1910. We estimated a make of 45,000,000 lb. in 1909. The production in 1908, according to returns, was 37,654,961 lb. The decline in the output of copper sulphate in 1910 is due to improvements in the metallurgical practice of some of the refiners enabling them to avoid making this undesired by-product, which is less profitable than recovery of metallic copper.



# The Mines of Butte in 1910

By B. B. Thayer \*

Notwithstanding the fact that the output of the Butte camp for the year 1910 was curtailed to a certain extent, development work throughout that period was pushed with the usual vigor, and with most gratifying results to the operating companies.

It is doubtful if there is another well founded copper district in the country where the copper-bearing boundaries have been extended laterally from year to year to such an extent as has been the case in the Butte district.

Twenty-five years ago the operators were inclined to think that the great copper zone was confined to a certain area extending from the Colusa on the east, with the Anaconda and Parrot mines in the central district, to the Gagnon on the west. Some years later a group of claims, known as the Chambers Syndicate, was purchased and developed, and afterward became the so called "Northern" properties of the Anaconda Copper Mining Company.

For years afterward it was felt that this was practically the northern limit of the copper zone, and that the country to the

north of this area would prove to be absolutely a silver district, and developments up to that time seemed to warrant the belief; but in later years, the development of a great mining property well north of the area mentioned, and distinctly within the so-called silver zone, exploded the old surmise, and further developments during the year 1910 by the Anaconda Copper Mining Company, and also by W. A. Clark and others, made it more evident that the northern, eastern and western limits of the copper-bearing veins still remain to be determined.

Large orebodies have been encountered at depth in the mines of Butte, during the year 1910, and the discoveries have not been confined to any one particular portion of the district. The most gratifying feature of the developments mentioned is in the fact that the orebodies encountered have been found on the deepest levels of the mines, and that the grade of the ore has been far superior to that which occurred in many of the upper levels. In many instances no knowledge of the existence of these orebodies was gained by the workings on the upper levels, as in some cases the

orebodies occur in apparently disconnected masses, while in others they appear in vein form in fissures which were known to be barren nearer the surface. The orebodies give every indication of extending to great depth.

For many years the fact that zinc existed in the Butte ores was well known, but it was treated as an unfortunate occurrence, and looked upon simply as an undesirable element in smelting operations.

A great deal of attention, however, has been paid to the development of zinc within the last two years, especially so during the year 1910, and operations have passed from the experimental stage to that of absolute production upon a fairly large scale. Large bodies of zinc ore have been found at a number of points in the Butte district, and while the reduction process, so far as concentration is concerned, has not been absolutely satisfactory, improvements in methods are constantly being made, and the opinion is freely expressed that the Butte district will within the next few years become as prominent a factor in the production of zinc as it has in the copper industry.

\*President, Anaconda Copper Mining Company, 42 Broadway, New York.

## The Miami Copper Mine and Mill

By J. Parke Channing \*

The year 1910 was devoted to getting the Miami property in shape for production, and it is expected that the mill will be ready to operate in the early part of 1911. The underground work was confined entirely to operations above the 420-ft. or main-extraction level. The ground was cut up into rectangles 50x100 ft., and sub-drifts have been run every 25 ft. Up to the first of December the total underground work on the property was as follows: Shafts, 2,062 ft.; drifts, 63,842 ft.; raises, 10,976 ft.; total, 76,880 ft. There are 250,000 tons of ore on the stock pile.

### TWO MOUNTAIN-SHAPED OREBODIES

The No. 2, or Red Rock shaft, which was the original discovery shaft, came down in a mountain-shaped body of ore, which gradually increased its area as depth was attained. Developments on

the 370-ft. level showed that the ore at this level extended further north than was shown in the original work, and this resulted in the discovery and development of a second mountain of ore lying to the north and extending up almost to the same height as the original mass. As this body of ore must be removed first, it necessitated considerable additional underground work in thoroughly blocking it out.

No particular attempts were made during the year to block out additional tonnage, though two drills were kept at work systematically on day shift only, so as to make the results as reliable as possible, and a total of 29 holes were drilled. A drift was run out to the Captain claim that encountered the ore struck in the first 10 holes driven on that particular part of the property, but nothing was done toward blocking out this particular ground, as it is not needed for the present.

### NEW OREBODY SHOWN BY DRILL HOLES

Nineteen more holes were drilled, mostly to the north of the present ore deposit, and out of these six showed no ore, while the other 12 showed ore of varying thickness and grade. It seems quite likely that this ore will in time be found to be connected with the present main orebody, when drifts are extended to it and it is systematically opened up as has been the main body. It is perhaps a little early to determine accurately the amount of ore indicated by this drilling, but it certainly will amount to several million tons over and above that previously reported in the main orebody, which on Jan. 1, 1910, was estimated at 15,500,000 tons.

### SIX UNITS OF THE MILL ERECTED AND MACHINERY INSTALLED

While foundations for nine units of the mill have been completed, only six units have been erected and machinery installed. In two of the sections the fine-

\*Consulting engineer and vice-president of Miami Copper Company, 42 Broadway, New York.

crushing machinery was temporarily left out until the results obtained from the Burch fine-crushing rolls were determined. Three of the sections are provided with chile mills, and one section with these fine-crushing rolls. Should the results in the first two months' run be satisfactory, rolls will be added to the remaining two sections. Should, however, the results not be superior to the chile mills, then chile mills will be added.

The power plant undoubtedly will be the most economical in the southwest, and there have already been installed three 600-h.p. boilers, two 1250-k.w. alternating-current generators, each operated by a Nordberg four-cylinder triple-expansion engine, and also one 4000-ft., two-stage, four-cylinder, triple-expansion Nordberg

compressor. Foundations are in for a fourth boiler, a third generating set and a second air compressor.

The two hoists at the main shaft of the mine are installed, both are geared, and will be driven by re-heated compressed air. The main, or ore hoist, will handle 7½-ton skips, and the total capacity of the shaft will be 2000 tons of ore per eight-hour shift. The main hoisting engine will be given over exclusively to the handling of ore by self-dumping skips from a 1000-ton underground pocket. The second hoist will be used entirely for men, timber and supplies.

#### WATER SUPPLY

A pumping plant consisting of two Nordberg flywheel pumps has been installed at the McLane ranch, distant four

miles from the mill, and these pumps run by synchronous motors, will furnish the mill and power plant with a proper supply of water. The discharge flume from the Old Dominion mine has been extended by a 14-in. wooden pipe to the McLane ranch, and will be the main source of water. Developments on the McLane ranch, however, proved three wells, each of a capacity of 500,000 gal. per 24 hours, so that an ample supply of water is assured.

The methods of mining and milling adopted at this property are all with the idea of making as large a saving of ore and copper as is consistent with a fair cost of producing copper, keeping in view the fact that the conservation of the mineral resources of the company is as important to it as it is to the State.

## Copper in Arizona in 1910

By James Douglas \*

The copper trade in Arizona and northern Sonora was unchecked in 1910. The only incident of importance was the closing of the Imperial smeltery. The company followed the mistaken policy of not keeping its development work ahead of its stopes, with the inevitable results. It is doing some interesting exploration on adjacent porphyry claims.

In the Warren district the most notable

In the Clifton district there were no changes in the operations of the present companies and no great change in the production. The old copper-mining company, originally known as the Copper King, and reorganized as the New England & Clifton Copper Company, again failed to make a financial success, but its production was never large enough to affect notably the grand total.

as depth is gained. The large concentrator of the Ray Consolidated, at Winkelman, is approaching completion. It is understood that its concentrates will be smelted in El Paso by the American Smelting and Refining Company, to which also the concentrates from the porphyry ores of the Chino, in New Mexico, will be entrusted. Their addition will tell upon next year's figures of production.

#### COPPER PRODUCTION IN ARIZONA, 1910.

	Pounds.
Douglas smeltery*.....	93,926,240
Calumet & Arizona.....	53,615,000
Detroit Copper Mining Company.....	22,826,725
Arizona Copper Company.....	33,158,000
Shannon Copper Company.....	18,000,000
Old Dominion Copper Company.....	28,222,666
Total.....	249,758,631
Moctezuma Copper Company (Mex.).....	22,556,754
Cananea Copper Company (Mex.).....	46,395,232

\* This includes the Copper Queen and custom ore, but does not include shipments from the Moctezuma Company at Naco. In all cases the December output is estimated.

incident has been the negotiating for the amalgamation of the properties of the Calumet & Arizona Mining Company and the Superior & Pittsburg Company, which, if consummated, will give the new company a vast territory with great possible resources under a unified management.

To the dividend-paying mines was added the Shattuck & Arizona, which company, however, continues to ship its ore, for reduction, to the Douglas smeltery, of the Copper Queen company. The same good feeling, looking to helpful cooperation, prevailed among the different companies near Bisbee.

\*President, Phelps, Dodge & Co., Inc., 99 John street, New York.

#### GLOBE APPROACHING LARGE PRODUCTION

Globe is approaching the time when the first of the low-grade mines will commence making good its promises. The Miami mill will start early in 1911, and ship the concentrates to Cananea for reduction. The neighboring properties, especially the Inspiration, have continued exposing more millions of tons of copper-bearing schist. The Black Warrior was a producer, and is said to be opening up well. On the east of Pinal creek, the Old Dominion company developed its mines in depth, both east and west, with encouraging results in places, but exercising "hope deferred" in others. The reserves of the Old Dominion mine and its ally, the United Globe mines, are, however, greatly in excess of what they were in 1909, but the facilities for economical mining and extraction are not sufficiently advanced to warrant expectation of a much larger production than at present.

The Arizona Commercial Company and the Superior & Boston Company are still in the development stage. The Saddle Mountain mines, on the Gila, now under the control of the Development Company of America, are said to be encouraging

None of the old smelting works are making provision for increased output. Improvement was made in the Calumet & Arizona smeltery, at Douglas, and the Copper Queen company made plans and preparations for a reverberatory addition to its Douglas plant. This is with the view of handling more economically the large volume of concentrates from Naco, which decrease in copper contents as the grade of the ore declines, but increase in the percentage of iron and sulphur contents.

#### MODIFICATION OF SMELTING METHODS LIKELY AT CLIFTON

The decline, in the Clifton district, of first-class lump ore and its replacement with richer concentrates point to a modification of smelting methods, and the replacement of the cupola by the reverberatory; but none of the three companies who reduce their own ores have yet made plans looking to an immediate change.

At Cananea, likewise, the extension of the smelting plant is in the direction of reverberatory in preference to cupola smelting. The estimated 1910 production in the districts above referred to is given in the accompanying table.



# Developments at Cananea in 1910

By L. D. Ricketts \*

The accompanying sketch shows the relative position of the various mines of the Cananea Consolidated Copper Company and allied interests. It will be seen that these mines extend through a territory seven miles long by about two miles wide. Geologically this strip cannot be strictly called a single zone although there are many large croppings as yet unexplored between some of the developed mines.

The development work of the Cananea Consolidated Company for 1910 was as follows: Drifts, 45,160 ft.; shafts, 1949 ft.; raises and winzes, 9583 ft.; total, 56,692 feet.

### PRODUCTION

The mines produced the following tonnages of dry ore: Puertocitos, 26,279 tons; Henrietta, 26,290; Elisa, 57,261;

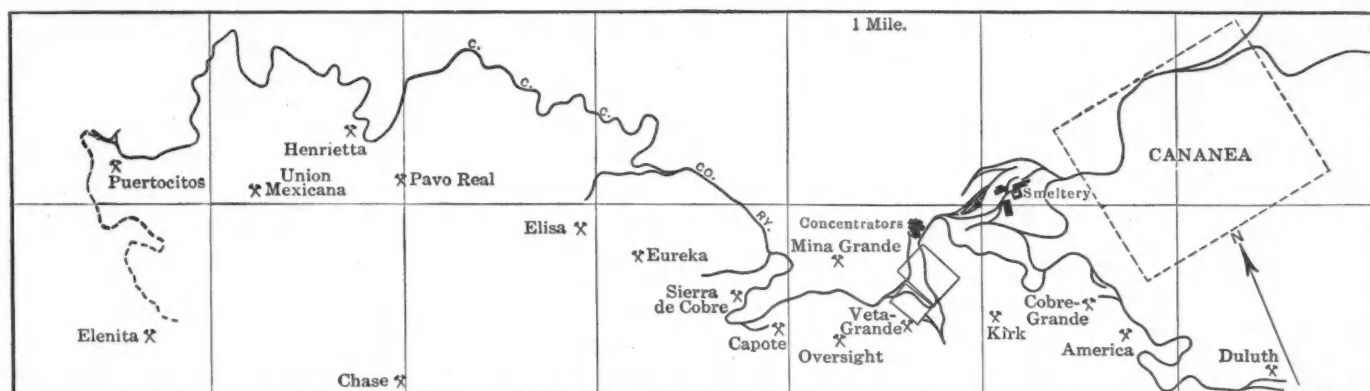
output of each mine, and accordingly during the latter half of 1910 the Puertocitos, Henrietta, Veta Grande and America mines were closed.

The total reduction-division costs, per dry ton of ore and concentrate treated, at Cananea, have fallen yearly for the last four years. In 1907 the cost was \$6.82, and during 1910 it was \$2.62. This reduction in cost will continue and the company expects to smelt in 1911 for about \$2.25 per ton. These costs permit direct smelting of material that previously had to be concentrated or left in the ground as waste.

It has long been known that the large limestone areas contained copper, but with the single exception of the ores of the Elisa mine, the value has been too low to make the material ore, but now the company can treat such material

traced during the year and is of better grade, but owing to the irregular form of the lenticular deposits of this mine it would be difficult to say just what tonnage has been opened.

In the Sierra de Cobre property, mining followed in the old workings on Eureka hill, and the ore given above has come chiefly from this mine. The ore-shoot was developed a vertical distance of 240 ft. below the stopes and the grade is maintained on the bottom level in a satisfactory way. The most interesting development on this property is from the Combination tunnel, which passes from Capote basin to the Elisa mine. Here two raises have penetrated a flat body of ore that appears to be 50 ft. thick. Developments are encouraging, but have not proceeded far enough to state how large the orebody is. The ore so far



SKETCH MAP SHOWING MINES AND RAILROAD OF CANANEA CONSOLIDATED COPPER COMPANY

Sierra de Cobre, 66,841; Capote, 22,428; Oversight, 362,380; Veta Grande, 109,157; Kirk, 102,701; Cobre Grande, 13,221; America, 28,576; Cananea-Duluth, 161,936; total, 977,070 tons.

Of the above total tonnage 332,060 dry tons went direct to the reduction works, and 645,010 dry tons to the concentrators. The latter produced 182,217 tons of concentrates. The bullion yield was as follows: fine copper, 46,395,232 lb.; silver, 1,173,321 oz.; gold, 5609 ounces.

Both the tonnage and the yield would have been higher, but about the middle of 1910 production was notably decreased. To meet the reduced output and to preserve costs it was decided to close down mines instead of reducing the

profitably, and during 1910 a large amount of the development work was in the limestone.

About the first of the year the Cananea Consolidated Copper Company and associated companies purchased the property of the Indiana-Sonora Copper and Mining Company. The chief asset of this company consisted of about 396 acres of mining ground entirely surrounded by the property of the Cananea Consolidated Copper Company. It also owned about 2267 acres of undeveloped mining land southeast of Cananea, which are of doubtful value.

### IMPORTANT DEVELOPMENTS

Briefly the important developments are as follows: In the Elisa mine satisfactory development has been made on the fifth level, which is 140 ft. higher than the Combination tunnel. No development of moment has as yet been made on the sixth level. The known ore developed far exceeds the tonnage ex-

taken out in development has averaged about 4 per cent. copper.

The Capote mine produced little ore during 1910. At present it is being opened on the 10th and seventh levels and above. Some copper glance was found on the 10th level but as yet not in notable quantity. Valuable ore is known to lie under the seventh level and this will be developed later. In the old orebody a notable tonnage of smelting ore with some concentrating ore was opened between the sixth and fifth levels, but until 1911 no production of moment from this mine will be made.

### DEVELOPMENT IN PORPHYRY ORE

The most important developments in the porphyry ore were in the Oversight mine, where there was opened an area of concentrating ore, several acres in extent, in the vicinity of the deepest extraction tunnel. The Oversight zone has also been opened a considerable distance to the northwest and an orebody about 70 ft.

\*General manager, Cananea Consolidated Copper Company, Cananea, Mexico.

The tonnage and production figures and all statistics in this article are close estimates, subject to revision for the month of December. They are also subject to revision on account of stocks on hand Jan. 1, 1910, and Dec. 31, 1910.

wide and several hundred feet in length has been found which is estimated as containing approximately  $3\frac{1}{2}$  per cent. copper. As the company is in no need of concentrating ore, development in this body has ceased for the present and no extraction is being made from it.

A small amount of work was done during 1910 in the Sierra de Cobre property adjoining the Oversight, and one drift has passed through 32 ft. of an excellent grade of concentrating ore. No attempt was made to develop this class of ore.

#### IMPORTANT DEVELOPMENT AT THE KIRK MINE

Possibly the most important development made during 1910 was in the Kirk mine, where was found a zone of altered limestone, dipping at about 30 deg. and

extending from near the surface to below the third level of shaft No. 12. As far as developed it appears to be about 750 ft. in length, from 150 to 200 ft. in width, and from 60 to 70 ft. in thickness. While there is a great deal of coarse material that will have to be thrown out in mining it would appear that this bed can be mined to a grade of over 3 per cent. copper, with approximately 2 oz. in silver and about \$0.30 in gold. It is self-fluxing and a desirable ore.

During the latter part of 1910 development was resumed in the Cobre Grande mine, and a notable tonnage of ore containing from 3 to 6 per cent. copper is being developed. This ore contains from 70 to 75 per cent. silica and alumina combined, and is used for converter lining. The use of this material has reduced the acid contents of the converter slag from

38 to about 27 per cent., and has, therefore, made the slag much more desirable as a flux.

On the Cananea-Duluth the developments were satisfactory on the fourth level. The shaft passed through valuable ore between the fifth and sixth levels but no development has been done on the fifth and crosscutting on the sixth has not proceeded far enough to determine the importance of the ore found.

In closing it may be said that during 1910 the developments at Cananea were exceedingly satisfactory and a far larger tonnage of ore was developed than was extracted. I do not care to give an estimate of the tonnage opened on account of the irregularity of the orebodies and on account of the fact that development is not done with a view of estimating ore reserves.

## Lake Superior Copper District

By Carl L. C. Fichtel \*

During 1910 the mines of the Lake Superior copper district were operated under normal conditions with one or two exceptions, where advantage of the metal market was taken to make needed repairs and alterations which would result in more efficient and economical handling of the product. As a result a slight curtailment will be noted at these properties.

#### KEWEENAW COUNTY

Diamond drilling was done on the Clark property, which occupies a position near the extreme end of the Keweenaw peninsula. The Keweenaw Copper Company did some drilling from the bottom of its Medora shaft during the summer months. Both the Calumet conglomerate and the Osceola amygdaloid lodes were penetrated at depth, but the cores did not show copper in commercial quantities. Later this shaft was allowed to fill with water. The shaft on the Kearsarge lode was put down several hundred feet, but the lode was not sufficiently opened to determine its mineralization. Several drill cores were taken from the Ashbed lode of the Phoenix property showing it to be about 40 ft. wide and well charged with copper.

The Cliff property was acquired by a new company, controlled by the Calumet & Hecla, and an exploratory shaft started on the Kearsarge lode near the northern boundary of the Ojibway. Sinking was resumed in both shafts of the Ojibway below the 1250-ft. level. Good results were obtained by the drifts from the 500-, 650- and 800-ft. levels in both shafts. This property has opened a large amount of ground and should be in a po-

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

sition to begin milling operations during 1911.

The Seneca property continued sinking and at a depth of 920 ft. the lode was encountered and found uniform and well charged with copper. Developments about this point were disappointing. The Gratiot company, under the management of the Calumet & Hecla, entered the producing list, shipping its rock to the Alouez-Centennial mill. Rock shipments were made from the two stock piles at Shaft No. 1, which was put down below the 17th level. Operations at Shaft No. 2 were suspended the greater part of the year.

The Mohawk operated under about normal conditions throughout the year with the lower levels of its northern shafts showing an improved mineral yield. Shaft No. 6, started a little over a year ago, was put down below the third level, which corresponds with the sixth level of the main workings, and the lateral openings showed average copper bearing ground. An agreement was made by this and the Ahmeek company relative to the boundary lines whereby both companies benefited.

Shafts No. 3 and 4 of the Ahmeek company were put down during the year and the curve was put in to conform to the pitch of the formation as the shafts neared the Kearsarge lode. Two heads of this company's new mill went into commission. The two shafts of the Alouez company were opened extensively and a large reserve of high-grade ground blocked out, so that production can be increased materially when conditions warrant. At the stamp mill, owned jointly by this and the Centennial company, the sixth head went into commission.

#### HOUGHTON COUNTY—CALUMET & HECLA

The Wolverine began shaft sinking on the Osceola amygdaloid lode after a series of drill cores had been obtained. The Centennial company confined its operations to the extension of lateral openings from the lower level of its two shafts which are bottomed at the 35th level. Drifts were extended toward the Wolverine and Kearsarge zone where bunches of rich ground were found.

All of the shafts on the conglomerate lode of the Calumet & Hecla mine were operated throughout the year, with the exception of No. 12. At the Red Jacket shaft new guides were installed in the two hoisting compartments and alterations were made to the shaft house which required about six weeks to complete and caused a reduction of about 900 tons in daily production, during that time. On the Osceola lode six shafts were operated and one on the Kearsarge. This company also carried on drill explorations on the St. Louis tract. A large addition was built to its machine shop and additional machinery installed in the foundry. At the stamp mills all the conglomerate rock from this and subsidiary companies was treated, the amygdaloid rock going to the Osceola and Tamarack mills. At the smelting plant, the erection of a new furnace building was started. The sale of the Cliff lands wiped out the standing indebtedness of the Tamarack company, and the treating of the conglomerate rock at the main mills of the Calumet & Hecla company gave a much better mineral yield per pound of rock stamped.

[The directors of the Calumet & Hecla Mining Company announced on Jan. 3, 1911, a plan of consolidation of the affiliated companies.—EDITOR.]



## HOUGHTON COUNTY—OTHER COMPANIES

Operations at Shafts No. 5 and 6 of the Osceola Consolidated Company were suspended during March and repair work continued the remainder of the year. Shaft No. 3 of the Kearsarge branch was overhauled and alterations were made to the rock house. Shaft No. 3 on the main mine was equipped with electrically operated pumps to handle the mine water. The Laurium Mining Company sunk its shaft to a depth of about 1150 ft. and drifting from the various levels showed a good grade of rock. A site for the second shaft was staked out, but nothing further done. Shipments to the Allouez-Centennial mill were started by the LaSalle. Results from the Tecumseh tract were encouraging, but operations were suspended on the Caldwell tract. A large amount of drilling was done at the south end of the property without warranting further development.

Franklin centered its activities on the Pewabic lode. Shafts No. 1 and 3 were sunk deeper and good ground was opened at depth. A search was made to locate the Hancock series of lodes without results. The Quincy company purchased 800 acres of land from the St. Mary's Mineral Land company, which will enable it to sink Shafts No. 2 and 8 to a greater depth. This company installed a low-pressure steam turbine, operated by the exhaust steam from one of the hoisting engines, to generate its electric power. This is the first installation of the kind in the district and promises to be the forerunner of numerous other similar installations. The Hancock company sunk its vertical shaft to a depth of about 2700 ft., cutting the series of Hancock lodes.

About normal conditions prevailed at the Champion and Baltic properties of the Copper Range Consolidated and improvement was noted in the lower workings of the Trimountain shafts. The Contact Copper company was organized under Michigan laws and acquired the lands and effects of the Elm River company and secured options on several hundred acres of adjoining land. Exploration work was started.

## ONTONAGON COUNTY

At the various properties in Ontonagon county a systematic search was carried on for copper ground and promising results were obtained by the North and South Lake, Indiana, Cherokee, Algomah and Bohemia companies. The Indiana encountered in its No. 2 drill hole, at a depth of about 1450 ft., a copper-bearing felsite formation, about 40 ft. thick.

South Lake encountered a series of three copper-bearing lodes and started clearing a shaft site. At the Algomah, a shaft was put down on an outcropping of copper ore and for a distance of 104 ft., at which point the first level was started, the ore continued with undiminished richness. The Lake company

passed into the hands of a new management, headed by W. A. Paine as president. The shaft was put down below the eighth level and a crosscut was driven to the lode on the seventh level. Drifts, from the levels above, opened a good grade of stamp rock with an occasional lean streak.

Shaft C of the Mass company succeeded in opening good ground on the Butler lode from the 4th to 8th levels, inclusive, and as a result the unwatering of Shaft B, which has been bottomed for a number of years at the 18th level, was started so that this lode could be opened at greater depths. Elton W. Walker was appointed superintendent.

The Michigan company carried on exploratory work. The Adventure's vertical shaft was put down about 1000 ft. The Victoria did much development work, tributary to the 22d level of its main shaft, with good results.

## Operations of the Tennessee Copper Company in 1910

By N. H. EMMONS\*

There were treated in 1910 at the smeltery of the Tennessee Copper Company 452,500 tons of ore, of which about 30,500 was custom ore; 16,900,000 lb. of copper was produced from this ore. The mines produced their usual tonnage, with the exception of London mine, at which the new shaft house was not completed until about Oct. 1, when mining operations were resumed.

Back stoping was gradually introduced, in place of the usual underhand method in use since the mines were opened. In the Burra Burra mine a filling system was inaugurated to recover the back of the first level. The diamond-drill work, completed in 1910, at the Eureka mine indicated an orebody of greater magnitude than any so far developed in the basin, but the copper content is lower than in the other mines. This, however, is compensated for by the high sulphur which will make the ore as valuable as that of the others.

## SMELTERY IMPROVEMENTS

At the smeltery a bedding plant, with two beds for ore and two for first matte, was installed, together with a sampling mill for sampling all material going to the beds. A new 400-k.w. generator was installed and two 512-h.p. Altman & Taylor boilers put in place of the four old National water-tube boilers that have been in constant use for 10 years. This gave the smelter power plant four large boilers.

A departure was made at the smeltery when the settlers were lined with silicious copper ore, instead of brick. The first

one of these, lined in June, is still in good condition. The improved tops for the furnaces, particularly the new cast-iron and brick top, proved the correct type and three furnaces were equipped with the new top and a fourth is being built.

Between the smeltery and acid plant, the new dust chamber proved a great benefit, cleaning the gases of dust and doing away with the violent fluctuations of temperature and strength of gas so noticeable under the old system. Gas was turned into this chamber and the new Glover towers the latter part of June when the first part of the remodeled sulphuric acid plant was started.

## NEW ACID PLANT THE LARGEST IN THE WORLD

The sulphuric acid plant was completely remodeled and a second unit, larger than the first, completed and put in operation. The last four chambers completed were started Dec. 6, 1910, and the plant now consists of the following: Two Glover towers, octagonal, 30 ft. across, 50 ft. high; one flue from the Glover towers to the cooling chambers, 10x20x120 ft.; sixty-four cooling chambers, 10 ft. 10 in. x 10 ft. 10 in. x 70 ft. high; eight cooling chambers, 10 ft. 10 in. x 24 ft. x 70 ft. high; four lead-lined fans, each with a capacity of 67,000 cu. ft. of gas per min.; twelve old chambers, 50x50x70 ft. high; six new chambers, 50x50x75 ft. high; eight new chambers, 23x50x80 ft. high; four old Gay-Lussac towers, 23x23x50 ft. high; four new Gay-Lussac towers, octagonal 19 ft. across, 70 ft. high. This, with the necessary coolers, pumping apparatus and 15 iron storage tanks with a total capacity of 15,000 tons of acid, comprises by far the largest plant for acid making in the world.

## ACID PRODUCTION NOW 14,000 TONS PER MONTH

The production of the plant at the end of the year was at the rate of 14,000 tons of 60-deg. sulphuric acid per month, which will be increased as soon as the two new Gay-Lussac towers, now under construction, are put in use. These new towers are to be 36 ft. across, octagonal, and 65 ft. high and should be completed in February, 1911.

The result of the year's work showed that the object for which the acid plants were installed was attained, namely, the consumption of smoke that damaged the timber and farming interests in the vicinity. This fact was clearly demonstrated by the success attending the venture in farming made by the Tennessee Copper Company on some of its adjoining lands. The year 1911 gives promise of being a banner year for this company on account of the completion of the many expensive improvements in 1910.

\*General manager, Tennessee Copper Company, Copperhill, Tenn.

<sup>1</sup>Bull. A. I. M. E., Nov., 1910.

# The Tin Industry in 1910

Tin mining in the United States in 1910 continued to be about as inconsequential as in previous years. The only really noteworthy feature was the serious attempt to develop an industry, both in Texas and in South Dakota. In Texas a company under the management of Walter E. Koch, a well known mining engineer, continued the development of a mine at Camp Florella, near El Paso, and erected a mill and a smelting furnace. In December a few tons of pig tin were produced and shipped to New York, and our latest information is that the plant is running regularly. Further information about the enterprise will be found in the article on the mining industry of Texas, elsewhere in this issue.

In the southern Black Hills of South Dakota, the Pahasa Mining Company, which succeeded the old Harney Peak Tin Company, was engaged in the opening and unwatering of old shafts, clearing out tunnels, sampling, and in a general way studying its properties under the guidance of Dr. A. R. Ledoux. Matters have not yet reached the point of determining the next step. In the northern Black Hills some interesting developments were made by the Tinton Tin Company.

## The Tin Market in 1910

The domestic market, which is more or less dominated by the transactions on the London Metal Exchange, has naturally followed closely the fluctuations of the quotations made in London, at least so far as Straits tin is concerned. American consumers were entirely at the mercy of the London syndicates representing the bull and bear parties and, as the bull party most of the time had the upper hand, were forced to pay top prices. This was especially so where spot material was concerned, which at all times was closely held, and for which heavy premiums over the import price were asked. Under these circumstances, importations of so called impure tin produced in England, China, Bolivia, etc., were quickly taken advantage of in a good many quarters to replace Straits tin, which had heretofore been consumed exclusively. This tin was sold at a considerable discount from the price of Straits tin, and while its quality is inferior, nevertheless it answered the purpose for which it was wanted. Naturally, those consumers will continue the use of impure tin so long as they can get it at a discount, and this may have a considerable bearing on the import of Straits tin in the future.

The year opened with a very weak mar-

ket in London, where heavy transactions were consummated at constantly declining prices. The lowest point reached by the metal in this market was 32½c. per lb. Subsequently considerable purchases were made in the London market on the part of the largest consumers in this country, with the result that prices improved somewhat and remained on the basis of about 32¾c. per lb. until the middle of February. Then there was a vigorous advance in London, and while American consumers were not inclined to follow the same in making their purchases for future delivery, their necessary requirements for spot material had to be covered at about 33¼c. per pound.

At the beginning of March the market again became lifeless and weaker, and when toward the middle of March the London quotations declined considerably,

TIN AT NEW YORK

Month.	1909.	1910.	Month.	1909.	1910.
January	28,060	32,700	July	29,125	32,695
February	28,290	32,920	August	29,966	33,972
March	28,727	32,403	September	30,293	34,982
April	29,445	32,976	October	30,475	36,190
May	29,225	33,125	November	30,859	36,547
June	29,322	32,769	December	32,913	38,199
			Av. Year..	29,725	34,123

Prices are in cents per pound.

prices in this market were marked down to 31¾c. per lb. The end of March and beginning of April again witnessed an advance in the London market, which was helped to a large extent by the very favorable statistics for March, and prices advanced gradually to 33¼c. per lb. From this level prices declined until they stood at 32¾c. per lb. at the middle of April. At the lower prices a good deal of interest was evinced by American dealers and consumers, who placed large orders in London with a result that the market over there became very firm again, so that the month closed with tin at 32¾ to 33c. per pound.

In May prices moved between 32½ and 33¾c. per lb., while during June it was somewhat lower, closing at about 32½c. per pound.

In July the market became dull and uninteresting. Transactions at the London Metal Exchange broke the record so far as their smallness was concerned. The lowest point touched was 32c. per lb., but at the close the market was somewhat firmer at 32½c. per pound.

In August an advance of the spot quotation over the future quotation in London disclosed the fact that spot supplies were cornered not only abroad, but also in this market, where the representatives of the larger London interests had bought up all the spot supplies. The result was a con-

siderable advance and at the end of the month tin for September delivery was quoted at about 34¼c. per lb. The first half of September developed a rampant speculation in the London market, especially in spot tin, which advanced by leaps and bounds, and within a few days showed an increase of £8 over the price of three months' tin. The middle of the month, however, the corner seemed to have collapsed and quotations quickly broke £9 from the highest point reached in spot tin, while three months' tin only declined to the extent of £2 5s. The reasons given for this reversal were very heavy shipments from the Straits and the impending Banka sale. The effect in this market of this speculation for the rise and its subsequent collapse was a decline from the highest quotation of 36½c. to 34¼c. per lb. At the end of the month prices had become a little better and were marked at 35c. per pound.

In October a corner in spot tin was again instituted and prices advanced gradually to 37½c. for spot and 37¼c. for October tin by the middle of the month, but larger offerings from the East brought about a decline to 36¼c. at the end of the month.

At the beginning of the month of November the price stood at 36¾c. It went as low as 36¼c. during the first half of the month, but closed firm at 36¾c. per pound.

December witnessed a further advance in prices. At the beginning of the month quotations stood at 37¼c. per lb. and advanced gradually to 38½c. per lb. by the middle of the month. There were some small variations later, but the price stood at 38½c. at the close.

## Tin Output of Malaya

(As reported by *The Mining Journal*.)

	1910, Pikuls.	1909.† Pikuls.	1908.‡ Pikuls.
January	66,277	73,612	92,983
February	64,199	46,352	62,831
March	46,850	61,100	66,402
April	60,020	65,126	62,495
May	61,935	63,131	61,632
June	62,180	75,890	67,739
July	65,350	68,627	76,708
August	70,639	73,560	70,083
September	56,324	68,827	64,804
October	55,498†	68,316	76,082
November	56,935†	73,190	74,848
December	.....	81,156	77,412
Totals	666,107	818,887	854,019

The above figures show the monthly exports of tin and tin ore (the latter being stated at its assumed metal content) upon which duty is paid to the F.M.S. Government. One ton (2240 lb.) = 16.8 pikuls.

†Exclusive of Pahang.

‡Finally revised figures.



# The Production of Lead in 1910

The production of lead in the United States in 1910 is reported in the accompanying table, the statistics of which are based upon reports from all of the refiners. Owing to a possible duplication, that one producer is unable to determine at this time, the total of domestic desilverized may be a little too high. The totals include not only the lead refined from base bullion, but also that derived from the scrap and junk, comparatively small in quantity, that the refiners work up along with their primary material. At the present time it is impossible to make any distribution of the production, according to the State of or-

IMPORTS AND EXPORTS OF LEAD.  
(In tons of 2000 lb.)

Imports:	1909.	1910.
In ore.....	111,105	47,000
In base bullion.....	3,576	57,500
Refined.....	114,681	3,700
Total.....	114,681	108,200

Exports:  
In ore and bullion..... 86,077 72,350

concerned. The only possible explanation is that they were operating on charges higher in lead than formerly.

As to consumption and stocks, no precise data are available, this being where

## PRODUCTION OF REFINED LEAD IN THE UNITED STATES.

(IN TONS OF 2000 LB.)

Class.	1909.	1910.
Desilverized.....	211,499	220,918
Antimonial (a).....	12,730	14,146
Southeast Missouri (b).....	126,784	146,056
Southwest Missouri.....	20,489	20,404
Total domestic.....	371,502	401,524
Total foreign.....	89,681	90,597
Grand total.....	461,183	492,121

(a) Includes all of the antimonial lead, without attempt at classification between domestic and foreign. (b) Includes the total production of works in southern Illinois.

the mystery centers. At the beginning of 1910 there was a large stock. During the first half of the year this was unquestionably reduced to some extent. A few weeks ago it was given out that the accumulation of the American Smelting and Refining Company had come down to practically nothing. If it were true that the total stock of domestic lead had been reduced to a low figure there would

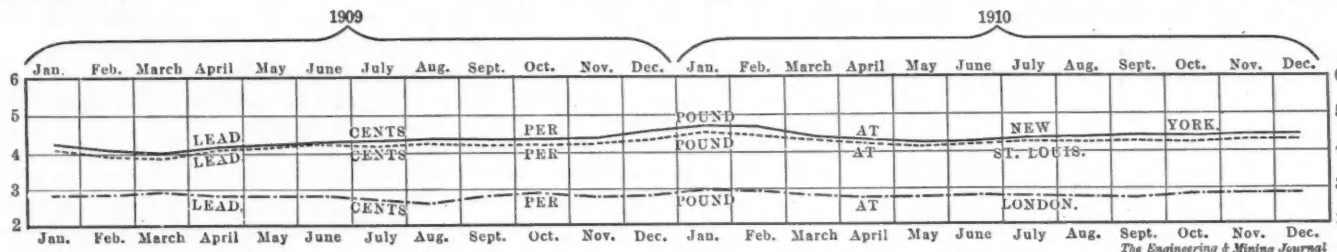
that the lead market is apt to be a quiet affair. It is commonly the case that a large business may be in progress without any surface indications whatever. The year just elapsed was no exception.

## AVERAGE PRICE OF LEAD.

Month.	New York.		St. Louis.		London.	
	1909.	1910.	1909.	1910.	1909.	1910.
January.....	4.175	4.700	4.025	4.582	13.113	13.650
February.....	4.018	4.613	3.868	4.445	13.313	13.328
March.....	3.986	4.459	3.835	4.307	13.438	13.063
April.....	4.168	4.376	4.051	4.225	13.297	12.641
May.....	4.287	4.315	4.214	4.164	13.225	12.550
June.....	4.350	4.343	4.291	4.207	13.031	12.688
July.....	4.321	4.404	4.188	4.291	12.563	12.531
August.....	4.363	4.400	4.227	4.290	12.475	12.513
September.....	4.342	4.400	4.215	4.289	12.781	12.582
October.....	4.341	4.400	4.215	4.271	13.175	13.091
November.....	4.370	4.442	4.252	4.314	13.047	13.217
December.....	4.560	4.500	4.459	4.363	13.125	13.197
Year.....	4.273	4.446	4.153	4.312	13.049	12.920

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

January opened with lead selling at New York at 4.70c. This could not be held, however, in the face of the large surplus supply, and the lower offerings by independents, the market being dominated by the accumulation of Missouri lead, and the price steadily declined un-



COURSE OF LEAD PRICES IN 1909 AND 1910.

The increase in production in 1910 deepens the mystery surrounding the economic position of this metal. The larger part of the increase was due to the

## THE WORLD'S PRODUCTION OF PIG LEAD.

(According to latest reports obtainable, as compiled by Julius Matton, of London.)

(In Metric Tons.)

Country.	1907.	1908.	1909.
United States.....	366,729	316,971	362,955
Spain.....	186,496	188,062	188,000
Germany.....	134,136	155,954	158,069
Australia.....	96,487	119,946	73,600
Mexico.....	75,000	104,000	115,000
England.....	27,753	29,856	28,358
Italy.....	22,887	26,003	22,183
France.....	24,803	26,112	30,000
Belgium.....	27,455	35,650	40,306
Greece.....	13,813	14,305	15,301
Austria-Hungary.....	15,224	14,213	14,541
Turkey.....	10,398	11,772	12,128
Canada.....	17,518	16,560	23,273
Japan.....	3,075	2,936	3,225
Sweden.....	809	277	166
Russia.....	200	200	200
South America.....	102	254	558
Africa and East India.....	2,740	3,553	7,511
Total.....	1,025,625	1,066,624	1,095,374

nonargentiferous lead of Missouri, but in desilverized lead there was a gain, although the smelters were operating at reduced capacity insofar as ore tonnage is

be indicated a consumption that is beyond belief. Lead consumption in some lines was indeed very good, but not so in all. The manufacturers of white lead, who normally consume 35 to 40 per cent. of the total pig lead, suffered from the high price of linseed oil and do not report any remarkable prosperity in 1910, as may be seen from the special article that follows this.

It is preposterous to assert that the American stock of lead at the end of 1910 was insignificant. We are inclined to believe that it was smaller than at the beginning, which admission implies a substantial increase in consumption, but we know of the existence of considerable stocks, and we are inclined to think that the aggregate is still large.

## The American Lead Market in 1910

So large a part of the domestic lead production goes into consumption under time contracts at quotational averages

til it reached 4 1/4c. in May. Then the spring demand made itself felt, and the independent surplus having been largely absorbed the market advanced to 4.40c., the A. S. and R. Co.'s price, at which figure it remained until November, when it was unexpectedly advanced to 4.50c. The latter was the closing price of the year.

## The European Lead Convention

The European lead convention, organized in the early part of 1909, continued in operation during 1910. This convention was organized to obtain a more favorable sale of lead output than had previously been realized by unrestricted competition and the means adopted for the attainment of that object was the appointment by a number of European, American, and Australian lead producers of the Metallgesellschaft, Frankfurt-am-Main, as their sole selling agent.

By thus associating for the common sale of their productions, the parties to

the convention intended not only to do everything in their power to obtain higher prices for their products, but also to increase the profits of the sale by allotting to the different members of the association, according to the geographical situation of their works, certain exclusive districts for the sale of their output, and thereby enabling them to dispense with agents in other districts and to save costs of transport.

While the convention comprised such important interests as the American Smelting and Refining Company (in its export business), the Broken Hill Proprietary, the works of several companies in which the Metallgesellschaft is interested, and some Spanish producers, a good many important European interests remained outside, these including the Braubach company (the largest Rhenish producer) and Beer, Sondheimer & Co., controlling the output of Overpelt and contracting for the Rhein-Nassau production for several years, besides some other lead. There has been therefore a good deal of competition in the sale of lead in Europe and it is doubtful whether the convention has materially influenced prices. Satisfaction as to its operation has, however, been expressed by producers interested, and there is a feeling that if it has failed to improve the price for the metal, at least it has maintained it. Since its organization the London lead market has lost much of its previous importance and the prices quoted on the Metal Exchange have perhaps less significance than formerly.

### White Lead in 1910

However much the manufacturers of any paint pigments may have plumed themselves upon the importance to the industry of their special product, they have been taught, during 1910, that all pigments are but secondary in consequence to the vehicle, and that linseed oil remains the controlling element, in spite of all the scientific and empiric efforts that have been made during the last quarter of a century to displace it. At the time of writing the 1909 review, the price of linseed oil was advanced so far above the normal range as to be responsible for an advance in white lead in oil, which was recorded as having occurred on Dec. 6, 1909. Oil at that time was quoted at 65c. per gal. in New York, in car lots, and advanced steadily on a scarcity of spot stock and the early evidence of extensive damage to the growing crop from drouth until it reached 98c. in September—the highest price that has been touched in many years. Every hundred pounds of pure white lead in the paste form in which it is generally sold, contains about eight pounds, or a little over a gallon, of oil, and an average of five gallons more of oil is necessary

to put this paste in a condition for use as paint. The effect upon the paint industry of an advance of more than 40c. per gallon above the accepted normal price of linseed oil will, therefore, easily be understood. Numerous substitutes of more or less value were introduced or met increased sale during 1910, but they did not, either in volume or efficiency, compensate for the scarcity of this standard vehicle, and the consumption of paint in every form was in consequence greatly curtailed.

### LEAD CARBONATE

As foreshadowed in the 1909 review there was a further advance on Jan. 3, 1910, of  $\frac{1}{4}$ c. on white lead, both dry and in oil, due to the higher cost of pig lead. This made the price of standard makes of white lead  $5\frac{3}{8}$ c. dry, and  $7@7\frac{1}{4}$ c. in oil. These prices were nominally maintained until Sept. 16, 1910, when another  $\frac{1}{4}$ c. was added to lead in oil, as a result of the rapid advance in linseed oil, and the year closed with  $7\frac{1}{4}@7\frac{1}{2}$ c. the ruling prices. So much lead had been placed in dealers' hands at the prices current before each advance, however, that at no time during the year did consumers feel the full effect of the advance, and the checking of trade was due rather to the excessive cost of the oil necessary to make paint of the lead than to the cost of the lead itself. The volume of business in lead in oil was, however, below that of 1909.

The same was true of dry lead, which is largely consumed in the manufacture of ready-mixed paints, the cost of oil having necessitated so much of an advance in the price of those products as measurably to check their sale. The large consumers of dry lead had their requirements for 1910 pretty well provided for before the close of last year at  $5\frac{1}{4}$ c., and while the nominal price has been  $5\frac{3}{8}$ c. since the advance in January, a more common price was  $5\frac{3}{8}@5\frac{5}{8}$ c. with the usual annual reduction to  $5\frac{1}{4}$ c. on Nov. 17. This price was continued for only a week, during which time contracts for 1911 were largely entered up, and an advance to  $5\frac{1}{2}$ c. was announced by some of the largest corrodors on Dec. 2, 1910. Judging by the experience of past years, unless there is a further advance in pig lead, the sales of carbonates during the coming six months, at least, will be for the most part at  $5\frac{3}{8}@5\frac{1}{2}$  cents.

### LEAD OXIDES

All consuming industries using linseed oil curtailed their consumption of pigments, and both red lead and litharge suffered in consequence. There was, however, little fluctuation in the prices of either material. Red lead in a large way sold mainly at  $6\frac{1}{2}@6\frac{3}{4}$ c., and litharge at  $5\frac{3}{4}@6$ c., with concessions

from the lower figure to large consumers in special cases. This was notably true of litharge, which recently was contracted for as low as  $5\frac{1}{4}$ c., owing to sharp competition for the trade of a particularly large consumer, but for the most part manufacturers were not willing to shade  $5\frac{3}{4}$ c., and at the current cost of pig lead this is not a price that invites competition.

## The Coeur D'Alene District

### SPECIAL CORRESPONDENCE

The gloomy reports, that are freely circulated, of an early complete failure of the Coeur d'Alene mines are not justified by the facts. During 1910 these mines yielded 227,580,000 lb. of lead and 7,000,000 oz. of silver. These figures are an increase over the production in 1909, but are not equal to the record yields of 1906 and 1907, when under the stimulus of high prices the mines put forth their best efforts. At that time speculative interest in development projects gave the district great activity not only in stock trading, but also in the starting of a large amount of real, and more or less intelligently directed, prospecting and development work, which has continued intermittently ever since. It is unfortunate that this extensive work, scattered impartially throughout the district, has so far resulted in no really new producer of importance.

During 1910 the Stewart mining company and the Caledonia mining company gave important new production, but in each instance from old, heretofore dormant properties. Several famous mines of the district, the Gem, Helena-Frisco, Tiger-Poorman are bottomed and now closed, probably forever. In due course, mines now active must go the same way and to keep the district up to the present mark new producers must in like amount be brought in. This is not being accomplished.

On the other hand, after 20 years of continuous operation, the Coeur d'Alene district made for 1910 an excellent showing. Profits dwindle faster than output. The increased cost of production, higher supply costs, deeper mines, lower metal markets and decrease in grade of ore were more serious factors during 1910 in cutting into profits than were ore failures. These factors will continue to be adverse. Several individual mines will continue to make handsome profits for many years, but for the district as a whole the top figure for financial return has without doubt been passed, and unless some new, important, regular producers are added, either by fortunate discovery or by development of some known and at present unimportant property, the production will by natural laws recede year by year from the magnificent recent annual outputs.



The Yreka district, comprising the camps of Wardner and Kellogg, during 1910 showed better results than any other section of the region. The only new production came from the Caledonia and Stewart mines. The early exhaustion of the Wardner mine of the Federal Mining and Smelting Company predicted in the last annual report of that company, is an exhaustion of a portion of the upper horizon of the mineral

field of the Yreka district and is not a complete bottoming. The Yreka district, as disclosed by the bottom levels of the Bunker Hill & Sullivan mines, shows no signs of failure and the output from this district can be maintained, barring any unforeseen geological conditions to be met by further development in depth, for many years, while the tonnage developed for immediate extraction approximates closely to anything in the past.

The situation is thus one not to cause immediate alarm. A district which has yielded for over two decades at the rate of this one, and the yield from which comes from a considerable number of different properties will not terminate abruptly. The field is large and though unsuccessful prospecting has been done extensively, there are still reasonably good chances that oreshoots, at present unknown, will be discovered.

## Southeast Missouri Lead District

By H. A. Wheeler \*

The output of the Southeast Missouri lead belt in 1910 approximated 140,000 tons of lead, with an estimated value of \$12,240,000. This record tells its own story of a successful year, besides establishing a new high mark and maintaining its phenomenal growth. This output pre-eminently placed it at the head of the lead-producing districts of the world, and strongly emphasizes the importance of low-grade but large orebodies when treated by modern methods. While some of the mines produce ore that yields over 5 per cent. lead, and occasionally over 15 per cent., the average yield of this district approximates 4 per cent., and 2 per cent. ore is frequently worked. These figures are the results in pig lead, after deducting the milling and smelting losses, and should not be confused with assay reports which are considerably higher.

About 96 per cent. of the output was produced by the five large companies that each operate several mines, at Bonne Terre or in the Flat River district, St. Francois county.

Madison county, at the southern end of the belt, made the smallest output in many years, as only one company operated throughout the year. Financial wounds dating back from the 1907 panic resulted in receiverships and the closing down of the other three well known though not large producers, and their troubles are not adjusted.

### SMALL MINES POOR PRODUCERS IN 1910

The innumerable "diggings" and small mines in Washington, Jefferson and Franklin counties produced but little lead in 1910, as the price was not sufficiently high to induce prospecting. The Missouri "lead digger" is essentially a prospector. His daily earnings are liable to range from 10c. to \$10, but it has averaged too near the 50c. mark since 1907 to stimulate digging. He has temporarily gone back to farming, or cutting ties, or is working in the large mines in St. Francois county, where he can earn from

\$1.50 to \$2.50 per day. But if the lead market should advance sufficiently, or should some more persistent digger make a strike, they would flock back to the diggings, take up new leases and again become lead-producers of no small importance when considered collectively.

### RECENT DEVELOPMENTS IN WASHINGTON AND ST. FRANCOIS COUNTIES

Boston capital, under the name of the Potosi Mines Company, entered the lead belt and secured a promising piece of property in the Jake Day land, on Big river, between the Gumbo and Hunt mines of the St. Joseph company. The tract contains 357 acres, and a shaft was started on the bluff overlooking the river that will make a fine gravity site for the 500-ton mill that is contemplated. The same men also secured over 30,000 acres of valuable mineral land about Potosi, Washington county, that has produced considerable lead and large amounts of barytes from the shallow diggings. If this new company has the grit and success of the Bostonians who set aside \$500,000 and five years' time to test the Tamarack land at Lake Superior with a 2500-ft. prospect shaft, it is likely to have the honor of being the first to prove the disseminated deposits in Washington county.

### PROSPECT DRILLING

Prospecting for new orebodies was almost discontinued in 1910, and the little drilling that was performed was mostly to guide the mine superintendents in developing the mines. It was an unusually quiet year for the diamond drills. This was due to the high price of carbons, threatened labor troubles, and the panic of 1907.

The Penicaut, Manhattan and Bogy companies, which still require further drilling, did not operate a drill, nor did outsiders attempt any prospecting.

### THE ST. JOSEPH LEAD COMPANY

The St. Joseph Lead company, which has paid \$7,358,357 in dividends, besides putting nearly double that amount of profits back into plant, land, railroads and

improvements, made the largest yield in its history. Its production was about 15 per cent. larger than in 1909, its previous high record. The output was obtained from a daily production of about 3000 tons of ore derived from seven mines. The original or No. 1 mine at Bonne Terre, which is over 40 years old, is still the principal producer, though its large output is mainly coming from the deeper levels, or at 300 to 400 ft. The Hoffman mine at Leadwood, is developing into an important producer, as the orebody is not only large, but exceptionally rich. It is on the western edge of the lead belt—within two miles of the Washington county line—and is one of the so-called deep mines, as the shaft is about 500 ft. deep. It is equipped with a modern 1500-ton mill that also handles the output of the neighboring Hunt and Gumbo mines.

The centralization that has been in progress at Bonne Terre was further advanced in 1910 by arranging for the mill (No. 1) to be operated by electric motors from the central power plant. This will permit the shutting down of two large Corliss condensing engines, with a saving of about 50 per cent. in the fuel bill and payroll. The introduction of underground compressed-air locomotives enabled the hoisting that was formerly done through six shafts to be concentrated at the mill shaft, which effected a large saving in labor and fuel. The erection of a central electric power plant with three 600-kw. motors, operated by gas engines, closed down several scattered boiler plants. The shutting down of the mill engines will concentrate the power under one roof for operating all the mines and the 1500-ton mill at Bonne Terre, the adjoining railroad shops, the town lighting, and the Crawley mine at Flat River, seven miles distant.

Local improvements continued at Bonne Terre, which is now one of the most attractive, well equipped mining towns in the country. The memorial church which was the gift of the late superintendent, Charles B. Parsons, was completed in 1910, and it is a gem of

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Gothic architecture. A large brick office building is under construction to replace the present wooden structure. A hospital is being erected that is much larger and is a great improvement over the present building. A residence, that is typical of the success of the company, is being built for the superintendent, Roscoe Parsons.

The smelting plant at Herculeum, 30 miles north of Bonne Terre, where the concentrates of the St. Joseph and Doe Run companies are smelted, was materially improved in 1910. The Savelsberg pot-roasting plant, which had previously closed down the Freiberg or hand-roasting furnaces, was replaced by the Dwight sintering furnace. The latter is found to have a large capacity, two Dwight furnaces having replaced 19 roasting pots, with a marked saving in labor and a reduction in the losses.

A 350-ft. brick stack is nearly completed, which will take the smoke from the roasting and the five-shaft furnaces. The refining plant was also enlarged and improved.

#### THE DOE RUN LEAD COMPANY

The Doe Run company is a junior company of the St. Joseph company, having been formed in 1887 to operate an isolated discovery made at Doe Run, in the southern part of St. Francois county. A small mining, milling and smelting plant was erected that produced 4000 tons of lead in 1889, although it had to contend with hauling its freight three miles to Delassus, the nearest railroad point. From this modest beginning the company has steadily grown until its production is exceeded only by the St. Joseph and the Federal companies. The mining operations have been mainly transferred to the Flat River district, seven miles north, where it is operating seven mines, and recently completed a 2000-ton mill. Electric power is furnished by a finely equipped central station. The station has four 600-k.w. direct-connected gas-engine units that are operated by a battery of four down-draft producers of the Loomis-Pettibone type.

The old mill at Doe Run was enlarged to 1500 tons, and the Columbia mill was remodeled and increased to 600 tons. Dividends to date aggregate \$2,547,150, while a much larger sum has been expended out of the profits for extensive land purchases; new mining and milling plants, and for extensive surface improvements. The 1910 yield was considerably larger than the previous year, which had been the best in its history.

By the completion of its fourth unit in 1910, the new 2000-ton mill at Rivermines, which was formerly known as Central, was put into complete operation and the Columbia mill was closed down.

A shaft was completed to a new orebody recently found one mile south of the mine at Doe Run. It resembles the

latter in being shallow, and the lead-bearing limestone rests directly on the granite without the usual intervening sandstone. This should prove to be a profitable mine with its inexpensive shafts, small amount of water and close proximity to the railroad and old mill. The new shaft on the old Bonnelly property, near Esther, was completed and should become an important ore contributor in 1911.

#### DESLOGE CONSOLIDATED LEAD COMPANY

The Desloge company continued its usual policy of saying little, but made the largest output in its history. Part of the product was smelted in its four small Flintshire furnaces, but most of its ore was sold as concentrates in the St. Louis market. The mill was remodeled and increased to 1300 tons daily capacity by replacing the Harz jigs by Hancock jigs and increasing the capacity of the slime department. The ore was supplied by three mines, of which its latest, or No. 6 shaft, on Hoffmann hill furnished an increasing quantity of ore rich from a depth of 500 ft. This company operates its own railroad that connects the shafts with the mill. The road also connects with the Missouri River & Bonne Terre Railroad.

#### THE NATIONAL MINE

The mining property of the National Lead Company, which is locally known as the St. Louis Smelting and Refining Company, had a successful year and produced its usual large quota of lead. The concentrates were shipped to its smeltery at Collinsville, Ill., where considerable custom business is carried on with Joplin and Wisconsin ores.

A shaft, No. 6, was sunk 565 ft. deep, about one mile west of the mill. It was so dry that drilling water had to be sent down, until the underlying sandstone was tapped. This is quite exceptional in the Flat River district, as the water is usually excessive. In fact, the property was purchased at a bargain because the one small mine that had been developed was drowned out, and it was regarded by the local owners as a hopelessly wet mine.

The 1600-ton mill is supplied with ore from three mines, which are connected by a trolley surface road. In the recent death of H. H. McChesney, a great loss was sustained by the local office, as he managed the property from its inception with marked success.

#### THE FEDERAL LEAD COMPANY

The Federal company, which is a subsidiary of the Guggenheim Exploration Company, enjoyed a successful year. It not only maintained the big output that it made in 1909, but slightly increased it. As a vigorous, though youthful producer, it is entitled to the highest admiration, although its phenomenal growth

has been due to the powerful stimulus of unlimited capital.

The No. 1, or Federal 1000-ton mill, was not operated, but the new No. 2 or Central mill ran steadily throughout the year. The latter has a capacity of 4000 tons and is decidedly the largest individual mill in Missouri. It continued to pile up such a mountain of tailings that a new tailings elevator was necessary. The ore supply was derived from seven mines, though the old Central property furnished the greater part of the tonnage.

An effort was made to open up new orebodies by prospecting near the Valle mines, at the northern edge of St. Francois county, and also at De Soto, in Jefferson county, which is 20 miles northwest of Flat river. Drilling is still in progress at the latter place, where extensive options have been taken, and some of the holes have exceeded 1400 ft., which is the deepest thus far attempted in the district.

#### MADISON COUNTY

The Mine La Motte property, in Madison county, was operated steadily throughout 1910 and maintained about its usual production. A new shaft was sunk near the No. 3 mine and considerable prospecting was done with the diamond drill. The switch to the Iron Mountain Railroad was a great advantage, as it did away with three miles of teaming that was formerly necessary, and materially added to the profits. The new 500-ton mill was supplied from five shafts that are only 60 to 140 ft. deep.

#### NORTH AMERICAN LEAD COMPANY IN RECEIVERS' HANDS

The North American Lead Company, which has been operating as a producer of copper, nickel and cobalt, went into the hands of a receiver, and was recently bought in by the bond holders. There have always been doubts as to whether the large and costly metallurgical plant that it erected was justified, in view of the small amount of development work and the moderate land holdings. While there is a popular impression that its one orebody is nearly exhausted, there is little doubt that other orebodies can be found by energetic drilling, although this may require the acquisition of more land. The failure of this company was a heavy blow to Fredericktown, as with the closing down of the Catherine mine last year, the local mines are now idle.

An effort was made during 1910 to re-finance the Madison Land and Mining Company, which operated the Catherine mine, three miles north of Fredericktown, but the deal was not consummated.

The Hudson Valley Lead Company, which operated a small mill on a lease of the old copper mine from the Mine La Motte estate, was sold at a receiver's sale.



## Aluminum in 1910

BY ARTHUR V. DAVIS\*

The volume of aluminum business in 1910 was less than that in 1909, and from the same causes which resulted in a diminution of output in all other lines of production. In the first quarter of 1910 the demand was good, even better than in any quarter of 1909, but by the end of the second quarter of 1910 business receded to less than 50 per cent. of the first quarter, and has been, if anything, gradually decreasing since. The demand for aluminum in steel for the purpose of deoxidizing suffered a net decrease proportionate to the decrease in the steel business. The demand for aluminum castings, which is largely confined to the automobile trade, also fell off in connection with the slump in the automobile industry. A number of aluminum foundries shut down and the rest ran with lessened output, and the result was that the demand for ingot for this purpose, as well as for other purposes, was so reduced that it is this branch of the aluminum industry which showed the greatest falling off. The sheet and wire business did not fall off so much, and some of the specialties even improved.

As a result of the decline in demand large stocks of aluminum accumulated and are still accumulating. In the hope of an improved demand the Aluminum Company of America ran its smelting plants at nearly full capacity for some time, although a substantial amount of the aluminum produced had to be stored. Now some of the plants have been cut back half and unless the demand improves, still further cutting back will be necessary.

As above noted, however, some branches of the business made material progress. The use of aluminum, particularly aluminum tubing, in paper, chemical and other similar lines of manufacturing made a steady growth and seems to promise a substantial and large volume of business for the future. The use of aluminum in extruded shapes has also been constantly increasing. This business was started about three years ago and though no single line takes a large quantity of any one shape, an increasing number of new consumers are constantly being discovered with the result that the extruded-shapes output is constantly increasing, and the Aluminum Company of America in 1910 installed a separate plant of considerable size for this purpose. The aluminum cooking-utensil business was also good. These articles seem to have merit and win their way despite adverse commercial conditions.

Although a new sheet-rolling mill was built at Niagara Falls in 1910, it was not

put into operation on account of the falling off in the sheet business, but as the mill was built to meet future requirements it is still expected that the time will come when this mill will be required.

The aluminum wire and cable business, of course, followed the electrical-installation business. There have been comparatively few transmission lines financed and built in the last few years, and though there was apparently some activity in 1909, present commercial conditions seem to have checked the revival.

## Borax in 1910

BY S. T. MATHER\*

No marked change in the borax industry in the United States occurred during 1910. The sharp competition between the two producing companies was keener than ever and the low prices which resulted stimulated the consumption of borax materially. It is estimated that the United States is now absorbing borax at the rate of about 25,000 tons per year, a gain of at least 10,000 tons in the last 10 years.

California continued to be the only State in which the crude material was mined. The Pacific Coast Borax Company, which controls all the principal borax deposits in the Death Valley section, drew its supplies from the Lila C. mine at the lower end of Death valley, from which point the borate of lime or colemanite is shipped via the Tonopah & Tidewater Railway and the Santa Fé to its refineries on the eastern seaboard. It was reported that this company is planning to run a branch of the Tonopah & Tidewater Railway, which is controlled by it, to the mines in the upper part of Death valley, known as the Monte Blanco deposits, as it is said that the heavy demands upon the Lila C. deposits will make it necessary to tap some of the more northern sources of supply in order to keep up the rapidly increasing demand for the finished product.

The Sterling Borax Company, which controls rich borate mines in the Coast range in Ventura and Los Angeles counties, devoted all its attention in 1910 to its mines at Lang, Los Angeles county. Its position was materially strengthened by the construction of a narrow-gauge road from the railway station at Lang direct to the mouth of the mine. The veins of colemanite are beneath a narrow cañon and the mining is carried on by both shafts and tunnels. Shipments are made to the company's eastern refineries in Pennsylvania and Illinois. During July the Sterling mines were visited by the members of the American Chemical Society who stopped, in their special

train, on their way to the San Francisco convention.

The European market was supplied principally from the deposits of borate of lime in Chile and Peru, although the mines in Asia Minor continue to be worked. It is estimated that the European production has reached a total of about 50,000 tons. As the United States production is consumed entirely in this country, while the European refineries supply the rest of the world, this indicates that the United States absorbs about one-third of the world's production of this commodity at the present time.

## Arsenic in 1910

The general arsenic situation is chiefly of interest as witnessing a shifting of trade conditions due to new producers. Until a few years ago arsenic was entirely an imported product and New York was the sole distributing center. Later, owing to the production of this material by the Western smelteries as a by-product, the distributing centers tended to move west, although the situation of the paris green factories tended to retard this movement. Now, these factories too are moving West.

The year 1910 opened with arsenic at 2 $\frac{7}{8}$ c., and at that price the market was lively for a few weeks, but the effect of the large production in the West became more and more apparent as time went on, and the price gradually sank in a continued dull market until it is now nominally 2 $\frac{1}{4}$ c., but this price can sometimes be shaded, even in small quantities. There is no duty on arsenic or its compounds. About 150 tons per annum of red arsenic are imported, and probably 50 to 75 tons per annum of metallic arsenic and lead-arsenic alloys.

In Mexico, the Compañía Minera de Peñoles is working its arsenic plant only on the richest flue dusts, and by no means up to full capacity. In Canada the Deloro Mining and Reduction Company, Deloro, Ont.; the Canadian Copper Company, Copper Cliff, Ont.; the Coniagas Reduction Company at St. Catherines, Ont., continued to be the sole producers. In the United States the Everett smeltery, at Everett, Washington, the Washoe plant, at Anaconda, Montana and the United Smelting Company at Midvale, Utah, are the principal producers.

In spite of the fact that the use of lead arsenate as an insecticide is continually extending, and with the destruction of birds will probably still further increase, the outlook is that the arsenic market will show further declines rather than increases.

According to information furnished by the producers, the total white arsenic production of the United States in 1910 amounted to 1326 tons, against 1008 tons in 1909.

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# The Zinc Industry in 1910

The production of zinc in the United States in 1910 was the largest on record. The details, compiled from reports from all of the producers, except one small concern, whose output we have estimated at 5000 tons, are given in the accompanying table. The deliveries for consumption were large, and the actual consumption was undoubtedly larger, the galvanizers having been heavily overbought at the beginning of 1910, and probably less so at the end. The stock at smelteries at the end of 1910 is estimated at about 22,800 tons. Of the stock a considerable part was bonded spelter. Details of the stock cannot be discussed without disclosing individual business.

It is to be remarked that the decrease in deliveries does not necessarily imply decrease in consumption. At the end of 1909 manufacturers were notoriously overbought. We estimated actual consumption in 1909 at 261,600 tons, including the consumption of reclaimed spelter. If we estimate reclaimed spelter in 1910 at 12,000 tons the deliveries become 270,514 and actual consumption was probably in excess of that figure.

The imports of zinc ore in 1910 were about 85,000 tons, against 116,269 in 1909, as reported by the Bureau of Sta-

tistics. The exports of zinc ore were about 19,000 tons, against 12,456 in 1909.

## PRODUCTION OF SPELTER IN THE UNITED STATES.

States.	1909.	1910.
Colorado.....	6,115	6,352
Illinois.....	75,229	80,834
Kansas-Missouri.....	111,808	112,533
Oklahoma.....	28,840	34,762
South and East.....	44,470	43,899
Totals.....	266,462	278,380

## DELIVERIES INTO CONSUMPTION.

	1909.	1910.
Stock, Jan. 1.....	25,000	11,500
Production.....	266,462	278,380
Imports.....	9,670	3,380
Total supply.....	301,132	293,260
Exports.....	2,566 (a)	11,946
Stock, Dec. 31.....	11,500	22,800
Deliveries.....	287,066	258,514

(a) Includes 4200 tons of domestic spelter, 5029 tons of spelter from ore smelted in bond, and 2717 tons of spelter in manufactured articles upon which drawback was claimed.

The particular noteworthy features of the zinc industry of 1910 were the abandonment of several works at Iola because of failure of gas, the critical position in this respect of a number of other works in Kansas, the adoption of petroleum as fuel at some of them, the inauguration of

plans for several large works in Illinois, the discovery of calamine ore at Leadville, and the increase in the supply of ore from Butte and other Rocky Mountain points. The Joplin district made about the same output of ore as in 1909. Wisconsin and Oklahoma suffered decreases.

The results of 1910 showed that the tariff on zinc ore has not benefited the miners, the prices of zinc and zinc ore having averaged no higher than formerly, while it harassed the smelters. Thus, it has helped nobody and has hurt some persons. The year demonstrated furthermore that a price of less than \$40 per ton interferes seriously with the production of ore in the Joplin district.

Toward the end of 1910 people awoke to the remarkable situation of the zinc industry in that the failure of the natural gas in Kansas was likely to result in a shortage of smelting capacity. Four works at Iola have already been abandoned and the remainder are not expected to do more than live through the winter. At several of the other Kansas smelting points the situation is critical. Several new works are to be built in Illinois, but their construction will be a matter of a year or two.

## American Spelter Market in 1910

The year 1910 opened with a record production of zinc ore due to the stimulus created by the high prices which had been prevailing during the latter part of 1909. The plenitude of the supply of raw material resulted in exceptionally profitable margins for the smelting industry. In consequence every available furnace was operated at full blast, and the output of spelter had reached the highest rate in the history of the industry. Already in December, the weight of the heavy production began to make itself felt in the market, and when shortly after the opening of the new year the galvanizing demand fell off, stocks of spelter quickly accumulated at the various zinc works. As the smelters found no difficulty in replacing current spelter contracts by new supplies of ore at profitable margins, a competitive selling movement developed, which brought about a decline in the short period of two months, from 6.05@6.07½ at the beginning of January to 5.25@5.30 at the end of February.

At the low level, speculators began to take an interest in the market, and suc-

cessfully checked the decline. Buying from this source stimulated a more active inquiry on the part of consumers and a sharp rally took place, prices advancing by the middle of March to 5.57½@5.62½. Fundamental conditions, however, had not changed, and as soon as the immediate buying power had been exhausted, the market began to waver, but held at about 10c. below the highest point until toward the end of April. When the hoped for Spring revival in the galvanizing demand did not materialize, the decline was accelerated by the realization of speculative holdings, until the lowest prices of the year were reached about the beginning of May, quotations standing at that time at 4.85@4.90, St. Louis. At that level, corrective measures were automatically forced upon the industry through a contraction of the output of ore, particularly in the West at points where the high freight rates to the zinc smelters make the mining prohibitive except at a high spelter market. A larger amount of the requirements of the smelters had to be drawn upon from Joplin, and the smelting

margins quickly began to dwindle, until it became for the smelters a case of swapping dollars. Prices backed and filled within 15@20c. from the lowest level until the middle of August.

By that time a number of the smelters in the gas belt of Kansas had largely restricted their production, which, due to the failing supply of gas, had been carried on under great difficulties and large expense, justified only as long as the big smelting margin offered a compensation. Smelters became more reluctant in their efforts to effect sales, and the pressure having been taken off the market, a slow but impressive advance raised prices to about 5.40, St. Louis, at which figure they ruled practically unchanged until Nov. 1.

Coincident with the short-lived revival in all markets, it began to be realized that due to the failing supply of gas in the Kansas gas belt, there was no reserve capacity to fall back upon in the event of an expansion in the demand, and in anticipation of such a contingency, the largest buying movement of the year developed, stigma of having been silent partners of



bounds to 5.85@5.90 at the end of November. The demand was only met to the extent of current output and stocks on hand, as the smelters expected a scarcity of spelter during the winter months. This put them in a vulnerable position when it turned out that the galvanizers, instead of requiring larger quantities, were compelled to reduce their operations, and that the brass industry, which had been flourishing throughout the year, was also beginning to feel the effect of the general contraction. Prices dropped off as quickly as they had advanced, and the year ends with the market weak at 5.27½@5.32½.

List of American Zinc Smelters

The accompanying table is compiled from the latest available data, most of the figures entered in the table having been supplied by the respective companies:

Of the above retorts, 11,104 are owned by smelters at Bartlesville, Okla., 25,524 at Iola, Kan., and 21,248 at other places in Kansas. The furnaces of the United States Zinc Company at Pueblo, Colo., have Rhenish retorts. At all of the others the retorts are of the Belgian type.

At the works of the Lanyon Zinc Company at Iola, Kan., the last furnace was

Zinc Mining in Wisconsin in 1910

By J. E. KENNEDY\*

The net tonnage of zinc ore shipped to smelteries from the Wisconsin district in the first 11 months of 1910 was 55,927 tons. Approximately 5000 tons were zinc carbonate; the remainder was zinc sulphide assaying from 40 to 62 per cent. metallic zinc. The production in the 12 months of 1909, computed from smelter receipts, was 69,000 tons.

ZINC SMELTING CAPACITY OF THE UNITED STATES AT END OF 1910.

Name.	Location.	Furnaces.	Retorts.
American Zinc, Lead and Smelting Co.	Deering, Kan.	6	3,840
American Zinc, Lead and Smelting Co.	Caney, Kan.	6	3,648
Bartlesville Zinc Co.	Bartlesville, Okla.	8	4,608
Bertha Mineral Co.	Pulaski, Va.	10	1,400
Chanute Zinc Co.	Chanute, Kan.	4	1,280
Cockerill Zinc Co. (Beer, Sondheimer & Co.)	Altoona, Kan.	6	3,840
Cockerill Zinc Co.	Bruce, Kan.	4	896
Cockerill Zinc Co. (L. Vogelstein & Co.)	Gas City, Kan.	4	2,560
Cockerill Zinc Co. (L. Vogelstein & Co.)	La Harpe, Kan.	3	1,853
Cockerill Zinc Co.	Nevada, Mo.	3	648
Collinsville Zinc Co.	Collinsville, Ill.	6	1,536
Edgar Zinc Co.	St. Louis, Mo.	9	2,000
Edgar Zinc Co.	Cherryvale, Kan.	24	4,800
Granby Mining and Smelting Co.	Neodesha, Kan.	6	3,840
Grasselli Chemical Co.	Clarksburg, W. Va.	10	5,760
Hegeler Bros.	Danville, Ill.	2	1,800
Illinois Zinc Co.	Peru, Ill.	7	4,640
Lanyon-Starr Smelting Co.	Bartlesville, Okla.	5	2,880
Lanyon Zinc Co.	Iola-La Harpe, Kan.	15	9,740
Matthiessen & Hegeler	Lasalle, Ill.	5	4,380
Mineral Point Zinc Co.	Depue, Ill.	6	4,520
National Zinc Co.	Bartlesville, Okla.	5	3,040
New Jersey Zinc Co.	Palmerton, Penn.	12	2,848
New Jersey Zinc Co.	Bethlehem, Penn.	19	1,680
Pittsburg Zinc Co.	Pittsburg, Kan.	4	910
Prime Western Spelter Co.	Gas, Kan.	14	8,584
Sandoval Zinc Co.	Sandoval, Ill.	4	896
United States Zinc Co.	Pueblo, Colo.	8	1,920
United Zinc and Chemical Co.	Iola, Kan.	6	2,784
United Zinc and Chemical Co.	Springfield, Ill.	3	2,080
		224	95,211

RECORD OF SHIPMENT AND PRICES

The accompanying table shows the shipment by camps up to Dec. 3, of both crude and finished concentrates. The shrinkage in the net shipment is developed at the roasting and separating plants. By the process of roasting and magnetic separation and also of electrostatic separation, green concentrates assaying from 10 to 40 per cent. zinc are converted into a product testing from 50 to 62 per cent. metallic zinc. A loss exceeding 10 per cent. of zinc content is sustained, together with a shrinkage of 30 to 90 per cent. in the gross weight of raw concentrates as zinc ore. Part of the sulphur content goes off in the fumes and the residual iron to the dump pile in the case of the roaster at Cuba City, and the iron pyrites separated as a by-product in the case of the electrostatic separator at Platteville. The largest week's shipments in the period covered was 3136 tons of zinc concentrates, as sent from the mines direct to the smelteries and to the separating plants, and 2431 tons of medium- and high-grade product as shipped direct to the smelteries from the mines and from the separating plants.

The top price paid for zinc ore was \$50 per ton, and the highest base price paid for 60 per cent. zinc was \$49 per ton, recorded in January. The base price dropped as low as \$38 per ton in February, May and August, and was below \$40 per ton during eight weeks of the year.

FIELD DEVELOPMENTS AND NEW MILLS

The zinc-producing area was extended to the southeast by the development of the Field, Drum, Little Minnie, Lucky Twelve and Winskill properties, which rank among the best producers in the district. Nine concentrators were rebuilt and constructed since Jan. 1, 1910, viz., the Drum, Little Minnie, Lucky Twelve and Schreier, at Benton; the Peaceful Valley at Cuba City; the Wallace at Highland; the Homestead and Cleveland-Klondike at Platteville, and the Unity, at Galena; six other concentrators were completed in 1910, the construction of

\*Platteville, Wis.

While prices may recede further, depending upon the return of a normal business situation, an undue decline would probably be checked through the relative proximity of the export basis and an ex-

closed down on Dec. 26. The three works will now remain closed indefinitely. The American Metal Company will surrender its lease of them.

The United Zinc and Chemical Company dismantled its Iola plant. At its Springfield plant it added one block of 800 retorts, and is building two blocks comprising 1600 retorts. These will go into operation in January and February, 1911. The Mineral Point Zinc Company increased its plant at Depue by one block of 600 retorts. The Bartlesville Zinc Company added two blocks, comprising 1152 retorts.

Of the old coal smelteries, the Pittsburg Zinc Company closed its plant early in 1911, and the Cockerill plant at Nevada, Mo., also was closed. On the other hand the works at Collinsville, Ill., long idle, were put once more into operation. The Cockerill Zinc Company went out of business in 1910, its Altoona works being taken over by Beer, Sondheimer & Co., and its Laharpe and Gas City works by L. Vogelstein & Co., the other plants becoming idle.

The tin production of Singkep in 1909-10 was 6560 Netherland Indies pikuls, against 6872 in 1908-9 and 6619 in 1907-08.

SPELTER

Month.	New York.		St. Louis.		London.	
	1909.	1910.	1909.	1910.	1909.	1910.
January.....	5.141	6.101	4.991	5.951	21.425	23.350
February.....	4.889	5.569	4.739	5.419	21.562	23.188
March.....	4.757	5.637	4.607	5.487	21.438	23.031
April.....	4.965	5.439	4.815	5.289	21.531	22.469
May.....	5.124	5.191	4.974	5.041	21.975	22.100
June.....	5.402	5.128	5.252	4.978	22.000	22.094
July.....	5.402	5.152	5.252	5.002	21.969	22.406
August.....	5.729	5.279	5.579	5.129	22.125	22.800
September.....	5.796	5.514	5.646	5.364	22.906	23.165
October.....	6.199	5.628	6.043	5.478	23.200	23.900
November.....	6.381	5.976	6.231	5.826	23.188	24.083
December.....	6.249	5.624	6.099	5.474	23.094	24.019
Year.....	5.503	5.520	5.352	5.370	22.201	23.050

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

ceptionally strong European position. Moreover, the market is as yet not hampered statistically. Available supplies do not exceed what might be termed a safe and normal working stock. Since providing new capacity in the coalfield will be a relatively slow process, the market can reasonably be judged as being surrounded by conditions which will enable it quickly to respond to favorable developments.

which began in 1909, viz., the Kohinoor and Dickson-Oettiker at Platteville; the Hinkle at Linden; the Little Four at Benton; the Hoosier at Galena, and the Kroll, at Highland.

At Cuba City the Campbell Ore Separating Company built a roasting and magnetic-separating plant, employing some new methods whereby iron sulphide is reclaimed as a commercial byproduct.

At Galena, Ill., the Interstate Light and Power Company completed a central power station of 2500-kilowatt capacity and extended 100 miles of power lines to furnish electric power to mines throughout the southern part of the district. At Platteville, a Sutton, Steel & Steele dry-process plant was constructed.

WISCONSIN ZINC ORE SHIPMENTS, 1910.

	Net to Smelters, Pounds.	Crude from Mines, <sup>1</sup> Pounds.
Highland.....	12,334,800	12,675,500
Linden.....	638,070	8,104,520
Harker.....	4,648,912	7,100,772
Mineral Point.....	28,635,505	5,514,780
Montfort.....	434,790	2,572,000
Livingston.....	211,164	15,489,522
Rewey.....	812,800	5,738,990
Platteville.....	24,742,350	28,921,658
Cuba City.....	9,051,423	12,687,973
Benton.....	10,490,809	41,114,285
Hazel Green.....	78,000	23,073,500
Shullsburg.....	1,486,300	2,531,840
Dodgeville.....	607,800	607,800
Galena.....	16,906,241	18,474,861
Council Hill.....	400,000	475,000
Dubuque.....	375,000	375,000
Total to Dec. 3, 1910.....	111,853,964	185,458,001

<sup>1</sup> Includes roasted ore from three mines

LABOR AND WAGES.

A total of 81 concentrating mills, 12 roasters and one electrostatic separator were in operation at different periods of 1910. Miners were in good demand at all times except a few weeks during the early spring, when a number of men left for the Black Hills, to work in the Homestake and other mines in place of the Western Federation miners who were on strike. This exodus was due, largely, to the fact that higher wages could be secured. Drill runners generally receive \$2.50 per day; helpers, \$2.25 per day; hoistman, \$2.50 to \$2.75; shovelers and trammers were paid \$2 per day by day wage and from \$2 to \$5 per day by contract at 5 to 6c. per 1000-lb. can.

# The Joplin District in 1910

By Jesse A. Zook \*

The year 1910 was ushered in amid favorable conditions, which made it seem more than probable that a "record breaker" was in store. Spelter was above \$6 and weather conditions were such that there was little danger of declining prices being brought about by a big surplus piling up in the producers' bins. By the end of January spelter began to decline, gradually going downward until in August it reached \$4.90, making it certain that the expected record breaker would not materialize.

The year began with the top price of zinc ore at \$52 per ton. By the third week in February it had declined to \$42.50. In March it climbed up to \$49 but settled back to \$46 in April and remained there during the month. In May it declined to \$42 and remained between that and \$44 until September. In November it reached \$51.

Lead prices showed more stability, beginning the year at \$58 per ton, but gradually declining until in May the price was \$48. In the first week of June \$49 was paid and the price remained there until the third week in August when the price began to ascend and reached \$58 in November. The extremes in the lead ore market were \$58 in January and \$48 in May.

It will be noted that the low price of the year for both zinc and lead was in May, and in that month mining became so unprofitable in the sheet-ground district from Oronogo to Duenweg that many of the operators closed their mines. Throughout the entire Joplin district, mines closed down until it was estimated that at least one-third of the mills were not operating. Many of them remained

idle for three, four and five months; some are now preparing to resume operations. Despite the fact that at least a third of the mills of the district were out of commission the weekly shipments of zinc concentrates were around 5500 tons. This

conclusively proves that most of the mines that were idle added only a small part to the weekly production of the district.

Some of the large operators in the Webb City sheet-ground district turned

TABLE 1. PRODUCTION OF ZINC AND LEAD IN THE JOPLIN DISTRICT (11 MONTHS).

District.	ZINC ORE (Short Tons).				LEAD ORE (Short Tons).			
	1910.	1909.	Increase.	Decrease.	1910.	1909.	Increase.	Decrease.
Webb City-Carterville.....	101,845	90,888	10,975	.....	20,811	19,350	1,461	.....
Joplin.....	44,807	45,833	.....	1,026	5,787	6,221	.....	434
Alba-Neck.....	17,123	10,480	6,643	.....	132	155	.....	23
Duenweg.....	15,579	15,405	174	.....	2,036	2,394	.....	358
Prosperity.....	.....	10,394	.....	10,394	.....	2,887	.....	2,887
Oronogo.....	7,557	7,407	150	.....	1,083	842	241	.....
Carthage.....	5,204	6,486	.....	1,282	5	8	.....	3
Sarcozie.....	4,107	4,142	.....	35	11	.....	11	.....
Zincite.....	.....	3,561	.....	3,561	.....	73	.....	73
Carl Junction.....	2,999	1,501	1,498	.....	42	28	14	.....
Cave Springs.....	1,516	1,677	.....	161	37	10	27	.....
Reeds.....	105	.....	105	.....	.....	.....	.....	.....
Jasper county.....	200,842	197,774	3,068	.....	29,944	31,968	.....	2,024
Granby.....	13,111	13,060	51	.....	349	321	28	.....
Spurgeon.....	7,331	8,005	.....	674	1,650	1,891	.....	241
Jackson.....	3,585	1,421	2,164	.....	489	181	308	.....
Saginaw.....	281	1,227	.....	946	40	130	.....	90
Wentworth.....	176	288	.....	112	.....	.....	.....	.....
Seneca.....	62	23	39	.....	38	50	.....	12
Newton county.....	24,546	24,024	522	.....	2,566	2,573	.....	7
Aurora.....	6,977	11,420	.....	4,443	279	333	.....	54
Stott City.....	790	573	217	.....	15	.....	15	.....
Lawrence county.....	7,767	11,993	.....	4,226	294	333	.....	39
Dade county.....	137	61	76	.....	.....	.....	.....	.....
Barry county.....	.....	18	.....	18	.....	.....	.....	.....
Green county.....	.....	.....	.....	.....	19	41	.....	22
Galena.....	16,044	16,260	.....	216	1,621	1,772	.....	151
Badger.....	6,122	7,669	.....	1,547	515	145	370	.....
Cherokee county.....	22,166	23,929	.....	1,763	2,136	1,917	219	.....
Miami.....	9,617	10,312	.....	695	2,973	3,561	.....	588
Quapaw.....	3,895	4,599	.....	704	242	277	.....	35
Peoria.....	40	242	.....	202	.....	.....	.....	.....
Ottawa county.....	13,552	15,153	.....	1,601	3,215	3,838	.....	623
Murray county.....	.....	16	.....	16	.....	.....	.....	.....
Missouri.....	233,292	233,870	.....	578	32,823	34,915	.....	2,092
Kansas.....	22,166	23,929	.....	1,763	2,136	1,917	219	.....
Oklahoma.....	13,552	15,169	.....	1,617	3,215	3,838	.....	623
Joplin district.....	269,010	272,968	.....	3,958	38,174	40,670	.....	2,496

\*Joplin, Mo.



their attention to soft-ground mining and secured leases in the Neck City camp, where there were some discoveries of excellent orebodies. Table 1 shows what developments were made in that camp during 1910, with an increase of 6643 tons of concentrates over 1909. The ore is of high grade, assaying 62 to 63.50 per cent. zinc, and a production of 300 to 400 tons is being made weekly. Another new and rich territory is being opened up at what is known as Toms Sta-

TABLE 2. SEVENTEEN YEARS' PRODUCTION OF JOPLIN DISTRICT.

Year.	Zinc Ore, Tons.	Lead Ore, Tons.	Total Value.
1910.....	295,565	42,149	\$14,061,898
1909.....	296,453	43,659	14,573,077
1908.....	258,628	38,533	10,995,977
1907.....	286,538	42,065	15,419,827
1906.....	278,930	39,189	15,128,175
1905.....	252,435	31,679	15,302,800
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..	4,052,508	568,327	\$163,565,641

tion, a few miles north of Joplin. Little has been added to the production from that section, but 1911 promises much ore from that territory. The Carl Junction camp made a nice gain through increased developments in that field. The new sheet-ground district west of Joplin showed considerable development; several new mills were built during the summer, but there was not a large increase in production. Jackson, southwest of Joplin, just over the line in Newton county, made big strides and showed a nice increase

TABLE 3. ORE PRICES IN JOPLIN DISTRICT (12 YEARS).

Year.	ZINC ORE.		LEAD ORE.	
	High.	Average.	High.	Average.
1910.....	\$52.00	\$40.42	\$58.00	\$51.98
1909.....	55.00	41.08	60.50	54.56
1908.....	47.00	34.36	66.00	54.66
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

over 1909. More new properties are coming in now in that field and the outlook is good for an increased production in 1911. Granby and Spurgeon, in Newton county, just about held their own. Aurora, in Lawrence county, had a greatly reduced production, amounting to 4443 tons, while Stott City in the same county shows a gain over 1909. Webb City and Carterville made a big increase during 1910, but that is on account of the ore from the Prosperity camp being included, while in 1909 it was listed as a separate camp.

The same is true of Joplin and Zincite, as will be noted by the table. The Galena, Kan., camp took a new life in the last six months of 1910 and the camp gives promise of returning to the high position it once held in the Joplin district. The Badger-Peacock camp showed a big falling off and there was little new development in that field. Miami, Quapaw and Peoria, in Oklahoma, all show a decreased production.

There was probably never a time in the history of the district when there was so much acreage leased for mining purposes as during the last six months. The principal points of leasing were at Carl Junction, Toms Station and Galena. The section lying northwest of Neck City, along North Fork, also showed much activity along this line.

NEW LEAD SMELTERY

One of the most important features of 1910 was the building of another lead smeltery. Through the efforts of George W. Moore, former mayor of Webb City, a man who has been associated with different zinc- and lead-smelting concerns

TABLE 4. PRICES OF JOPLIN ZINC AND LEAD ORE PER TON, 1910.

Month.	ZINC.		LEAD.	
	High.	Average.	High.	Average.
January.....	\$52.00	\$45.32	\$58.00	\$57.53
February.....	48.00	39.47	56.00	53.63
March.....	49.00	39.78	55.00	51.58
April.....	46.50	39.35	50.00	49.77
May.....	46.00	37.51	49.00	48.15
June.....	46.00	38.11	49.00	48.80
July.....	44.00	36.74	49.00	48.63
August.....	45.00	37.32	54.00	49.79
September.....	48.00	39.74	56.00	54.70
October.....	48.00	40.80	56.00	53.76
November.....	51.00	43.40	58.00	54.62
December.....	51.00	43.10	57.00	52.00
1910.....	\$52.00	\$40.42	\$58.00	\$51.98
1909.....	55.00	41.08	60.50	54.56
Decrease.....	3.00	0.66	2.50	2.58

as buyer in this district for years, local and foreign capital was interested in building a lead smeltery, on the Guinn land north of Webb City, in the heart of the sheet-ground district. The plant was built along modern lines at a cost of \$60,000, and is capable of handling 500 tons of ore per week. Associated with Mr. Moore in the planning and specifications of the plant were R. A. Farnham and J. B. O'Reilly, of Galena, Kan., both of whom have long been connected with the lead-smelting industry. The concern is known as the Webb City Smelting and Manufacturing Company. The plant is expected to begin operations in January, 1911.

In November the United States Mint coined 954,250 gold pieces, value \$15,400,000; silver, 3,220,000 pieces, value \$406,000; nickel and copper, 16,743,000 pieces, value \$381,030; total, 20,917,250 pieces; value \$16,187,030. In addition there were coined for the Philippines 425,000 twenty-centavo pieces, and 200,000 one-centavo pieces.

Lead and Zinc Mining in Oklahoma in 1910

By G. W. BIGHAM\*

Probably at no time since the discovery of lead and zinc in Oklahoma have the prospects for increased development been brighter than at the close of 1910. Several things aid in making the outlook promising. The fuel question is settled with the piping of natural gas to the mines. Many of the plants already use it for fuel, while some have installed modern gas engines. A new railroad is about to be built connecting the mines with the smelters at Bartlesville, Okla., making a short haul for the ore.

The most important development, however, was the fact that the deeper run of ore found in the Miami camp proved better than was anticipated, although there is a great deal of water to pump. Three shafts are now in the ore on the 250-ft. level and three more will be down inside of 60 days, and it is the prediction of the experienced miners that the 250 to 300-ft. run of ore will prove the best in the district.

The value of the lead and zinc sold from the Miami-Lincolville camp between Jan. 1, 1910, and Dec. 10, 1910, is \$680,813. The Emma-Gordon Mining Company was the largest producer, yielding 6,282,990 lb. of zinc ore, valued at \$69,739 and 1,386,650 lb. of lead ore, valued at \$35,196.

The Kansas Mining Company, operating the smallest mill in the district, made an excellent showing. It produced 2,422,080 lb. of zinc ore, valued at \$41,843, and 853,950 lb. of lead ore, valued at \$23,029. This company took an option on the Neel-Freeman mine about two miles southwest of the camp and is to begin development work at once.

During 1910 several tailing mills were installed to remill the tailings from the older mines, and in nearly every instance these mills proved a profitable undertaking. There were at the close of 1910 about 35 mining plants in operation in the Miami-Lincolville district.

Canadian Asbestos

The merging of most of the important asbestos properties in the Thetford-Broughton-Black Lake region, of Quebec, into the Amalgamated Asbestos company did not lessen operations in the district either of the merged or the independent companies. Many improvements were made in the Amalgamated properties and much independent exploration was carried on. The failure of the Amalgamated company to completely finance its project had the effect of weakening its dominant relation to the industry.

\*Vice-president of Bigham Implement Company, Miami, Okla.

# The Iron and Steel Industry in 1910

By Frederick Hobart

As the record of 1909 was one of a recovery from panic and depression, which subsequent events have proved to be too rapid, so that of 1910 has been a story of slow decline and gradually growing depression. This, we believe, will be proved by events to come to have been as much exaggerated as was the eager anticipation of another boom a year ago. The year was marked by very large production and by a very large consumption. The latter, however, did not come up to expectations; large as it was—probably in excess of any previous year except 1907—it did not quite equal the preparations made to supply it. The consequence was overproduction, and this was severely felt, especially toward the close of the year. Each year for many years the history of the iron trade has been the repetition of some past and perhaps forgotten year. In some respects, however, 1910 was exceptional; and it was so largely because the trade is now consolidated so largely in the hands of a few leaders, and most of them are so deeply impressed with their own power that they failed either to study the records of the past—or if they did, to interpret them rightly.

## IRON ORES

The production and consumption of iron ore for two years past are estimated as in the accompanying table:

	1909.	1910.	Changes.
Lake Superior	42,586,869	43,470,206	I. 883,337
Southern States	7,350,000	7,500,000	I. 150,000
Other States	3,150,000	3,325,000	I. 175,000
Total production	53,086,869	54,295,206	I. 1,208,337
Add imports	1,696,411	2,670,000	I. 973,589
Total supply	54,783,280	56,965,206	I. 2,181,926
Deduct exports	455,932	711,000	I. 255,068
Deduct increase in stock	521,000	950,000	I. 429,000
App. consumption	53,807,348	55,304,206	I. 1,497,858

The production of ore was a little above that of 1909, although the anticipations of a much greater output which were entertained in the earlier part of the year were not realized, owing to the declining activity of the furnaces in the later months of the year. The Lake Superior district, which supplies the raw material for about 80 per cent. of our make of pig iron, is separately treated below. The ore mines of the South made a good production, notwithstanding some drawbacks, and there were some additions to the producing capacity by new developments. In the East the mines were generally active. In New York the Adirondack and Lake Champlain districts were

large producers, and some new mines were opened, while arrangements were made to reopen some of the old mines in the Western Berkshire region. The New Jersey mines kept up their output, and the same can be said of the Lehigh Valley and Cornwall districts in Pennsylvania.

In the table the increase in stocks is that visible only, including the increase on Lake docks and at a few other points. The stocks in furnace yards are not reported and it is almost impossible to estimate them. It is probable that those stocks were rather lower at the close of 1910 than at the opening of the year.

the upper Lake docks, by ports; rail shipments for 1910 being estimated.

## SHIPMENTS OF LAKE SUPERIOR ORES.

	1908.	1909.	1910.
Escanaba	3,351,502	5,748,042	4,959,869
Marquette	1,487,487	2,909,578	3,248,930
Ashland	2,513,670	3,834,286	4,093,822
Two Harbors	5,702,237	9,181,132	8,271,169
Superior	3,564,030	6,540,505	8,437,261
Duluth	8,808,168	13,470,503	13,609,155
Total by water	25,427,094	41,683,599	42,620,206
By rail	587,893	903,270	850,000
Total	26,014,987	42,586,869	43,470,206

The distribution by ranges in 1910 is not yet complete. Escanaba and Mar-

## RECEIPTS AND STOCKS, LAKE ERIE PORTS.

PORTS.	RECEIPTS.			STOCKS.		
	1908.	1909.	1910.	1908.	1909.	1910.
Toledo	680,553	1,374,224	1,225,202	590,925	332,456	433,215
Sandusky		11,088		36,079	39,557	17,728
Huron	213,377	243,082	197,951	458,158	477,333	375,118
Lorain	2,286,388	2,796,856	2,884,738	426,274	407,129	259,448
Cleveland	4,240,816	6,051,342	5,800,501	1,458,592	1,547,142	1,638,795
Fairport	1,518,961	1,734,277	1,516,434	835,821	867,640	839,970
Ashtabula	3,012,064	8,056,941	9,620,638	2,293,531	2,594,359	3,287,816
Conneaut	4,798,631	7,007,834	6,309,548	1,296,675	1,411,002	1,329,997
Erie	828,602	1,235,057	942,592	730,530	788,046	792,011
Buffalo	2,835,099	5,002,235	4,704,439	315,148	501,125	452,783
Detroit		159,889	296,412			
Total	20,414,491	33,672,825	33,498,455	8,441,533	8,965,789	9,426,681

A beginning was made in the development of the iron ores of eastern Texas. Some mines are being opened and a railroad is under construction to give them an outlet to a Gulf port. No commercial production was made in 1910, however, the only shipments being some small lots for testing at Eastern furnaces.

**Lake Superior Iron Ores**—In the statement of the railroads the deliveries of iron ore to the Lake docks for the season of 1910 are reported as below:

Port and Road:	Tons.	Per Cent.
Escanaba, Chi. & N. W.	3,697,773	8.6
Escanaba, Chi., Mil. & St. P.	1,262,096	3.0
Marquette, L. Sup. & Ishpeming	1,865,724	4.3
Marquette, Duluth, S. Shore & At.	1,383,206	3.2
Ashland, Chi. & N. W.	3,387,916	7.9
Ashland, Minn., Sault Ste. M. & At.	705,906	1.7
Two Harbors, Duluth & Iron Range	8,271,169	19.4
Duluth, Dul., Missabe & N. Superior, Great Northern	13,609,153	31.8
	8,437,261	19.8
Total, Mich. & Minn.	42,620,204	99.7
Michipicoten, Algoma & Hudson Bay	116,096	0.3
Total	42,736,300	100.0

This shows an increase of 882,363 tons over the railroad statement for the previous season.

The shipments and receipts of Lake Superior ore are strictly kept at the docks and are carefully collected and compiled by the *Iron Trade Review*, and from that source we take the following figures. The first table gives the shipments from

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 shown in the second table.

	1909.	1910.
Stocks on docks, May 1	8,441,533	5,444,080
Receipts for the season	33,672,825	33,498,455
Total	42,114,358	38,942,535
Shipments to furnaces	33,148,569	29,515,654
Dock stocks, Dec. 1	8,965,789	9,426,881

In 1909 stocks on docks Dec. 1 were 524,256 tons more than on May 1; in 1910 the increase was 3,982,801 tons, although the December total increased only 461,092 tons.

The third table shows the season receipts and the stock remaining on docks Dec. 1 for three years past, at the various Lake Erie ports.

Deliveries to Lake Michigan ports, which are fully reported in 1910 for the first time, were: South Chicago, 5,080,-



679; Gary, 1,775,880; Indiana Harbor, 287,172; Milwaukee, 121,446; minor ports for northern Michigan charcoal furnaces, 186,907; total, 7,452,084 tons. Adding this to the Lake Erie receipts makes a total of 40,950,539 tons, leaving 1,669,667 tons, delivered to Lake Superior ports and to Canadian ports.

The season prices of Lake Superior ore on Lake Erie docks were as follows: Bessemer ore—base 55 per cent. iron and under 0.45 phosphorus—\$5 per long ton for Old Range and \$4.75 for Mesabi; nonbessemer ores—base 51.5 per cent. iron—\$4.20 for Old Range and \$4 for Mesabi. There prices apply to not more than 20 per cent. of the ore mined. The rest is from mines owned by the Steel Corporation and other large steel companies, and the price to them is a matter of bookkeeping, the real charge being the costs of mining and transportation. To the prices given above the cost of transportation from Lake docks must be added to get the cost of the ore at furnaces; this will run from 50c. to \$1 per ton, according to the situation of the furnaces.

**Imports and Exports**—In the latter part of 1909 some good contracts were made for delivery of foreign ore to Eastern furnaces. These were not all fully carried out, partly because the supplies were not needed, and in some cases because the ores did not come up to the standard expected. Cuban ores imported go for the most part to two or three large steel companies which control mines in the island; though there is some surplus for sale to outside users. In the table the receipts for December are estimated. For the 10 months for which we have full returns the imports included 1,251,960 tons from Cuba, 401,612 from Spain, 209,017 from Sweden, 140,040 from Canada, and 216,859 from other countries—much of this from Newfoundland. The imports were the largest ever recorded in a year.

Exports are chiefly of Lake Superior ore to Canadian furnaces.

**PIG IRON**

The production of pig iron was at its highest early in 1910, when the blast furnaces were turning out iron at the rate of 31,600,000 tons a year. Month by month, however, the rate fell off, especially during the last half of the year, and in December the make was at the rate of about 21,500,000 tons yearly. Notwithstanding this recession, the total reached the highest point ever reported.

The following table shows the production by half years for three years past.

	1908.	1909.	1910.
First half.....	6,918,004	11,022,346	15,012,392
Second half....	9,018,014	14,773,125	12,283,200
Total.....	15,936,018	25,795,471	27,295,592

For the first half of 1910 the figures are those collected and published by the American Iron and Steel Association—

as are the totals for 1908 and 1909; for the second half they are estimated on the basis of the monthly reports of the capacity of the active furnaces. The figures are, in long tons:

The increase of 3,990,046 tons in the first half of 1910 changed to a decrease of 2,489,925 in the second half; the total showing a gain over 1909 of 1,500,121 tons, or 5.8 per cent. If we take the second half of 1909 and the first half of 1910, we find that in the 12 months ended June 30, 1910, our furnaces made the great total of 29,785,517 tons—by far the greatest output ever recorded in 12 months, being nearly 4,000,000 above the high record made in the calendar year 1909. This total was still below the capacity of the furnaces, which could, on demand, turn out over 35,000,000 tons in a year.

Assuming that the production of the second half of the year was approximately on the same lines as that of the first half, the division of the output according to the uses for which the iron was intended was approximately as follows:

	1909.	1910.	Changes.
Foundry and forge.....	6,386,833	6,161,021 D.	225,812
Bessemer.....	10,557,370	11,482,948 I.	925,578
Basic.....	8,250,225	9,007,200 I.	756,975
Charcoal.....	376,003	403,898 I.	27,895
Spiegel and ferro.....	225,040	240,525 I.	15,485
Total.....	25,795,471	27,295,592 I.	1,500,121

It is probable that the final returns will make some changes in these figures; especially in the quantity of basic iron. The production of pig iron in the United States for 10 years has been as follows, in long tons:

1901.....	15,878,354	1906.....	25,307,391
1902.....	17,821,307	1907.....	25,781,381
1903.....	18,009,259	1908.....	15,936,018
1904.....	16,497,003	1909.....	25,711,846
1905.....	22,992,380	1910.....	27,295,592

As compared with 1901, the gain last year was 11,417,238 tons, or 71.9 per cent:

An incident of the decline in business of the latter part of the year was a large and important increase in the stocks of unsold or unused iron held by makers. No returns of stocks are made, and it is possible only to estimate them. From the best data available it is believed that these stocks were about 400,000 tons at the beginning of 1910, and at the close of the year they had grown to about 2,100,000 tons; an increase of 1,700,000 tons. Of these stocks probably less than 300,000 tons were held by the steel companies, which make iron for their own use, leaving 1,800,000 tons in the hands of the merchant furnaces. The merchant companies, which sell their iron in the form of pig, make about one-third of the iron produced, or 9,000,000 tons last year; so that they were carrying on Dec. 31 about one-fifth of their yearly production. This is a heavy burden and there is no wonder that it brought about low prices and a pressure to sell. Over 300,000 tons is

held in the South, almost all of it being foundry iron; the remainder is divided into foundry, basic and forge, with some bessemer pig. The large steel companies had a surplus from their own furnaces, and bought very little bessemer iron from outside producers.

To offset this, it is well known that stocks in consumers' yards are unusually small. The policy of buying for immediate use has been followed for months by both large and small users of pig iron; and probably there has been no time in recent years when the quantity in the yards of foundries and the smaller basic-steel makers has been so small. The consumers have been confident in their position, sure that they could get the iron when they needed it, and probably at lower prices; and they have transferred the burden of carrying stocks from their own shoulders to those of the makers.

The curtailment in output in the last quarter of the year was much greater at the steel-works stacks than at the merchant furnaces. The steel companies adjusted their make closely to current demands, while many of the merchant companies ran along in hope of a turn, naturally hesitating to incur the expense involved in blowing out a stack, unless it was forced upon them. They have waited long after the fact of overproduction had been impressed upon them.

The consumption of pig iron in the United States in 1910 was approximately as follows, December exports and imports being estimated:

Production for the year.....	27,295,592
Imports.....	237,000
Total supplies.....	27,532,592
Exports.....	120,000
Increase in stocks.....	1,700,000
Total deductions.....	1,820,000
Approximate consumption.....	25,712,592

This consumption for the year was approximately 639 lb. per capita; a decrease of 4 lb. as compared with the previous year.

**STEEL PRODUCTION**

There are no data on steel production during 1910 as yet available. Based on consumption of pig iron, however, the total steel output for the year may be roughly estimated at 24,750,000 tons, of which 9,650,000 tons were bessemer, 14,950,000 tons open-hearth and 150,000 crucible and special steels. For finished steel also no accurate figures are available. The business in structural steel was large; there was also a heavy make of bars and plates, while the sales of pipe, wire, nails and other construction materials were large. In foundry trade cast-iron pipe was an important factor. During the second half of the year railroad buying was light; but railroad orders no longer hold the predominating position in the trade which they once had.

The United States Steel Corporation

continued to be the most important factor in the industry, making about 60 per cent. of the finished steel. In the decline of production in the last quarter of the year the independent companies probably reduced their output in smaller proportion than the Steel Corporation.

#### CHANGES AND CONSOLIDATIONS

There were few important changes in 1910 in the way of consolidations or the organization of new companies. There was talk of a general merger of Southern iron companies; but it finally resolved itself into a consolidation of two smaller concerns, the Woodward Iron and the Birmingham Coal and Iron companies.

In new works the chief additions made were at the Steel Corporation plants at

Gard, Ind., and Birmingham, Ala. The Jones & Laughlin Steel Company and the Bethlehem Steel Company also made additions to their plants.

Labor conditions were generally quiet and while there were local disturbances, there were no important strikes. The Steel Corporation established a system of pensions for employees disabled by reason of old age or accidents. There were no reductions of importance in wages, and their level showed no great changes.

#### IMPORTS AND EXPORTS

*Iron and Steel*—Exports and imports of iron and steel in the United States for the 11 months ended Nov. 30 are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1909.	1910.	Changes.
Exports.....	\$142,605,148	\$182,970,193	I. \$40,365,045
Imports.....	27,079,199	36,267,677	I. 9,188,472
Excess, exp.	\$115,525,949	\$146,702,522	I. \$31,176,573

The increase in exports was 27.5 per cent. Rails and structural steel were large items in this gain, as was also material for the Panama Canal construction. The increase in imports was 33.9 per cent.; billets, heavy steel scrap and tinplates being large items.

The exports of iron ore for the 11 months were 453,443 tons in 1909, and 638,578 in 1910; an increase of 185,135 tons. Imports of iron ore were 1,472,348 tons in 1909, and 2,417,321 in 1910; an increase of 944,973 tons. The ore movement is referred to elsewhere.

## Iron and Steel Markets in 1910

By Frederick Hobart

As a rule the existence of a large consumptive demand is the cause and occasion of active and rising markets. In 1910 this rule was nullified by two causes. Consumption of iron and steel products was large throughout the greater part of the year, though there was some falling off toward its close. Large as the demand was, however, it failed to reach the level of the great production which was started in the second half of the preceding year. There was undoubtedly an overproduction, which resulted in an accumulation of unsold stocks which acted as a depressing weight on the market, when its existence became generally

recognized. This was especially the case with pig iron, where the blast furnaces continued to turn out metal in excess of the demand, and where curtailment in output was slow and irregular. In finished steel the adjustment of supply to demand was much closer, and sharp reductions were the rule during the third quarter of the year.

The close adjustment of the steel trade to immediate demand is shown by the statement that at the close of the year the Steel Corporation was operating its mills at about 55 per cent. of their capacity, and the leading independent concerns to between 60 and 65 per cent. This

capacity is greater by 25 to 30 per cent. than that of 1906-7; and there is little doubt that the total actual consumption of 1910 was but little behind that of those two boom years. Notwithstanding the increase in pig-iron stocks, of which so much has been said and written, the approximate consumption in 1910 as shown elsewhere in this article, was 25,712,000 tons, or 4000 tons more than in 1909.

The conditions are well expressed in the local reports which follow. These include Pittsburg and Birmingham, the two chief primary markets; Chicago, the chief distributing point in the West; and the local markets on the Seaboard.

## Pittsburg Iron and Steel Markets

By B. E. V. Luty

The year 1910 was one of almost continual decline in production and prices. In the retrospect it is obvious that the movement in the second half of 1909, following the great break in prices, was overdone. Prices during that period were advanced too rapidly, and buyers bought for forward delivery too freely. The two went together, for each burst of buying encouraged the mills to put up prices, and each advance in prices encouraged buyers to contract for additional tonnages.

At the beginning of 1910, however, this was not realized. There were those who expected prices to advance farther and demand to experience additional enlarge-

ment. This, however, did not occur. In spots pig iron had weakened slightly in the two closing months of 1909, and before the following February was out noticeable declines had occurred. Finished products soon began to follow suit. Wire products weakened slightly in February, and in April a well defined weakness appeared in plates and shapes. Some other commodities suffered occasional shading.

It will probably never be known with certainty whether the actual ultimate consumption of the country decreased during the first half of 1910. It is true the railroads sharply curtailed buying early in April, but that left large orders for bridge material, cars and locomotives still on books, and the actual consump-

tion of steel in filling them hardly decreased before July 1 at the earliest. In other directions there were no signs of actual reduction in ultimate consumption.

The course of production, nevertheless, was one of decline after February, this decline being rather rapid during April and May. There are good grounds for concluding that the rate of actual ultimate consumption underwent some increase during the first half of 1910, and that the decline in production simply represented the working off of contracts and orders placed during the excitement in the late months of 1909, the material being largely put in stock by jobbers, manufacturing consumers and others.

\*Bessemer building, Pittsburg, Penn.



The position in midsummer was that while the mills had accumulated no stocks, having regulated production to shipments, there were large stocks in buyers' hands. The industry faced curtailment of output until these stocks should be worked off, whereupon an increase in demand upon the mills could reasonably be expected. The event was not in conformance with these expectations, for production and shipments were

markable record, seeing that no calendar year had shown as much as 26,000,000 tons, although 1906, 1907 and 1909 had all exceeded 25,000,000 tons. Output in the second half of 1910 was about 12,300,000 tons, making 27,300,000 tons for the year. While this made a new record for a calendar year, the largest output for 12 consecutive months was slightly in excess of 29,800,000 tons, and was made from Aug. 1, 1909, to July 31, 1910.

### The Alabama Iron Market

BY L. W. FRIEDMAN

The year just closed showed a larger production of pig iron, so far as Alabama is concerned and perhaps the entire South, than any twelvemonth heretofore. The year, though, has not been as prosperous as former years; in fact the average has not even been fair. There will be found on furnace and warrant yards the first of the new year, when inventories are completed, more than 300,000 tons of pig iron. The quotations for the product during 1910 have not been high, \$12.50@13 per ton, No. 2 foundry, being a maximum, while a quantity of iron was sold on a basis of \$10.75@11 per ton, No. 2 foundry.

The production of pig iron in Alabama during 1909 amounted to 1,763,617 long tons. For the year 1910 it was 1,918,000 tons, showing an increase of 154,383 tons.

Steel operations during 1910 in the Southern territory were better than during the previous year. The plant of the Tennessee Coal, Iron and Railroad Company at Ensley had a fairly good year, though the demand for rails fell off toward the latter part of the year. Improvements were made at the rolling mills of the company at Bessemer, which permit the make of a larger quantity of steel; plates, bars and angles were in good demand.

All things considered, the Southern Iron and Steel Company did fairly well during 1910. The new rod, wire and nail mills, after they were started up, increased their make right along, the steel plant adjoining being kept in operation throughout the better part of the year.

Southern cast-iron pipe plants melted a larger amount of pig iron than ever before in a twelvemonth. While the profits were not large, there was a steady operation and a large consumption of iron. Foundries and machine shops did fairly well only during 1910. The home consumption, in other words, was not bad, though not altogether up to expectations.

### The Seaboard Iron Markets

SPECIAL CORRESPONDENCE

The seaboard markets include Philadelphia, which is also to some extent a primary market for a considerable district in eastern Pennsylvania; and New York, which supplies an active consuming district in New York State and New England. In raw iron and half-finished material the Seaboard is a large consumer of foundry iron, taking also forge and some basic, but little bessemer pig. It is a buyer of steel billets, of bars and plates

AVERAGE PRICES AT PITTSBURG, 1910.

	PIG IRON.				STEEL.					NAILS.	
	Bessemer.	Basic.	No. 2 Foundry.	Ferromanganese.	Bessemer Billets.	Beams	Plates.	Bars.	Black Sheets No. 28.	Wire per Keg.	Cut per Keg.
Jan. ....	19.90	17.77	17.83	46.20	27.00	1.55	1.55	1.48	2.40	1.85	1.80
Feb. ....	18.96	17.21	17.50	45.55	27.00	1.55	1.55	1.45	2.40	1.83	1.80
Mar. ....	18.48	16.99	17.02	44.70	27.00	1.55	1.55	1.45	2.40	1.80	1.80
Apr. ....	18.27	16.84	16.65	42.95	26.75	1.51	1.54	1.45	2.40	1.80	1.80
May. ....	17.10	15.94	16.20	42.95	25.85	1.50	1.50	1.45	2.40	1.80	1.80
June. ....	16.52	15.60	15.50	41.70	25.00	1.45	1.42	1.43	2.34	1.75	1.75
July. ....	16.40	15.40	15.25	41.20	25.00	1.42	1.40	1.45	2.25	1.72	1.73
Aug. ....	16.05	14.92	15.00	41.20	24.60	1.40	1.40	1.40	2.20	1.70	1.67
Sept. ....	15.92	14.73	14.90	41.35	24.25	1.40	1.38	1.40	2.15	1.70	1.65
Oct. ....	15.90	14.05	14.80	40.80	23.65	1.40	1.38	1.40	2.18	1.70	1.65
Nov. ....	15.84	14.26	14.65	40.45	23.25	1.40	1.37	1.40	2.15	1.70	1.60
Dec. ....	15.90	14.15	14.65	40.45	23.00	1.40	1.40	1.40	2.18	1.70	1.60
Year. ....	17.10	15.65	15.83	42.48	25.20	1.46	1.45	1.43	2.29	1.75	1.72
Year, 1909.	17.46	16.44	16.40	44.42	24.58	1.41	1.41	1.31	2.26	1.82	1.77

Prices of pig iron, ferromanganese and billets are per ton; of steel products, per pound; of nails per keg of 100 lb.

fairly well maintained during the third quarter and then, when the country was practically bare of stocks of finished products, demand underwent a great decrease, so that during the fourth quarter production was rapidly decreased.

If our conception is true, actual consumption of iron and steel increased during the late winter and early spring and was heavy during the summer, but experienced a very sharp decrease in the closing months.

The light railroad buying has been held largely responsible for the slump in demand. This cannot be proved, for the consumption of railroad material has been relatively light since 1907 and there is no ground for inferring that the railroads will ever again take nearly as large a percentage of the total iron and steel output of the country as they did in the years 1905-6-7. Railroad purchases, such as they might have been, were largely held up after April 1 on account of the refusal of the Interstate Commerce Commission to allow advances in freight rates, at least without exhaustive investigation.

#### FEBRUARY PIG-IRON PRODUCTION AT RATE OF 31,600,000 TONS PER ANNUM

Production in pig iron reached a rate of 31,600,000 tons per year in February, 1910, this being the high point in all history. The average rate from Oct. 1, 1909, to April 1, 1910, was 31,000,000 tons, and the actual output in the twelvemonth ended June 30, 1910, was very close to 30,000,000 tons. This was a re-

At the close of the year pig iron was being made at the rate of between 21,000,000 and 22,000,000 tons annually.

The steel works, which make about two-thirds of the total pig iron, regulated their output closely to their requirements, and did not accumulate pig iron, unfinished steel or finished steel. The merchant furnaces, which made about one-third of the total pig iron, or in the neighborhood of 9,000,000 tons, probably accumulated over 1,000,000 tons, thus practically doubling their stocks, entering the new year with stocks amounting to more than three months' run at the reduced output.

Finished-steel prices declined irregularly, but rather steadily, during the first seven months of the year, but after Aug. 1 suffered little if any decline. It was not generally understood that a "controlled market" was reestablished about that time, but such must have been the case. At the close of the year it was patent that a "controlled market" was in existence, and no effort was made to deny it.

Monthly prices of leading products at Pittsburg are shown in the accompanying table. The price of bessemer-steel rails has not changed since the advance from \$26 to \$28 in the spring of 1901; but in opening order books for 1911 the rail mills changed the basis to 1.25c. per lb., which is the exact equivalent of \$28 per gross ton. As specifications have been made more and more rigid, the quality of rails has been improved in the past few years, which is held equivalent to a slight reduction on the base price.

and an important market for structural material. An important part of the struct-

PRICES OF STEEL AND IRON  
AT TIDEWATER.

	Dec. 29, 1909.	Dec. 28, 1910.	Changes.
Pig iron:			
No. 2 X foundry, Phila., ton.....	\$19.00	\$15.50	D. \$3.50
No. 2 Southern, N. Y., ton.....	18.75	15.50	D. 3.25
Basic, Phila., ton.....	18.75	14.75	D. 4.00
Billets:			
Open-hearth, sea- board, ton.....	30.50	24.50	D. 6.00
Finished iron and steel:			
Refined iron bars, tidewater, lb....	1.65c.	1.35c.	D. 0.30c.
Steel bars, tide- water, lb.....	1.66c.	1.56c.	D. 0.10c.
Tank plates, tide- water, lb.....	1.71c.	1.56c.	D. 0.15c.
Beams and angles, tidewater, lb....	1.71c.	1.56c.	D. 0.15c.
Wire nails, tide- water, keg.....	\$2.05	\$1.90	D. \$0.15
Old Material:			
Old iron rails, Phila., ton.....	\$20.50	\$17.00	D. \$3.50
Old car wheels, Phila., ton.....	17.50	13.00	D. 4.50
Heavy steel scrap, Phila., ton.....	17.00	12.50	D. 4.50

ural business, however, is done through the large contracting and fabricating companies, which buy their rolled steel rather in Pittsburg than in New York or Philadelphia. An important part of the trade in finished material is done through the large jobbing houses.

*Pig Iron*—The opening of the year found consumers of pig iron pretty well stocked up through the heavy buying of October and November. After a quiet January business revived, and takings, of both foundry and basic, continued on a fair scale well through the first half of the year. In midsummer buyers began to be impressed with the belief that the merchant furnaces had been running on a higher scale than was warranted by the demand. Color was lent to this belief by some pressure to sell, especially from Southern makers, and the general opinion found expression in limited buying, based upon immediate needs. This was further helped by the financial conditions, the continued declines on the stock exchanges and the limitations on accommodations by many of the banks. There was some doubt, also, as to crop conditions; but the removal of this doubt later made little difference in the character of the buying. Except in a few short periods of panic and general depression, there have been few—if any—times when the stocks of pig iron carried in consumers' yards were so small as in the fourth quarter of 1910. The result was a gradual and continuous fall in prices of pig iron.

The accompanying table shows the prices of leading grades of pig iron and

of finished iron and steel at tidewater at the close of 1909 and 1910, with the changes during the year.

*Finished Material*—Throughout the year structural steel was the leader in the market. Not only were many large building projects forward in the larger cities throughout the East, but there was a steady growth—as in several years past—in the use of steel beams in the construction of smaller buildings. This is partly the result of stricter building and fire laws, and partly of the increasing cost of lumber, especially of the heavier beams used in the lower stories. Another source of building demand is found in the use of concrete structures, and this has increased so much that several of the larger companies have installed special mills for rolling the forms of bars used in reinforcing concrete.

The course of the market in finished products has been generally downward, though the decline was not so great in proportion as in pig iron. Moreover it is to be noted that during the last quarter the market was controlled—at first quietly, then openly. It is also to be noted that during December the larger fabricating companies in the East have been bidding for contracts at prices which involve a considerable further reduction in prices of steel.

## The Chicago Iron Market

By E. Morrison

With a record of gradually lowering prices from its beginning to its end, the year 1910 was a disappointment to those optimists who looked for a maintenance of the conditions that existed at the close of 1909. The volume of iron sold, however, was large and the year was unmarked by any violent disturbance of business. Overproduction, or a belief in it, accounted for the lowering of prices as the year advanced and for the reluctance of consumers to contract for much iron on the old plan of buying six to eight months ahead. Believing that there had plainly been overproduction, the melter concluded to go slowly and for the greater part of the year he bought not more than three months ahead. This condition was aided by furnace agents, who refused to accept current prices for deliveries far ahead, on the theory that the market was bound to turn in their favor.

In one respect the record of the year is peculiar. In previous years the heavy buying of one or a few large interests, at a low point in prices, turned the market upward. The few large sales or periods of heavy buying, in 1910, did nothing of the sort. In other words, the

average buyer of foundry iron, on whose needs the Chicago market chiefly depends, refused to be led into plunging by these examples. Seeing more iron ahead than the furnaces could easily dispose of, he held off from purchasing, with the result that he got lower and lower prices.

January opened with Northern No. 2 iron selling at \$19@19.50 and Southern at \$18.35@18.85 (\$14@14.50, Birmingham). Sales of pig iron were light, in striking contrast to the large sales of railroad and structural materials and other finished goods. The few buyers of pig iron were contracting for deliveries in the second half of the year. In February finished materials sold heavily with something of a struggle among buyers for the available stocks. In March sales of pig iron became so small that Northern and Southern sank 75c.@\$1 from the January quotations.

The situation was better for the local Northern furnaces than any other among the sellers, for in March they were well sold up for the first half and the Southern interests had much iron to dispose of. As the weeks went on there came further reductions. Northern reached \$17

in May, \$16.50 in July and \$16 in October. At the last named quotation it stayed until the end of the year. Southern's decline was more rapid. It fell to \$16.85 by the end of March, \$15.85 by June 1, and \$15.35 early in August, continuing at this point until December, when sales were made at 25c. less.

The highest prices of both Northern and Southern occurred thus in January and the lowest in December. Late in May about 60,000 tons was sold in large lots and in June there were further sales, some of 10,000 to 15,000 tons each. The average buyer kept to his policy of buying a few hundred tons for early delivery. Inquiries became numerous, however, for first-quarter needs of 1911. The furnaces refused to take offers of \$11.50, Birmingham, on such deliveries. Quotations, as they gave them (and as they are generally given in this review), pertained to deliveries not more than three to four months ahead. The furnaces weakened from this position by July, but by that time the melter had become less inclined to buy, for the drift of the market was plainly in his favor.

By the middle of August nearly all melters had covered their requirements



for 1910 and inquiry about 1911 deliveries became active again. Late in the month 40,000 to 50,000 tons were sold to a leading plow factory for first-half requirements. This also caused many other inquiries about large tonnage but few sales. In October and November other large sales were made, but they were isolated cases. November developed a large tonnage record, but this was due almost wholly to a large accumulation of small sales. Neither seller nor buyer cared, up to the close of the year, to contract for second-quarter or first-half needs on terms satisfactory to the other party. The last half of the year found a waiting spirit expressed constantly by both buyer and seller.

Highest and lowest prices for the year, compared with similar figures for 1909, are given in the accompanying table:

Sales of iron and steel products were large throughout the early part of 1910 and continued large in some lines,

PRICES OF IRON AND STEEL IN CHICAGO.

	1909.		1910.	
	High-est.	Low-est.	High-est.	Low-est.
Lake Superior charcoal.....	\$20.00	19.50	\$20.00	\$18.00
Northern No. 2 foundry.....	19.50	16.50	19.50	16.00
Southern No. 2 foundry.....	19.85	15.35	18.85	15.10
Bar iron.....	1.60c	1.30c	1.65c	1.35c
*Structural material.....	1.78c	1.40c	1.88c	1.58c

\*Beams and channels, 3 in. to 15 in., and angles, 3 in. to 6 x 4 in. or heavier.

though not the leading ones, until the close of the year. The failure of the railroads to purchase largely is held to

by some observers of the market to have caused the steady decline in prices. Structural materials sold heavily throughout the year and at the close many buildings requiring large tonnage were projected. The price of structural material at the beginning of the year was 1.78@1.88c.; in July it became 1.58@1.63c., which continued until the close of the year. Bar iron sold in January for 1.78@1.88c., dropping to 1.73@1.78c. in March, 1.50@1.60c. in April, 1.45@1.50c. in June and to its low record for the year, 1.35@1.40c., in October, this last quotation continuing into December.

Lake Superior charcoal iron had a slighter though steady decline, bringing \$19.50@20 in January, \$19@19.50 in March, \$18.50@19 in May and \$18@18.50 from the middle of October to the end of the year.

# The Lake Superior Iron Country

By Dwight E. Woodbridge \*

The year 1910 was an unfortunate one for Lake Superior iron-ore miners. When they made their plans for development and exploitation preparatory to the shipping season of 1910, affairs in iron and steel were booming and their sales were large, their prices were good and neither buyer nor seller was insisting too closely on penalties nor expecting to enforce them. Before the season of navigation had opened there was a change, the slump had come, and buyers were looking for opportunities to abrogate their ore contracts, providing they could not secure postponements in deliveries for a year or more.

All this made a new set of conditions for those who had planned stripping and other development on the basis of what sales they supposed they had closed, and the difficulties of financing such improvements were serious. Independent mining companies were especially affected. These people see no probability of improvement during 1911. Shipments of the year were large—slightly in excess of those for 1909, while furnaces were running under check for most of the season, and ended the year with a decided drop in active melting capacity. Nearly all the independent furnaces are loaded up with more ore than ever before at the close of navigation, more not only actually but relatively to the annual consumption. It is generally understood that the United States Steel Corporation will make shipments during next year about the same in volume as in 1910, though no definite statements have been made, or can be for some time to come.

\*Mining engineer, Duluth, Minn.

## NEW DEVELOPMENTS

Developments of the year have been marked by the usual changes and betterments. Exploration on the Cuyuna range has continued on a very considerable scale; a new district is being shown in the Marquette region; exploration on the Vermillion range has taken a new lease of life and is progressing under heavy expense and at many points; the Steel Corporation, that some time ago took over practically all the ore-bearing formation in the Baraboo district of southern Wisconsin, has spent a large sum there and is carrying on extensive operations; the great ore-beneficiating works of the Oliver company, at Coleraine, have started extensive and successful operations; various mechanical refinements looking toward the shipment of a higher-grade product are being considered seriously by many companies, and mining methods show the gradual change for the better. That has continued for a long time.

### CUYUNA RANGE

Throughout the year many drills were working on the Cuyuna. While some ore was shown it is incontrovertible that results have not been as great as expected. Some well known mine operators of the region go so far as to say there was no ore found during the year that could be sold in the market. While this is probably an exaggeration, the fact remains that the amount of merchantable ore so far found, aside from what is being opened by the Rogers-Brown Ore Company, is quite disappointing. To be sure, some sales of properties have been made, at good figures and at minimums, indicating the belief in a large tonnage,

but it is one thing to explore a piece of land for the seller, and quite another to check it by other series of holes, from the standpoint of the buyer, both parties being all the time honest and fair in their procedure. Probably no Lake Superior ore can be sold today that is not guaranteed at 50 per cent. natural iron and low phosphorus, and this 50 per cent. natural will mean about 56 per cent. iron dried at 212 deg. There may be a mine or two of that class of ore on the Cuyuna, but if more I do not know of them. When one recollects that drilling operations have been continual there for the past six or eight years, with as high as 100 drills busy at times, the results appear rather meager. The territory that is found to show an attraction by dipneedle work is continually increasing, and there may be important finds outside of that area already partially drilled, while there is abundant room within the explored region for more mines of large tonnage. Doubtless explorations will continue there for years, and it will not be possible to attempt for a long time any definite statement as to tonnage on the range. Holes have shown ore assaying as high as 68 per cent. iron and down to 0.12 phosphorus, which is exceptionally good, but the total tonnage of such ore is very slight.

### MARQUETTE RANGE

In the Negaunee district and elsewhere on the Marquette range, explorations were attended with good results, and the development of mines found in the past two or three years by drill operation has proceeded steadily. It is safe to say that never in its history was there so great a

tonnage as now developed on that range, nor were the prospects for a still greater addition so bright. The old Volunteer, long bandied about as of no value, is now a bessemer mine, with more than a million tons in sight. It is all an interesting commentary on the strength and persistence of orebodies in a field whose geological characteristics are deep-seated, permanent and healthy.

#### VERMILLION RANGE

Subsequent to and consequent upon the successful outcome of work at Section 30, Vermillion range, exploration in that district received a tremendous impetus. Perhaps in no part of the Lake Superior region is exploration so costly or so difficult, and nowhere is the use of the diamond drill less to be recommended. For these reasons progress has been slow, and I doubt if any company operating there is able to state definitely that it has a mine. One concern claims to have developed a very considerable tonnage of gold-bearing porphyry that assays from \$1 to \$80 per ton, but parties unconnected with this company have little positive information as to its results. It is improbable that all, or the major share, of companies now drilling and sinking on that range will find mines, but it seems reasonable to expect that properties of value may be developed there as the result of the present campaign. Much of the work has been conducted with a disregard for geological indications that is startling and almost unthinkable, but this criticism may be made of work in any mining field.

#### THE BARABOO RANGE

Hundreds of thousands of dollars have been expended during the year in the Baraboo region, by the Oliver Iron Mining Company, and the tonnage of medium nonbessemer ore there, suitable for use in furnaces belonging to interests associated with the mines themselves, has been materially increased.

#### THE MESABI REGION

Work of the year in the Mesabi region has been unproductive of good ore, and what has been found is mostly in small deposits. The so called "Hill deal," made between the United States Steel Corporation and the Great Northern Railway, in 1907, has been unsatisfactory to the lessee company, so far as known, in that the tonnage developed in addition to that shown prior to the execution of the lease is less than anticipated. Royalty rates on this ore, for the base of 59 per cent. iron, will be 98.6c. a ton in 1911, and the minimum tonnage that the Steel Corporation will be compelled to turn over to the Great Northern road will amount to 3,750,000 tons this year, 4,500,000 tons in 1912. In order to deliver so much to the road the Oliver Iron Mining Company has been busy opening and developing mines on Hill lands, and now has several of

them already shipping or about ready for the coming season of navigation. In order to care for the ore from other mines with which it has hauling contracts and this Oliver ore, the Great Northern will add to its dock and track facilities during the winter.

The above brief and cursory summary of exploratory and development operations on the various ranges about Lake Superior indicates that new discoveries of merchantable ore have been trifling in the past year, perhaps less than in any corresponding period since the discovery of the Mesabi range in 1890.

#### CONCENTRATING ORES

Successful inauguration of washing sandy west Mesabi ores by the Oliver Iron Mining Company at Coleraine in the great works erected there last year, began in the spring of 1910. This result, while fully expected, was most gratifying to those who had made an expenditure of millions in preliminary development and ore-land purchases. It has called attention of other consumers to the benefits to be derived from the use of beneficiated ores from the Mesabi, and several independent concerns are now making estimates of washeries for eliminating free sand and of drying works for driving off excess moisture in these ores, prior to their shipment from mines. But however interesting these experiments may be, and how well they may show on paper, it is a fairly safe bet that no independent company operating on the Mesabi will actually install such works. In the first place the tonnage of washable ore held by any company aside from the Oliver is too small to permit the expense of suitable plants at available locations; and in the second the cost of drying Mesabi ores, together with the expense of arrangements that must be provided for protecting dried ores in transportation, will be found prohibitive.

#### MINING IMPROVEMENTS

The concrete shaft is an up-to-date equipment of a permanent character that was not considered necessary in the earlier days, but for two or three years it has found favor, and in 1910 the Foundation Company sunk no less than 10 of these shafts. One of them, at the Morton mine, near Hibbing, is circular, 21 ft. inside diameter, with walls of reinforced concrete 4 ft. thick, and was bottomed on a ledge at the depth of 185 ft., making it by far the most pretentious job of the sort ever carried out in the Lake country. Similar though smaller, shafts have been sunk during the year at the Scranton, Woodbridge and Marble mines on the Mesabi, the North American on the Vermillion, two mines on the Cuyuna and several in the Menominee and Marquette districts. At the Biwabik mine, Mesabi range, there is a large amount of very hard ore, high in iron and phosphorus,

that has been left along the north wall of the deposit, as it could not be handled by shovels and would not be taken by furnaces in its original condition. What is said to be the largest ore crusher in existence, a gyratory of 500 tons per hour capacity, is now being installed at the mine for reducing this to convenient shipping size.

#### GRADING ORES

Grades of Lake ore shipped show a continued tendency toward reduction of iron content. This is due in part to the increasing proportion of total tonnage mined by furnace concerns, in part to an earlier policy that took the high grades, in part to the fact that newer mines are not so rich in iron as the early discoveries. One does not necessarily criticize them by stating that early miners took high grade; the necessity of securing a market for Mesabis, financial requirements that compelled operators to earn the money with which to pay for mines out of the mines themselves, and at once, and the pressure from furnaces, all combined to force a sort of robbery of high grade that is not now much in vogue.

#### PROSPECTS

As I said before, indications are for a slight diminution of product from Lake Superior this year. With 25,000,000 to 30,000,000 tons of ore on docks and in furnace yards at the close of the year, and with active capacity at low ebb and no expectation of immediate betterment in the situation, 1911 might be well toward its end before newly mined ore would be required by the furnaces. But the wise policy of maintaining large reserves, of carrying forward organizations and keeping men and equipment employed, will doubtless make of 1911 an average year. It is expected that United States Steel Corporation mines on all ranges will maintain their production about as during the past season; at any rate there is so far no sign of curtailment. Naturally ore-carrying roads are not materially increasing facilities, for they were all prepared, at the beginning of navigation last year, to handle a tonnage much greater than they were given. The Duluth, Missabe & Northern is now equipped for the delivery at Duluth in a season of navigation of 16,000,000 tons of ore; in 1910 it moved 13,600,000 tons. Aside from some double tracking, etc., for the Great Northern and some additional rolling stock and a steel shipping pier to replace a worn-out wooden dock for the Duluth & Iron Range road, railway betterments for the ore trade are exceedingly slight. The same is true of ore ships; with a capacity afloat that can move with ease 50,000,000 tons in the season, new contracts at Lake yards are trifling, and only for mining companies whose policy is to gradually equip themselves to handle all theirs in their own ships.



# Chronology of Mining for 1910

In the following summary, important events are recorded under date of happening so far as known; but in some cases the dates represent the time of publicity rather than of occurrence:

## JANUARY

*Jan. 1*—Floods destroyed 100 miles of the Salt Lake-Los Angeles railroad in Nevada, greatly impeding mining.

*Jan. 8*—Fire destroyed warehouses and stores of Dolores company at Madera, Chih., Mexico. Loss, \$100,000.

*Jan. 13*—Pearl Consolidated mine, Idaho, sold to J. H. Harper of Spokane, Wash., for \$225,000.

*Jan. 14*—Payment in full of 500,000 pesos made by Marcus Daly estate for Cinco Minas property in Jalisco, Mexico.

*Jan. 15*—Homestake mine resumed partial operations with nonunion men, the principal mines of district adopting card system.

*Jan. 23*—Mill of Wasp mine at Lead, S. D., burned. Loss, \$97,000.

*Jan. 26*—Payment of 9,000,000 pesos made by the Camp Bird, Ltd., of London, for the Santa Gertrudis mine in Hidalgo.

*Jan. 26*—E. A. Wall's injunction against Utah Copper Company dissolved and absorption of Boston Consolidated by Utah Copper Company consummated.

*Jan. 29*—A fire damaged the shaft of the Goldfield Consolidated at Goldfield, Nev., to the extent of \$60,000.

*Jan. 31*—Explosion in coal mine at Primero, Colo., results in large loss of life.—Directors of Nevada Consolidated Copper Company vote to submit proposed merger with Utah Copper Company to a vote of the stockholders.

## FEBRUARY

*Feb. 1*—Explosion in Browder mine of Elk Valley Coal Company near Drakesboro, Ky.; 34 killed.—Fire destroyed tiple and shaft buildings at Scholl Brothers' mine near Bartonville, Ill.

*Feb. 2*—Explosion at Palau mine, Las Esperanzas, Coah., Mex.; 68 killed.

*Feb. 5*—Explosion at Ernest No. 2 mine of the Jefferson & Clearfield Coal and Iron Company at Indiana, Penn.; 11 killed.

*Feb. 7*—Property of Cockerill Zinc Company passes into charge of its bondholders.

*Feb. 8*—Explosion in the mine of the Stearns Coal Company, Stearns, Ky.

*Feb. 17*—Strike of the engineers' union at Butte, Montana.

*Feb. 25*—Arguments in the Trust suit against the anthracite-coal-carrying com-

panies were closed in the U. S. Circuit Court in Philadelphia, and the court took the case under advisement.

*Feb. 26*—Indian tariff increase on silver from 5 per cent. to four annas per oz. (about 16 per cent.) announced.

*Feb. 27-28*—Avalanches at Mace and Burke, Ida., caused large loss of life.

## MARCH

*March 1*—Judgment of \$2,464,660 entered against Lanyon Zinc Company and an order of foreclosure granted to Trust Company of America, the trustee for the bondholders.

*March 2*—Explosion of powder magazine in Alaska-Mexican mine, Treadwell, Alaska; 37 killed.—Homestake mine, South Dakota, announced full resumption after strike of Nov. 23, 1909.—Floods in Nevada stopped railroad traffic and interfered with ore movement.

*March 4*—Skookum camp, 20 miles north of Roslyn, Wash., wiped out by avalanche.

*March 6*—Fire destroyed No. 1 bunker of the Nay Aug Coal Company, near Scranton, Penn.; loss \$60,000.

*March 7*—Strike of engineers in Butte (Mont.) mines ended.

*March 12*—Seven miners killed by gas explosion in No. 3 shaft of the Lehigh & Wilkes Barre Coal Company.

*March 16*—The Government filed suit against Anaconda Copper Mining Company to compel it to abate alleged smoke nuisance.

*March 17*—Prairie Oil and Gas Company advanced price of crude oil in the Midcontinental field, the first advance in three years.

*March 23*—Collapse in price of shares of Granby Consolidated Mining, Smelting and Power Company.—Anaconda Copper Mining Company increased capitalization to 6,000,000 shares, or \$150,000,000, to absorb Amalgamated Copper properties.

*March 24*—Commonwealth mill, Pearce, Ariz., burned; loss \$150,000.

*March 26*—Montezuma Mines Company, of Costa Rica, filed petition of bankruptcy.

*March 28*—The Butte & Superior Copper Company purchased the North Butte Extension property at Butte.

## APRIL

*April 1*—All of the organized coal workers of the Eastern and Central coalfields quit work.—Wages of iron miners in Lake Superior region increased by U. S. Steel Corporation from 6 to 8 per cent.

*April 4*—Mount Hope washery near St. Clair, Penn., burned.

*April 9*—Fire at Consolidated mill, Goldfield, Nev., destroyed refinery, conveyor and trestle to mill and damaged 20 stamps, causing cessation of all milling operations for seven days.

*April 10*—Application for receiver for Mitchell Mining Company, owning La Dicha mine, Guerrero, Mexico.

*April 11*—Property of Lanyon Zinc Company sold at sheriff's sale, and bid in for \$265,550 by the bondholders.

*April 13*—Shipping from open pits began on Mesabi range, Minnesota.—U. S. Steel Corporation advanced wages of its 200,000 employees.

*April 14*—Ten men killed in Santa Gertrudis mine, Pachuca, Mex., by failure of air compressor to supply ventilation.

*April 16*—Consolidated Arizona company resumed smelting at Humboldt, Arizona.

*April 20*—British Columbia Copper Company secures practical control of the New Dominion Copper Company—Merger of Dominion Iron and Steel and Dominion Coal companies approved at joint directors' meeting.—Beer, Sondheimer & Co., take over Altoona works of Cockerill Zinc Company under lease.

*April 21*—Forty-one men killed by explosion in coal mine at Mulga, Alabama.

*April 22*—Mine explosion at Amsterdam, O., kills 18 men.

*April 25*—Compromise effected between Bunker Hill & Sullivan and Federal companies, the latter relinquishing the Last Chance mine in Idaho in exchange for 27,000 Bunker Hill shares.

*April 24*—Accident, caused by a cave, in the Camelia mine, Pachuca, Mex., kills seven miners.

*April 30*—Coal strike practically settled in Indiana, Ohio and Pittsburg.

## MAY

*May 1*—Nevada Consolidated listed on New York Stock Exchange.

*May 5*—Explosion in the Palos coal mine at Birmingham, Ala., killed 83 miners.

*May 12*—Explosion in the Wellington coal mine near Manchester, England, killed 136 miners.

*May 14*—Announcement that Anaconda had acquired the copper mines and works of W. A. Clark, at Butte.

*May 16*—The President signed the Bureau of Mines bill.

*May 17*—A. Y. & Minnie surface plant at Leadville burned. Loss \$25,000.

May 21—Mogollon mill at Cooney, New Mex., destroyed by fire.

## JUNE

June 8—Five killed by falling cage at Richmond mine of the Thomas Iron Company, at Dover, N. J.

June 13—Black Mountain mine, at Cerro Prieto, Son., Mexico, closed because of exhaustion of ore.

June 15—Fire destroys surface plant of Empire State property, Cripple Creek, Colo.

June 16—Arizona-New Mexico statehood bills passed by Congress.

June 17—Announcement of proposed issue of \$2,500,000 bonds by Utah Copper Company, to build a railroad from Bingham to Garfield.

June 20—Receiver appointed in Arizona for the Cieneguita Copper Company, of Sonora.

## JULY

July 1—Bureau of Mines established with George Otis Smith, director of the Geological Survey, as temporary head. Bully Hill smeltery, Shasta county, Cal., closed by order of Federal forestry agents.

July 3—Surface plant of Vulcan Sulphur Company, Vulcan, Colo., burned.

July 5—Suit involving Creede, Colo., mines, decided by Supreme Court after 11 years' litigation.

July 6—Water in the Comstock mines of Nevada lowered to 2502 ft., the lowest point since the flood of 1885.—Verdict against George D. Barron, of New York, for \$11,529,542 rendered in Mexican courts, the case growing out of the negotiations involving the Teziutlan copper mine, in Puebla, but not involving the Teziutlan Copper Company.

July 7—The Mines Company of America absorbs the El Rayo and Dolores companies in Chihuahua, and acquires the La Dura mine, in Sonora, and increases capital to \$9,000,000.—The Chino Copper Company let a contract for a 3000-ton mill to be erected in Silver City district, New Mexico.

July 8—Nevada "wildcat" mining law sustained by the State Supreme Court.

July 14—Apex and title suit against Tuolumne Copper Mining Company brought by the North Butte company.

July 15—Washoe sampling mill, Butte, Mont., burned; loss, \$75,000.—The Kennon Coal Company's power plant at Flushing, W. Va., burned.

July 19—New Portland cyanide mill at Cripple Creek started.

July 25—Smelting begun at Tooele plant of International Smelting and Refining Company.

July 26—Utah Copper Company announced its decision to curtail produc-

tion because of unsatisfactory market conditions.

## AUGUST

Aug. 1—Copperton mill, Bingham cañon, Utah, closed permanently.—Strike of coal miners of the Southwest declared, affecting 38,000 men.—Inauguration of plans for copper curtailment by Anaconda, Cole-Ryan, P. D. & Co., Utah-Nevada and Rio Tinto interests.

Aug. 2—Explosion in coal mines of the Cerro de Pasco company in Peru kills 60 men.

Aug. 5—Fire destroyed tippie and power house of Pennsylvania Coal and Coke Company, at No. 9 mine, near Crescon, Penn.; loss, \$100,000.

Aug. 6—Balaklala smelting plant at Coram, Cal., closed to await completion of Cottrell apparatus for eliminating smoke difficulties.

Aug. 10—Fire does surface damage of \$100,000 at Best & Belcher mine, Comstock lode, Nevada.

Aug. 12—A fire at the Granby mine in British Columbia destroyed buildings valued at \$70,000.

Aug. 13—Midget-Bonanza mill, Cripple Creek, Colo., struck by lightning and burned.

Aug. 20—U. S. Land Office ruled that lands in the oilfields cannot be patented unless discovery precedes location.—McCabe and Gladstone properties in Arizona sold to F. M. Murphy, \$150,000.

Aug. 21—Forest fires in the Northwest States damaged mines and mining towns. Wallace, Idaho, being partly destroyed.

Aug. 24—United Zinc and Chemical Company ceases smelting at its Iola plant.

Aug. 29—Associated Oil Company bought the McMurray and Hoepfner holdings in the Midway, California, field for \$3,000,000.

## SEPTEMBER

Sept. 1—Announcement of the abandoning of Le Roi mine in British Columbia by the London company.

Sept. 4—Wage agreement between Southwestern coal operators and miners closed.

Sept. 5—Joseph A. Holmes appointed director of the Bureau of Mines.

Sept. 9—Phelps, Dodge & Co., Inc., acquire a large stock interest in the Rock Island railway.

Sept. 10—Wage agreement between Illinois coal operators and miners closed.

Sept. 14—Completion of transfer of Cumberland-Ely mine to Nevada Consolidated Copper Company.

Sept. 19—In Wales, 250,000 miners went on strike.

## OCTOBER

Oct. 1—Announcement of the discovery

of important bodies of oxidized zinc ore at Leadville, Colo., mines.

Oct. 3—Explosion at Palau coal mine, Las Esperanzas, Coah., Mexico, kills more than 70 miners.

Oct. 5—American Metal Company takes over works of Lanyon-Starr Smelting Company at Bartlesville, Okla.

Oct. 8—Explosion in coal mine at Starkville, Colo., 60 killed.—Five killed in Rebaje shaft of Sirena mine at Guanajuato, Mexico, by a slide.—First shipment of asbestos from the Wyoming district.

Oct. 10—Fire destroyed the Magna Charta mine buildings at Butte, Mont.

Oct. 15—Announcement of sale of the Hidalgo Mining Company properties, including the railroad, at Parral, Chih., Mexico, to an American syndicate headed by A. J. McQuatters for \$1,500,000.—Cottrell fume process inaugurated at Coram, California.

Oct. 18—Four miners killed at Cleveland Cliffs' North Lake iron mine near Ishpeming, Mich.—Explosion in Sigfried potash mine, at Sarstedt, Prussia, kills 16 men.

Oct. 31—Announcement of the sale of the Sinaloa smelting concession to Pacific Smelting and Mining Company of New York.

## NOVEMBER

Nov. 1—Zinc smelters in Kansas and Oklahoma begin to receive calamine from Leadville.

Nov. 6—Explosion at Lawson mine, of the Pacific Coal Company, at Black Diamond, Wash., kills 15 and does \$250,000 damage.

Nov. 7—Fire destroys plant of Pennsylvania Coal Company, at Jamestown, Ark.; damage, \$100,000.

Nov. 8—Explosion in Mine 3 of the Victor-American Fuel Company, Delagua, Colo., kills 45.

Nov. 12—Renewal of the European spelter convention, which with some modifications is extended from Jan. 1, 1911, to April 1, 1914.

Nov. 18—Newhouse tunnel, at Idaho Springs, Colo., completed; length, 21,968 ft.—Roosevelt deep-drainage tunnel, Cripple Creek, Colo., taps water from El Paso shaft.

Nov. 20—Serious political disturbances break out in Mexico, preceded by anti-American demonstrations in Mexico City and Guadalajara.

Nov. 26—Ten miners killed by explosion in Providence, Ky., coal mine.

Nov. 28—Compromise announced in the North Butte-Tuolumne apex and title suits, at Butte, Mont.—Explosion in the Jumbo asphalt mine, at Durant, Okla., kills 13.

Nov. 30—Montgomery-Shoshone mine, at Rhyolite, Nev., closed permanently



after exhaustive exploration by drilling.—Close of navigation from Lake Superior iron and copper mines.—President Broughton, of Utah Consolidated, announced that redetermination of ore reserves of Highland Boy mine showed them to be less than half of what was supposed.

DECEMBER

Dec. 4—Fire at Copperhill, Tenn., destroyed about 100 houses of miners.

Dec. 7—Consummation of purchase of property of the J. C. Trees Oil Company in Louisiana by a subsidiary of the Standard Oil Company at price reported to be \$7,000,000.

Dec. 9—Announcement of purchase of large tract of Texas iron lands by

Charles M. Schwab and associates.—Explosion in mine of Western Canada Collieries Company at Bellevue, Alberta, killed 31 men.

Dec. 10—Federal suit brought against Southern Pacific to recover 6000 acres of oil land in Kern county, Colo., worth \$10,000,000.

Dec. 12—Second "harmony" dinner of copper producers.

Dec. 14—Explosion in the Green mine of Bend & Bruce Coal Company at Tacoma, Va., killed 22 men.

Dec. 15—Balaklala smelter at Coram, California, closed down to make further adjustments to overcome smoke difficulties.—Explosion in Leyden coal mine at Leyden, Colo.; 12 killed.

Dec. 16—Rail mill at Gary, Ind., the

largest of the U. S. Steel Corporation, closed on account of slack business.

Dec. 19—Explosion in Middleton mine of Consolidation Coal Company, near Fairmont, W. Va., killed two men.

Dec. 21—Explosion at Little Hulton colliery, near Bolton, Eng., killed 360 men.

Dec. 24—Four men killed at New River collieries, Eccles, W. Va., by falling bucket.

Dec. 27—Boston & Montana company dissolved after voting to exchange its shares for those of the Anaconda company.

Dec. 31—El Paso Tin Mining and Smelting Company announced this month first shipment of tin bars from property, near El Paso, Texas.

# Mining Company Dividends in 1910

The tables published herewith show the dividends paid in 1910 and to date by a number of the principal mining, metallurgical, holding and industrial companies in the United States, and by mining companies in Canada, Mexico and in Central America. The foreign companies listed are mostly those in which American capital is heavily interested. Totals of such a list necessarily cannot be regarded as complete, as there are many very profitable close corporations, the dividends of which are not published, and other companies are omitted for various reasons. However, the figures serve to indicate the immense import of this basic industry. Ninety-five operating mining companies in the United States paid a total of \$56,508,205 in dividends in 1910; 47 metallurgical, industrial and holding companies in the United States paid a total of \$140,244,508 and 30 foreign mining companies paid \$11,821,372.

COMPARISON OF 1910 AND 1909 RECORDS

A comparison of the tables herewith given and the similar ones published a year ago in the JOURNAL will show that many more mining companies throughout the States paid dividends in 1910 than in 1909, and that those companies which paid in both years, as a rule paid more during 1910 than they did during 1909. In support of this last statement may be cited the fact that five principal gold-mining companies in the United States and Alaska that appear in the tables for both years, paid in 1910, \$11,472,746, as against \$7,357,016 in 1909, an increased distribution of \$4,115,730. Considering eight of the largest copper companies that paid in both years, it is seen that the total for 1910 is \$13,798,572, which figure is \$5,723,440 larger than the total paid in 1909 (\$8,075,132). The four

MINING COMPANIES—UNITED STATES.

NAME OF COMPANY AND SITUATION.	SHARES.		DIVIDENDS PAID.					
	Issued.	Par Value.	1910.		To Date.	Latest.		
			Per Share.	Total.	Total.	Date.	Amt.	
Acacia, g.	Colo.	1,438,988	\$ 1			\$115,229	Dec. '09	\$0.01
Adams, s.l.c.	Colo.	80,000	10			778,000	Dec. '09	0.04
Alaska Mexican, g.	Alas.	180,000	5	1.90	\$ 342,000	2,742,381	Nov. '10	0.30
Alaska Treadwell, g.	Alas.	200,000	25	4.25	850,000	11,735,000	Nov. '10	1.00
Alaska United, g.	Alas.	180,200	5	0.75	135,150	792,830	Nov. '10	0.30
Am. Zinc, Lead & Sm.	Kan.	80,120	25	1.50	120,180	440,240	Jan. '11	0.50
Anaconda, c.	Mont.	6,000,000	25	2.00	9,600,000	57,900,000	Jan. '11	0.50
Argonaut, g.	Cal.	200,000	5	0.35	70,000	1,200,000	June '10	0.05
Arizona Copper, pf.	Ariz.	1,266,120	1.20	0.15	119,261	1,569,478	Nov. '10	0.047
Arizona Copper, com.	Ariz.	1,519,896	1.20	0.60	923,330	12,199,065	July '10	0.30
Atlantic, c.	Mich.	100,000	25			990,000	Feb. '05	0.02
Bagdad-Chase, g., pf.	Cal.	84,819	5			202,394	Jan. '09	0.10
Bald Butte, g.s.	Mont.	250,000	1			1,354,648	Oct. '07	0.04
Baltic, c.	Mich.	100,000	25	5.00	500,000	6,050,000	Sept. '10	5.00
Beck Tunnel, g.s.l.	Utah	1,000,000	0.10			675,000	Oct. '07	0.02
Bingham-New Haven, c.	Utah	228,690	5			68,669	Aug. '07	0.10
Boston-Sunshine, g.	Utah	150,200	1	0.04	6,008	19,522	June '10	0.02
Boston & Montana, c.	Mont.	150,000	25	14.00	2,100,000	71,225,000	Nov. '10	4.00
Bull. Beck & Champ., g.	Utah	100,000	10			2,728,400	July '08	0.10
Bunker Hill Con., g.	Cal.	200,000	1	0.70	140,000	406,000	Dec. '10	0.05
Bunker Hill & Sull., l.s.	Ida.	327,000	10	3.15	1,007,100	12,293,100	Dec. '10	0.25
Butte & Ballaklava, c.	Mont.	250,000	10	0.50	125,000	125,000	Aug. '10	0.50
Caledonia, l.s.c.	Ida.	1,300,000	1	0.04	52,000	52,000	June '10	0.01
Calumet & Arizona, c.	Ariz.	200,000	10	3.00	600,000	11,500,000	Sept. '10	1.00
Calumet & Hecla, c.	Mich.	100,000	25	29.00	2,900,000	113,450,000	Sept. '10	7.00
Camp Bird, g.s.	Colo.	1,100,000	5	0.96	1,013,050	6,779,700	Nov. '10	0.24
Centennial-Eur., l.s.g.c.	Utah	100,000	5	6.00	600,000	2,700,000	Oct. '10	3.00
Center Creek, l.z.	Mo.	100,000	10	0.20	20,000	410,000	Oct. '10	0.05
Central Eureka, g.	Cal.	398,425	1			778,920	Mar. '06	0.05
Champion, c.	Mich.	100,000	25	7.00	700,000	5,700,000	Dec. '10	1.00
C. K. & N., g.	Colo.	1,431,900	1			171,828	Nov. '04	0.01
Cliff, g.	Alas.	100,000	1	0.80	80,000	80,000	Oct. '10	0.15
Colo. Gold Dredging	Colo.	100,000	10	0.50	50,000	100,000	Nov. '10	0.25
Colorado, l.s.g.	Utah	1,000,000	0.20	0.24	300,000	2,330,000	Dec. '10	0.06
Columbus Con., g.s.	Utah	285,540	5			226,832	Oct. '07	0.20
Commercial Gold	Ore.	1,750,000	1			43,750	Dec. '10	0.004
Con. Mercur, g.	Utah	1,000,000	1			3,385,313	Dec. '06	0.02
Continental, z.l.	Mo.	22,000	25			242,000	Jan. '11	0.50
Copper Range Con., c.	Mich.	384,185	100	4.00	1,536,336	10,757,776	Jan. '11	1.09
Creede United, g.	Colo.	1,625,000	1			214,053	July '06	0.004
Cripple Creek Con., g.	Colo.	2,000,000	1			180,000	Mar. '05	0.004
Cumberland Ely, c.	Nev.	1,300,000	5	0.30	390,000	390,000	Sept. '10	0.10
Daly Judge, s.l.	Utah	300,000	1			225,000	Apr. '07	0.37
Daly West, s.l.	Utah	180,000	20	0.90	162,000	6,201,000	July '10	0.30
De Lamar, g.s.	Ida.	80,000	5			835,200	Sept. '06	0.24
Dr. Jack Pot Con., g.	Colo.	3,000,000	0.10			37,500	Dec. '09	0.004
Doe Run, l.	Mo.	65,782	100	6.00	394,596	2,547,152	Dec. '10	1.50
Elkton Con., g.	Colo.	2,500,000	1	0.07	187,500	2,704,459	Dec. '10	0.01
El Paso, g.	Colo.	2,450,000	1	0.01	24,500	1,389,045	Mar. '10	0.01
Federal M. & Sm., com.	Ida.	60,000	100			2,708,750	Jan. '09	1.50
Federal M. & Sm., pf.	Ida.	120,000	100	7.00	840,000	6,011,250	Dec. '10	1.75
Findley, g.	Colo.	1,250,000	1			337,500	Sept. '06	0.01
Florence, g.	Nev.	1,050,000	1	0.10	105,000	735,000	Apr. '10	0.10
Frances Mohawk, g.	Nev.	912,000	1			546,000	Jan. '08	0.05
Free Coinage, g.	Colo.	10,000	100			180,000	Dec. '09	1.00
Frontier, z.	Wis.	1,239	100	27.00	33,453	74,340	Dec. '10	5.00
Gemini-Keystone	Utah	5,000	100			2,000,000	Aug. '07	10.00
Gold Coin of Victor	Colo.	1,000,000	1			1,350,000	Feb. '09	0.02
Gold Dollar Con., g.	Colo.	2,500,000	1			62,500	Oct. '09	0.004
Gold King Con., g.	Colo.	5,750,370	1			1,234,808	Dec. '09	0.01
Gold Roads	Ariz.	300,000	10			150,000	Nov. '06	0.25
Gold Sovereign	Colo.	1,800,000	1			30,000	Nov. '09	0.004

principal lead companies in the United States paid a total of \$2,841,696 in 1910, as against \$2,435,301 in 1909, this being an increase of \$406,395. On the other hand the three largest silver companies paid \$325,000 more in 1909 than last year, during which \$1,912,500 was paid. This was notwithstanding the fact that the Tonopah Mining Company increased its dividend and Tonopah-Belmont again entered the list. The great fall was in the record of the Silver King Coalition, which company was in litigation throughout the year and only paid one dividend in January.

RECORD OF INDIVIDUAL COMPANIES

Of the individual companies the record of the Goldfield Consolidated Mines Company is most noteworthy. This company increased its dividends from \$3,909,616 in 1909 to \$7,117,696 in 1910, which is probably the largest sum ever paid by any gold mine in the world for a single year. The Homestake, Alaska-Treadwell, Anaconda, Boston & Montana, North Star, Copper Range, United Verde, Utah Copper and Wolverine continued their remarkable disbursements

The individual companies grouped under the heading of "Industrial, Metallurgical and Holding Companies" exhibited little change in their records for 1910 as compared with those for 1909. There were, however, increases in a general way throughout the whole list, and in several cases large bonuses were declared by the companies, as for instance in the case of the International Nickel Company on its common stock, General Chemical on its common stock, etc. In this class a number of the companies are worth special mention. The enormous sums paid by the Standard Oil (\$38,000,000) and United States Steel Corporation (\$27,956,636 on common stock, and \$26,219,676 on preferred stock) serve to indicate the immensity of the business of these corporations. Of the mining holding companies, Phelps, Dodge & Co., with a record of \$5,392,152, and Amalgamated with \$3,077,756, for 1910, are to be noted. The American Agricultural Chemical Company, Virginia-Carolina Chemical Company and the General Chemical Company each paid the usual large totals in dividends. Of the coal-mining companies, Consolidation Coal Company of Maryland, with \$1,141,480 paid in dividends in 1910, Lehigh Coal and Navigation with \$1,931,744 and Pittsburg Coal with \$1,485,048 are worthy of note.

FOREIGN MINING COMPANIES

The Mexican mining companies exhibit the usual creditable record, four of the largest having a total of \$2,274,252 paid in 1910. The foreign companies, however, which have attracted the greatest attention in the United States are those operating at Cobalt. Considering

MINING COMPANIES—UNITED STATES—(Continued).

NAME OF COMPANY AND SITUATION.	SHARES.		DIVIDENDS PAID.				
	Issued.	Par Value.	1910.		To Date.	Latest.	
			Per Share.	Total.	Total.	Date.	Amt.
Golden Cycle, g. .... Colo.	1,500,000	\$1			573,300	Dec. '05	0.04
Golden Star, g. .... Ariz.	400,000	5	0.05	20,000	140,000	Mar. '10	0.05
Goldfield Alamo, s.l. .... Nev.	700,000	1	0.06	42,000	42,000	May '10	0.03
Goldfield Comb. Fra., g. .... Nev.	922,000	1			92,111	Nov. '09	0.10
Goldfield Con., g. .... Nev.	3,558,367	10	2.00	7,117,696	12,806,500	Jan. '11	0.50
Grand Central, g. .... Utah	250,000	1	0.12	30,000	1,557,500	July '10	0.06
Granite, g. .... Colo.	1,650,000	1	0.01	16,500	263,000	Dec. '10	0.01
Hazel, g. .... Cal.	900,000	1	0.07½	67,500	711,000	Dec. '10	0.00½
Hecla, l.s. .... Ida.	1,000,000	0.25	0.20	200,000	2,110,000	Dec. '10	0.02
Hercules, l.s. .... Ida.	1,000,000	1		536,000	3,500,000		
Homestake, g. .... S. D.	218,400	100	5.00	1,092,000	26,228,840	Dec. '10	0.50
Horn Silver, c., s.c.z.l. .... Utah	400,000	25			5,642,000	Sept. '07	0.05
Imperial Copper .... Ariz.	500,000	10			300,000	June '07	0.20
Iowa, g.s.l. .... Colo.	1,666,667	1	0.01	16,666	183,500	June '10	0.01
Iron Blossom, s.l.g. .... Utah	1,000,000	0.10	0.20	200,000	680,000	Sept. '10	0.06
Iron Silver, s.l.g. .... Colo.	500,000	20	0.40	200,000	4,350,000	Oct. '10	0.10
Jamison, g. .... Cal.	390,000	10	0.04	15,600	370,500	July '10	0.02
Jerry Johnson, g. .... Colo.	2,500,000	0.10			100,000	Dec. '09	0.01
Kendall, g. .... Mont.	500,000	5	0.08	40,000	1,325,000	Dec. '10	0.02
Kennedy, g. .... Cal.	100,000	100	0.03	30,000	1,831,001	April '10	0.03
King of Arizona, g. .... Ariz.	200,000	1			396,000	Aug. '09	0.12
Liberty Bell, g. .... Colo.	130,551	5	1.00	130,551	522,093	Oct. '10	1.00
Little Bell, l.s. .... Utah	300,000	1	0.15	45,000	60,000	Sept. '10	0.05
Little Florence, g. .... Nev.	1,000,000	1			430,000	Jan. '08	0.03
Lower Mammoth .... Utah	250,000	1			57,000	Sept. '07	0.07½
MacNamara, s.g. .... Nev.	728,341	1	0.02½	18,363	40,213	May '10	0.02½
Mammoth, g.s.c. .... Utah	400,000	25			2,220,000	Mar. '08	0.05
Mary McKinney, g. .... Colo.	1,309,252	1	0.01	13,092	894,363	June '10	0.01
May Day, g.s.l. .... Utah	800,000	0.25			108,000	Sept. '08	0.01½
Mohawk Min. Co. .... Mich.	100,000	25	2.00	200,000	2,150,000	Aug. '10	1.00
Montana-Tonopah, s.g. .... Nev.	921,865	1	0.06	60,000	210,000	Dec. '10	0.06
Mountain, c. .... Cal.	250,000	25			4,216,250	May '08	0.44
National, g. .... Nev.	750,000	1	0.15	112,500	112,500	Sept. '10	0.05
Nevada Con., c. .... Nev.	1,151,200	5	1.50	1,726,800	2,158,500	Dec. '10	0.37½
Nevada Hills, g. .... Nev.	746,000	5			373,000	Dec. '07	0.10
New Century, z.l. .... Mo.	330,000	1			237,600	Oct. '09	0.01
New Idria, q. .... Cal.	100,000	5	1.20	120,000	1,360,000	Jan. '11	0.70
North Butte, c. .... Mont.	410,000	15	0.80	328,000	9,389,000	Jan. '11	0.30
North Star, g. .... Cal.	250,000	10	2.30	575,000	3,061,989	Dec. '10	1.10
Old Dominion M. & Sm. .... Ariz.	162,000	25	2.00	324,000	1,417,000	Jan. '11	0.50
Ophir, s.g. .... Nev.	201,600	3			1,816,360	May '08	0.10
Oroville Dredging .... Cal.	700,000	5			1,383,036	Dec. '09	0.12
Osceola, c. .... Mich.	96,150	25	10	961,500	9,343,250	Jan. '10	4.00
Osceola, l.z. .... Mo.	500,000	5			245,000	June '07	0.10
Parrot, c. .... Mont.	229,850	10	0.30	68,954	6,876,603	Nov. '10	0.15
Pearl Con., g. .... Wash.	1,909,711	0.05	0.09½	181,422	181,422	Dec. '10	0.02
Pharmacist, g. .... Colo.	1,500,000	1	0.00½	7,500	87,500	Feb. '10	0.00½
Pioneer, g. .... Alas.	5,000,000	1	0.03	150,000	1,891,526	Aug. '10	0.03
Platteville, l.z. .... Wis.	500	40			179,500	June '10	0.00
Portland, g. .... Colo.	3,000,000	1	0.08	240,000	8,677,080	Oct. '10	0.02
Quartette, g.s. .... Nev.	101,000	10			430,000	Sept. '07	0.10
Quincy, c. .... Mich.	110,000	25	5.00	550,000	19,440,000	Dec. '10	1.00
Red Metals, c. .... Mont.	110,000	100	9.08	1,000,000	3,500,000	Dec. '10	2.27
Republic, g. .... Wash.	1,000,000	1	0.08½	85,000	85,000	Nov. '10	0.01½
Rochester l.z. .... Mo.	4,900	100			136,947	Jan. '09	1.00
Round Mt., g. .... Nev.	866,426	1	0.12	101,300	328,404	Sept. '10	0.04
St. Joseph, l. .... Mo.	1,000,000	10	0.60	600,000	7,358,357	Dec. '10	0.15
Shannon, c. .... Ariz.	300,000	10			450,000	July '07	0.50
Shattuck-Arizona, c. .... Ariz.	350,000	10	2.00	700,000	1,050,000	Jan. '11	1.00
Silver Hill, s.g. .... Nev.	108,000	1			81,000	June '07	0.05
Silver King Coal, l.s. .... Utah	1,250,000	5	0.15	187,500	11,659,885	Jan. '10	0.15
Sioux Con., l.s.g. .... Utah	746,389	1	0.08	59,710	752,928	Oct. '10	0.04
Skidoo, g. .... Cal.	1,000,000	5	0.05	50,000	100,000	July '10	0.05
Smuggler, l.s.z. .... Colo.	1,000,000	1			2,235,000	Nov. '06	0.03
Snowstorm, c.g. .... Ida.	1,500,000	1	0.12	180,000	1,005,000	Aug. '10	0.01
Standard Con., g.s. .... Cal.	178,394	10			5,194,130	Dec. '08	0.01
Stratton's Ind., g. .... Colo.	1,000,000	0.60	0.12	120,000	180,000	Nov. '10	0.06
Strong, g. .... Colo.	1,000,000	1			2,275,000	July '05	0.02
Success .... Ida.	1,000,000	1			100,000	Nov. '07	0.02
Swansea, s.l. .... Utah	100,000	5			329,500	Mar. '07	0.05
Tamarack, c. .... Mich.	60,000	25			9,420,000	July '07	4.00
Tennessee, c. .... Tenn.	200,000	25			2,606,250	Jan. '11	1.50
Tomboy, g.s. .... Colo.	300,000	4.85	0.48	144,000	2,473,500	June '10	0.48
Tonopah-Belmont, s.g. .... Nev.	1,500,000	1	0.15	225,000	968,003	Jan. '11	0.15
Tonopah of Nev., s.g. .... Nev.	1,000,000	1	1.50	1,500,000	6,850,000	Jan. '11	0.40
Tonopah Extension, s.g. .... Nev.	943,433	1			283,030	Apr. '06	0.15
Tonopah Midway, s.g. .... Nev.	1,000,000	1			250,000	Jan. '07	0.05
Tri-Mountain, c. .... Mich.	100,000	25			800,000	Apr. '08	1.00
Uncle Sam, g.s.l. .... Utah	500,000	1	0.09	45,000	395,000	Dec. '10	0.02
United Copper, com. .... Mont.	450,900	100			5,962,500	Aug. '07	1.75
United Copper, pf. .... Mont.	50,000	100			1,500,000	May '07	3.00
United, z.l., com. .... Mo.	92,400	5			27,490	Oct. '03	0.05
United, z.l., pf. .... Mo.	19,556	25			312,782	Jan. '08	0.50
United (Crip. Ck.) g. .... Colo.	4,001,100	1	0.04	160,364	440,435	Jan. '10	0.04
United Globe, c. .... Ariz.	23,000	100			379,500	July '07	4.00
United Verde, c. .... Ariz.	300,000	10	9.00	2,700,000	26,947,000	Dec. '10	0.75
Utah, s.l. .... Utah	100,000	10			323,000	Feb. '09	0.02
Utah, c. .... Utah	1,526,599	10	3.00	3,431,345	6,799,450	Dec. '10	0.75
Utah Con., c. .... Utah	300,000	5	0.50	150,000	6,900,000	Jan. '10	0.50
Valley View, g. .... Colo.	1,000,000	1	0.24	240,000	240,000	Dec. '10	0.04
Victoria, g.s.l. .... Utah	250,000	1	0.04	10,000	207,500	Mar. '10	0.04
Vindicator Con., g. .... Colo.	1,500,000	1	0.12	180,000	2,227,500	Oct. '10	0.03
Wasp No. 2, g. .... S. D.	447,900	1			240,595	Dec. '06	0.01
Wolverine, c. .... Mich.	60,000	25	10.00	600,000	6,300,000	Oct. '10	5.00
Work, g. .... Colo.	1,500,000	1			172,500	July '08	0.00½
Yak, s.l. .... Colo.	1,000,000	1	0.04	40,000	1,417,685	Oct. '10	0.04
Yankee Con., s.l.g. .... Utah	1,000,000	1			182,500	Jan. '07	0.03
Yellow Aster, g. .... Cal.	100,000	10	0.13	13,000	1,061,879		
Yukon Gold, g. .... Alas.	3,500,000	5	0.40	1,400,000	2,100,000	Dec. '10	0.10
Total				56,508,205			

‡ Includes \$200,000 refunded on stock.



COAL, IRON, INDUSTRIAL AND HOLDING COMPANIES.

NAME OF COMPANY AND SITUATION.	State	SHARES.		DIVIDENDS PAID.				
		Issued.	Par Value.	1910.		To Date.	Latest.	
				Per Share.	Total.	Total.	Date.	Amt.
Amalgamated, c.	Mont.	1,538,879	\$100	\$2.00	\$3,077,756	\$62,809,884	Nov. '10	\$0.50
Am. Ag. Chem., pf.	U. S.	181,530	100	6.00	1,089,180	3,381,390	Oct. '10	3.00
Am. Cement	Penn.	200,000	10	0.20	40,000	1,388,000	July '10	0.10
Am. Coal	Md.	50,000	25	1.50	75,000	2,647,187	Sept. '10	0.75
Am. Sm. & Ref., com.	U. S.	500,000	100	4.00	2,000,000	19,500,000	Jan. '11	1.00
Am. Sm. & Ref., pf.	U. S.	500,000	100	7.00	3,500,000	36,750,000	Jan. '11	1.75
Am. Smelters, pf. A.	U. S.	170,000	100	6.00	1,120,000	5,240,000	Dec. '10	1.50
Am. Smelters, pf. B.	U. S.	300,000	100	5.00	1,500,000	7,857,000	Dec. '10	1.25
American Coal	Md.	50,000	25	1.50	75,000	2,647,187	Sept. '10	0.75
Butte Coalition, c.	Mont.	1,000,000	15	1.00	1,000,000	3,700,000	Dec. '10	0.25
Cambria Steel	Penn.	900,000	50	2.50	2,250,000	11,710,000	Nov. '10	0.62½
Central C. & C., com.	Mo.	51,250	100	6.00	307,500	2,998,125	Jan. '11	1.50
Central C. & C., pf.	Mo.	18,750	100	5.00	93,748	1,573,748	Jan. '11	1.25
Consolidated Coal	Ill.	50,000	100	6.00	300,000	425,000	Oct. '10	1.50
Consolidation Coal	Md.	190,247	100	6.00	1,141,480	217,876,880	Oct. '10	1.50
Crucible Steel, pf.	Penn.	244,365	100	7.00	1,710,556	9,896,781	Dec. '10	1.50
General Chem., com.	U. S.	74,103	100	215.00	21,111,546	3,556,942	Dec. '10	1.25
General Chem., pf.	U. S.	100,000	100	6.00	600,000	7,305,000	Jan. '11	1.50
General Dev. Co.	U. S.	26,000	100	10.00	260,000	2,769,000	Sept. '10	5.00
Guggenheim Expl.	U. S.	207,933	100	10.00	2,079,330	11,051,156	Jan. '11	2.50
Interl Nickel, com.	U. S.	88,226	100	231.00	22,735,006	3,226,373	Mar. '11	1.50
Interl Nickel, pf.	U. S.	89,126	100	6.00	534,756	2,807,366	Feb. '11	1.50
Interl Sm. & Ref.	U. S.	100,000	100	8.00	800,000	7,000,000	Dec. '10	2.00
Jeff. & C. & I., pf.	Penn.	15,000	100	5.00	75,000	1,012,500	Aug. '10	2.50
Lehigh Coal & Nav.	Penn.	482,936	50	4.00	1,931,744	18,671,604	Nov. '10	1.00
National Carbon, pf.	U. S.	45,000	100	3.50	157,500	3,228,759	Nov. '10	1.75
National Lead, com.	N. Y.	206,554	100	3.00	929,491	4,540,929	Dec. '10	0.75
National Lead, pf.	N. Y.	243,676	100	7.00	1,705,732	20,382,440	Dec. '10	1.75
Old Dominion, c.	Ariz.	293,245	25	1.00	293,245	1,673,756	Jan. '11	0.25
Penn. Salt	Penn.	60,000	50	3.00	180,000	15,278,000	Oct. '10	3.00
Phelps, Dodge & Co.	U. S.	449,346	100	12.00	5,392,152	10,784,304	Dec. '10	4.50
Pittsburg Coal, pf.	Penn.	297,010	100	7.00	1,485,048	12,920,011	Jan. '11	1.75
Pocahontas C. C., pf.	W. Va.	28,000	100	6.00	168,000	420,000	July '10	3.00
Republic I. & S., pf.	Ala.	204,169	100	8.00	1,633,353	10,181,759	Jan. '11	1.75
Sloss-Sheffield, com.	Ala.	100,000	100	4.50	450,000	2,608,000	Dec. '10	1.25
Sloss-Sheffield, pf.	Ala.	67,000	100	7.00	469,000	4,806,900	Jan. '11	1.75
Standard Oil	U. S.	970,000	100	40.00	38,800,000	707,122,000	Dec. '10	10.00
Texas & Pacific Coal	Texas	25,000	100	6.00	150,000	1,820,030	Dec. '10	1.50
Uni. Metals Selling	U. S.	50,000	100	20.00	1,000,000	6,625,000	Oct. '10	5.00
U. S. Steel Corp., com.	U. S.	5,083,025	100	5.25	27,956,636	122,741,498	Dec. '10	1.25
U. S. Steel Corp., pf.	U. S.	3,602,811	100	7.00	25,219,676	274,719,539	Nov. '10	1.75
U. S. Sm., Ref. & Min., com.	U. S.	486,044	50	2.00	702,000	3,202,230	Jan. '11	0.50
U. S. Sm., Ref. & Min., pf.	U. S.	351,010	50	3.50	1,701,175	8,284,139	Jan. '11	0.87½
Va.-Car. Crem., com.	U. S.	279,844	100	2.50	699,810	1,049,715	Feb. '11	1.25
Va.-Car. Chem., pf.	U. S.	180,000	100	8.00	1,440,000	16,860,000	Jan. '11	2.00
Warwick I. & S.	U. S.	148,671	10	0.70	104,069	631,808	Nov. '10	0.40
Westmoreland Coal	Penn.	60,000	50	2.50	150,000	9,030,000	Oct. '10	2.50
Total					140,194,508			

v Plus 15% stock dividend July, 1910. w Includes 2 per cent. accumulative. October, 1910.  
 x Stock dividend \$6,130,000 March, 1909. y Stock dividend \$2,866,950 January, 1910. z Includes stock dividend 10 per cent., March, 1910.

FOREIGN MINING COMPANIES.

NAME OF COMPANY AND SITUATION.	State	SHARES.		DIVIDENDS PAID.				
		Issued.	Par Value.	1910.		To Date.	Latest.	
				Per Share.	Total.	Total.	Date.	Amt.
Amparo, g.s.	Mex.	2,000,000	\$1	0.12	240,000	440,884	Nov. '10	0.03
Buffalo, s.	Ont.	1,000,000	1	0.30	300,000	977,000	Feb. '11	0.05
Coniagas, s.	Ont.	800,000	5	0.30	240,000	1,400,000	Nov. '10	0.15
Crown Reserve, s.	Ont.	1,750,000	1	0.60	1,050,000	2,648,500	Jan. '11	0.15
Dolores, g.s.	Mex.	400,000	5	0.67½	270,000	1,134,866	Jan. '11	0.22½
Dominion Coal, com.	N. S.	150,000	100	4.00	600,000	4,500,000	Jan. '11	1.00
Dominion Coal, pf.	N. S.	50,000	100	7.00	350,000	4,040,000	Aug. '10	3.50
Dos Estrellas, g.s.	Mex.	300,000	0.50	2.50	750,000	6,030,000	July '10	2.00
El Oro, g.s.	Mex.	1,147,500	4.85	0.72	826,000	7,439,286	Dec. '10	0.36
El Rayo, g.s.	Mex.	360,020	2	0.24	216,012	279,015	Jan. '11	0.17½
Esperanza, s.g.	Mex.	455,000	4.85	1.44	644,752	10,691,232	Jan. '11	0.36
Granby, s.l.c.	B. C.	135,000	100	1.00	135,000	3,913,630	Dec. '10	1.00
Guanajuato D., pf., s.	Mex.	10,000	1,000	6.00	60,000	274,356	Jan. '11	3.00
Hedley Gold	B. C.	120,000	10	1.70	204,000	204,000	Dec. '10	0.30
Kerr Lake, s.	Ont.	600,000	5	2.00	1,200,000	2,730,000	Dec. '10	0.50
La Rose Con., s.	Ont.	1,498,407	5	0.40	599,360	1,977,721	Jan. '11	0.10
Le Roi No. 2, g.	B. C.	120,000	24.25	1.92	230,400	1,177,200	Nov. '10	0.48
Lucky Tiger Com., g.	Mex.	715,000	10	0.60	429,000	910,000	Dec. '10	0.05
McK.-Dar. Sav., s.	Ont.	2,247,692	1	0.15	337,155	1,146,322	Jan. '11	0.15
Mines Co. of Am.	Mex.	1,700,000	5	0.09	180,000	4,227,500	Jan. '11	0.22½
N. Y. & Hond. Ros.	C. A.	150,000	10	1.20	180,000	3,015,000	Dec. '10	0.30
Nipissing, s.	Ont.	1,200,000	5	1.37½	1,650,000	5,490,000	Jan. '11	0.37½
Peñoles, s.l.g.	Mex.	80,000	25	4.68	374,400	4,741,687	Sept. '10	1.56
Peregrina M. & M., pf.	Mex.	10,000	100	7.00	70,000	328,656	Sept. '10	3.50
Pinguico, pf., s.	Mex.	20,000	100	3.00	60,000	420,000	Apr. '10	3.00
Right of Way Mines, s.	Ont.	1,685,500	1	0.08	134,840	168,550	Jan. '11	0.02
Rio Plata	Mex.	373,437	5	0.40	149,372	177,380	Dec. '10	0.10
Temiskaming, s.	Ont.	2,500,000	1	0.03	75,000	659,155	Jan. '11	0.03
Tem. & Hud. Bay, s.	Ont.	7,761	1	21.00	162,981	1,334,892	Nov. '10	3.00
Trethewey, s.	Ont.	1,000,000	1	1.00	100,000	661,998	Jan. '11	0.10
Total					11,821,372			

† Previous to January, 1910, \$324,644.

11 of these companies which appear in the dividend tables for 1909 and 1910, it is seen that the record of dividends paid in 1910 is \$183,798 less than those paid in 1909. The total for 1910 is \$5,849,336, as against \$6,033,134 in 1909.

The Cement Industry

Notwithstanding an advance of 10c. per bbl. by the Licensees' Association in July and an unquestionably better demand, the condition in 1910 was such that only the best-equipped plants could show even a moderate profit and none of them much in the way of dividends. This was manifested by the passage of their semi-annual dividends by several important companies in December. In this connection, the directors of the American Cement Company made the following statement:

"It is not a case of a single plant in the industry being unable to make money. The American Cement Company is affected by the same conditions that have affected every plant in the industry. As is well known, several companies have been obliged to close their plants during 1910, and a change of management and control was made in the case of the largest company."

The advance of 10c. in July made the price of portland cement, \$1.25 per bbl. of 400 lb. gross at the mills corresponding to about 90c. net. The average value of portland cement, at mills, during recent years has been approximately as follows:

1899.....	\$1.43	1905.....	\$0.96
1900.....	1.09	1906.....	1.13
1901.....	0.99	1907.....	1.11
1902.....	1.21	1908.....	0.85
1903.....	1.24	1909.....	0.85
1904.....	0.88	1910.....	0.90

Cement manufacture, like other industries, has suffered from over production. The statistics for 1910 will probably show a further increase, but fortunately the shipments also increased. In the Lehigh Valley district but little improvement over 1909 was experienced. At the very end of December the sudden dissolution of the Association of Licensed Cement Manufacturers was announced followed immediately by a cut of price to 85c. per bbl., net at the mills.

At the end of 1908, the latest time for which statistics upon this point are available, there were 112 cement plants, of annual capacity of 85,000,000 bbl., in the United States. Since then there has been an addition to the number, in spite of the deplorable condition of the trade. The production in 1909 having been only 61,300,000 bbl., it is obvious that this industry has experienced the same over-extension as have the iron and copper and many others.

# Changes in Iron and Steel Making

By Bradley Stoughton \*

During the year 1910 three important innovations in blast-furnace practice made progress. The first is the establishment of the "thin-lined blast furnace" as an industrial factor of real importance. Experiments with such a furnace by the United States Steel Corporation had been in progress for more than a year, but in 1910 for the first time the success of these experiments was established, and the use of the thin-lined furnace, cooled outside from top to bottom by means of circulating water, has been increasing.

The second innovation of importance is the use at a Belgian blast furnace of air enriched with oxygen, instead of installing the costly apparatus required for drying the blast. J. E. Johnson, Jr., pointed out some time ago that the use of oxygen for this purpose would have many advantages, but the cost has been against the adoption of this suggestion. Every year, however, the cost of oxygen has been decreasing, and it has now reached such a low price in Europe as to make this process feasible. The last innovation is merely an innovation as far as America is concerned, as it has been in practice for some years in Europe: the agglomeration of flue-dust on a large scale. This has now been taken up by the United States Steel Corporation, and the sintering process under the Gröndal patents is to be employed. In Germany, where agglomeration of flue-dust, ores, etc., has made more progress than anywhere else, and where they briquet 500,000 tons of flue-dust annually, the press processes, using generally some binder also, are most commonly employed, as the sintering process is somewhat more costly. American iron makers, however, prefer the product of the sintering process, on account of the compactness of the briquets. In this same connection it is worthy of note that the briquetting of cast-iron borings for melting in the cupola is now being employed in this country, following again the European practice.

## DUPLEX STEEL PROCESSES

There are already well established two or three types of duplex process; namely, a combination of bessemer with open hearth, a combination of bessemer with electric furnace, and a combination of the open-hearth furnace and electric furnaces. The Dominion Iron and Steel Company, of Nova Scotia, is now installing furnaces for a triplex process employing first a 500-ton rolling basic open-hearth furnace, then a basic bessemer converter and finally a 50-ton basic open-

hearth furnace. The first open-hearth furnace is used to desiliconize the liquid pig iron from the blast furnaces, a little scrap and limestone being added to the charge. The desiliconized metal is then dephosphorized by about five minutes' blowing in a basic bessemer converter—the pig iron contains about 1.50 per cent. phosphorus—and finally the metal from several of these bessemer converters is put into a 50-ton open-hearth furnace, where it is purified as desired and recarburized in the ladle in the ordinary way. It is believed that the final furnaces in this triplex process will be able to make 60 to 70 heats per week, as compared with 18 to 20 heats for an ordinary 50-ton open-hearth furnace.

## OPEN-HEARTH STEEL PROGRESS

Louis M. Atha, superintendent of the Titan Steel Casting Company of Newark, N. J., has been using a waste product of the oil retorts, known as "carbo," or oil-retort carbon, which contains about 99 per cent. pure carbon and is very slow in burning. He finds that an open-hearth charge can be made up without pig iron, provided a certain amount of this carbo, preferably in the powdered form, is mixed with it, as it burns so slowly that there is opportunity for a good deal of the carbon to become dissolved by the metal and thus prevent superoxidation, which occurs when one tries to melt down steel in the open-hearth furnace without pig iron. This process has been patented and put upon the market in the year 1910, and is already spreading rapidly. N. S. MacCallum, superintendent of open-hearth furnaces of the Phoenix Iron Company, has been experimenting for some years with a process of tapping the steel from an open hearth furnace through a bifurcated spout into two ladles at once, with the object of increasing the charge of the furnace, without at the same time putting an additional burden on the mechanical handling of the product. He is thus able to make a 50-ton furnace take about 100 tons of metal, with consequent decrease in the cost of operation.

In some of the European open-hearth furnaces the ports, instead of being water-cooled, as is becoming more common in the United States, are made so that parts that suffer from melting down can be quickly changed when worn out without putting the furnace out of commission or disturbing other parts of the brick work. Other developments in Europe are changing the shape of the regenerative bricks so that the dust will not collect on them and clog them up so

soon, whereby some furnaces are said to make many thousand heats before the regenerators have to be torn down. A modification of the Bertrand-Thiel process now in use at the Hoesch works. This consists of charging magnetite, scale and lime into the open-hearth furnace and then pouring 20 to 22 tons of liquid pig iron from a mixer on top of it. At the end of two or three hours the metal and slag are poured into a ladle, the latter being allowed to overflow from the top and sold as fertilizer, as it contains 20 to 25 per cent. phosphoric anhydride. The metal is then poured back into the furnace on top of a fresh charge of ore, lime and scrap, and in about two hours more the refining is complete. In the first period of this process, the greater part of the phosphorus and almost all of the silicon and manganese are removed, together with about one-half of the carbon. In the second period the carbon is brought to the desired point and the purification from phosphorus completed.

## ROLLING MANGANESE STEEL

The Potter patents for the rolling of manganese steel, especially in the form of plate, were published in August, 1910; they involve mixing the steel from a basic open-hearth furnace with molten ferromanganese in an acid-lined ladle, under a layer of acid slag. The mixture should be at 1400 to 1450 deg. C., and is held in the ladle until it is cooled to about 1375 deg. C., in order to allow the metal to be deoxidized and purified. The ingots are then teemed and are allowed to cool before stripping until they are transferred to a soaking pit and heated to 1175 deg. C., or somewhat higher, reduced to 1100 deg. C. and then permitted to rise again to about 1125 deg. C., taken from the soaking pit and first subjected to light mechanical work on the surfaces, before the full pressure of rolling is applied.

## MISCELLANEOUS DEVELOPMENTS

The Carnahan patents for the manufacture of American ingot iron were published during this year, and it is seen that this American ingot iron is a dead-soft open-hearth steel, in which the purification has been carried much further than is ordinarily employed. The superoxidation is then reduced by means of silicon, and the gases in the steel are removed by the addition of aluminum in the mold.

Attempts made in the United States to heat open-hearth furnaces with coke-oven gas have not met with success so far, although this process is very satisfactorily performed in Europe. Such a

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method has, however, been definitely determined upon at Bethlehem, where a large plant of retort coke-ovens is now in process of erection.

The Goldschmidt thermit process was developed in a number of ways during 1910 and especially in welding the rails up around the head as well as the flange and web, which is said to give a much superior result.

The manufacture of titanium steel rails has been largely increased and the use of titanium in iron and steel foundries has begun on a really commercial basis.

#### ELECTRIC FURNACES

In the electric manufacture of iron and steel the year 1910 witnessed the first genuine success, from a commercial standpoint—if we may judge from published results work was done in ore smelting, compared to which previous efforts are more in the line of experiments; and we may say that both in California and Sweden the process is now being carried on as an industrial operation with satisfactory results.

In the refining of steel in the electric furnace, progress was rapid, and the five large furnaces operating in this country were active. The rights to the

Héroult process in America have been purchased by the United Steel Corporation, which had two 15-ton Héroult furnaces operating throughout the greater part of the year, one refining metal from the bessemer converters at South Chicago, and the other refining metal from the open-hearth furnaces at Worcester, Mass. The number of steel furnaces is to be increased by the addition of a Roebling & Rodenhauser induction furnace at a steel-casting plant in Pennsylvania.

#### SOME COMMERCIAL HAPPENINGS

From the commercial standpoint much interest attaches to the meeting, during the autumn, of the American Iron and Steel Institute, which was attended by some of the best known iron and steel masters of England and Europe. Besides discussing many matters of importance from the commercial and industrial side of the industry, the institute also visited a large number of works and did much to establish cordial international relations among all those interested in iron and steel manufacture.

A second innovation from the commercial side is the decision to quote the price of steel rails hereafter on the basis of 100 lb. instead of the long ton. This

change is for the purpose of making the price of rails readily comparable with that of other steel products, which are quoted on the 100-lb. basis.

#### IRON-ORE SUPPLIES

The year 1910 witnessed the beginning of several changes in the matter of iron ore which may have far-reaching influence. Among the more important of these was the increased importation of iron ore on the Atlantic coast, which seemed likely, at one time, to become very large in amount but was temporarily reduced by the falling price of pig iron and consequent decrease in smelting. The same conditions affected the increased mining of iron ore in the East. The year also witnessed for the first time importations of Chinese iron ore on the Pacific coast, and the first considerable shipment of iron ore from Texas. A great deal of attention was attracted by the efforts of the Republic of Brazil to interest, first European and later American, capital in the exploitation of what are said to be tremendous deposits of Brazilian iron ore. It is the desire of the Brazilian authorities to see an iron-smelting industry established on a firm basis in that country.

# The Metallurgy of Copper in 1910

By Arthur L. Walker \*

While no startling or radical improvements in the metallurgy of copper were made during 1910, important developments took place, some of which can be briefly reviewed as follows:

#### REVERBERATORY PRACTICE

The increased tonnage of fine copper concentrates which will be treated in the new copper smelters in Utah, Nevada and Arizona, necessitating the use of reverberatory furnaces to smelt this product, means that the importance of this class of smelting compared with blast-furnace practice is increasing. Any improvement therefore which can be effected in reverberatory practice is of growing importance. The new reverberatory furnaces which are being built are of practically the same size as those constructed by Mr. Mathewson at Anaconda, some years ago, and at present apparently a furnace having a length of 105 to 115 ft. is as long as can be economically operated.

It was formerly considered difficult to run copper reverberatory-furnace slag as high in silica as blast-furnace slag, and the practice at Humboldt, Ariz., indicated that when the slag was allowed to run

over 38 or 40 per cent. silica, the duty or the tonnage of the reverberatory furnace was much decreased. Recently in reverberatory smelting, however, slag was made running as high as 45 per cent. silica, at the Garfield plant in Utah, and as high as 43 per cent. silica at the Step-toe plant in Nevada, the results being in every way satisfactory. The reason for obtaining such results with these highly silicious slags is supposed to be due to greater care in mixing and preparing the charge, and in having plenty of draft. The advantage of being able to make a reverberatory-furnace slag running 45 per cent. instead of 38 per cent. silica, which was considered fair practice only two or three years ago, is great, reducing materially the operating expense and cost of flux.

At Cananea<sup>1</sup> an improved method of claying reverberatory furnaces was practised, which was suggested by Mr. Gmahling, and installed under the supervision of Mr. Shelby. It consisted of having small holes through the roof of the furnace directly above, and on a line with the side walls, through which holes fettling material was charged into the furnace, building it up as a bank along the

walls at the slag line. It was then tamped down with an iron tamping bar so that it could not float away, and by this means the side walls were protected from corrosion at the matte line, reducing the cost of repairs on the furnace greatly. These holes are about 5 in. square, spaced 18 in. center to center, and are, therefore, close enough to distribute the fettling material to any point desired. When not in use the holes are closed with firebrick and covered over with fine material.

#### COLLECTION OF FLUE DUST

While metallurgists have for many years taken steps to collect a large portion of the flue dust carried off in the furnace gases, it has only been recently that the importance of this subject has been fully appreciated. In former years flue dust was considered to have small value, on account of the difficulty of reworking it. Now with the improved appliances for handling and preparing fine material for smelting, and the decreased cost of retreating this material, the question is of greater importance. This is especially the case when it is expected to smelt concentrates running 20 to 40 per cent. in copper and the flue dust carried off in the gases from the furnaces

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<sup>1</sup>ENG. AND MIN. JOURN., Feb. 5, 1910; *Mines and Methods*, March, 1910.

in which these concentrates are to be treated is of such value that an extensive plant for the purpose of saving this dust is warranted.

Experiments made at the Tye smeltery, Ladysmith, B. C., and recently communicated by Thomas Kiddie in the *Transactions* of the American Institute of Mining Engineers, are interesting. For a period of two years, when the velocity of the gases in the flues was 1200 ft. per min., the recovery of flue dust amounted to 2 per cent. of the ore smelted, while in another period of two years, with a velocity of 420 ft. in the flues, the recovery was 3.1 per cent. In the same communication, Mr. Kiddie also states that at another plant where practically the same change was made in reducing the velocity of the gases, the recovery of flue dust was increased from 2.9 to 4.3 per cent. or 50 per cent. In none of these experiments, however, were records made of the amount of flue dust passing out of the flue in the gases.

#### FLUE DUST DEPOSITS QUICKLY FROM SLOW-MOVING GASES

At the Copper Queen smeltery, Douglas, Ariz., careful tests were made to determine, not only how much flue dust can be collected in the flue by reducing the velocity of the gases, but also how much dust or fume is still in the gases after they leave the flues. George B. Lee, superintendent, stated<sup>2</sup> that the result of these experiments showed that if the velocity of the gases through the flue did not exceed 150 ft. per min. (which may be somewhat increased if wires or screens were placed in the flue), practically 80 per cent. of the dust in gases was caught in a flue 100 ft. long (and of this 80 to 90 per cent. in first 50 ft.), the remainder being caught in a baghouse. This indicates clearly that by properly reducing the velocity of the gases, all of the dust which can be caught by settling will be recovered in a comparatively short flue, and that a baghouse is necessary to catch the finest particles which cannot be caught by a settling chamber. Mr. Lee found that, of the heavier particles of dust that settled in the chamber itself, approximately 90 per cent. passed a 200-mesh screen.

At the Great Falls plant of the Boston & Montana company, provision was made to recover flue dust from furnace gases by the friction system, using wires instead of Freudenberg plates. Charles W. Goodale states that in their elaborate flue system designed to reduce the gases to a velocity of not greater than 500 ft. per min., nearly one and one-quarter million of dust-arresting wires will be used. Extensive tests were made before installing the wire system, which showed that

the wires gave nearly as high an efficiency in dust recovery as the plates, and with much less friction resistance to the gases.

The great importance of collecting flue dust was carefully borne in mind in the construction of the new copper smeltery at Tooele, blown in during 1910, where the main dust chambers were so designed that the velocity of the gases will not be over 300 to 400 ft. per min., depending on the temperatures, and this was for a plant where the material treated is comparatively low grade.

#### SMELTERY SMOKE

The seat of the campaign against smeltery smoke and fumes was transferred from the Salt Lake district, Utah, to Shasta county, California, and as a result the smelteries situated in that locality were compelled to take active measures to prevent any possible damage from their smoke. At the Mammoth Copper Mining Company smeltery, near Kennett, a baghouse was installed for the purpose of filtering the fumes, using the system patented by the United States Smelting Company, and inaugurated at the Midvale smeltery in Utah. At the latter it was necessary to inject zinc oxide as fume into the gases for the purpose of neutralizing the  $SO_2$ , so that the gases could be passed through the baghouse without injuring the bags and also that no sulphuric acid escape. At the Mammoth smeltery, however, there is sufficient zinc already in the fumes to neutralize the  $SO_2$ . With the installation of the baghouse at the Mammoth smeltery, the question of filtering fumes from copper-smelting furnaces seems to have been more thoroughly solved, but it is stated that the capacity of the present baghouse is insufficient to take care of the gases from the entire furnace plant.

At the Balaklala smeltery in the same district, it is intended to overcome the trouble by the use of the Cottrell system which has been tried experimentally at the Selby plant near San Francisco for several years and the experiments pronounced successful. In this system, by the use of a direct current, electric sparks are discharged between plates in the flue, sulphuric acid and the solids in the gases being deposited out. Fifteen thousand volts are used, but the power required is small and it was estimated from data obtained in the experimental plant that 15 h.p. will furnish electric discharges sufficient to knock down all of the sulphuric acid and solid matter contained in the fumes resulting from roasting and smelting 400 tons of ore per day. The process was installed at the Balaklala smeltery for the purpose of treating all of the fumes from the smeltery and accomplishing the results just mentioned. At the present time, it promises to be

successful and the final outcome will be watched with a great deal of interest.

#### COPPER-CONVERTING OPERATIONS

The experiments carried out by the Peirce-Smith Converter Company with their basic converters were so successful that during 1910 arrangements were made to install this type of converters at several of the new smelteries which were or are being built in Nevada and Arizona. This new process of converting is apparently on a firm footing and offers several advantages when compared with acid-lined converters for treating copper matte.

In this type of converter, the lining is magnesia brick and with one lining more than 1000 tons of copper can be produced from 35 to 40 per cent. matte without extensive repairs.<sup>3</sup> The lining expense is, therefore, reduced to a minimum, and the usual plant necessary for lining converters is done away with. The tuyeres in these converters have been the subject of much attention, as this was the weak point in all former experiments with basic-lined converters. In the Peirce-Smith converter, the tuyeres are so arranged and designed that they will last for a production of as much as 2000 tons of copper, and sometimes even more. There is also a reduction in the crane work as the usual handling of converter shells is done away with. Silicious ore to flux the iron in the matte need not be as high in silica as is required for the lining of the ordinary converters, but an ore containing from 40 to 50 per cent. silica and upwards can be used as flux and charged into the converters by itself.

An improvement made at the Tooele smeltery in Utah consisted in running the matte from the reverberatory furnaces direct to the converters in launders which are nearly 80 ft. long and on an incline of about 7 per cent. No trouble was experienced in keeping these launders free and open, while the handling of matte by cranes and transfer cars and the reworking of matte skulls in the usual manner were avoided.

#### COPPER REFINING

During 1910 the copper-refining plant of the American Smelting and Refining Company at Maurer, N. J., changed the size of its anodes from 2x3 ft. to 3x3 ft., following the practice which was introduced at the Chrome, N. J., plant of the United States Metals Refining Company by Mr. Prosser a few years ago. The advantage of handling large anodes in units has been fully recognized, and with the reduced value of blister copper in gold and silver in recent years there is less danger of loss due to the slime from the anodes lodging on the cathodes; hence it is now possible to use larger anodes.

<sup>2</sup>ENG. AND MIN. JOURN., Sept. 10, 1910.

<sup>3</sup>ENG. AND MIN. JOURN., Mar. 12, 1910, June 25, 1910.



In the future, the question of large anodes and also of larger tanks should receive careful consideration in the building of new copper refineries or in extending any of those which are now in existence.

LEACHING PROCESSES

Although many processes have been proposed for leaching copper from its ore and many experiments have been made during the last 30 years, the record shows that the only leaching plant in which copper has been successfully extracted from its ore in America was the one built by James Colquhoun about 25

years ago, at the plant of the Arizona Copper Company at Clifton, Ariz., which, on account of local conditions, has been operated successfully for many years, using sulphuric acid manufactured on the ground as a solvent and scrap iron to precipitate the copper from solution. During the last few years experiments have been made by the Cananea Consolidated Copper Company, at Cananea, Mexico,<sup>4</sup> and by the Ray Consolidated Copper Company, at Kelvin, Ariz.,<sup>5</sup> using ferric sulphate as a solvent. In both cases, the

<sup>4</sup>Mines and Methods, Sept., 1910.  
<sup>5</sup>Mines and Methods, Oct., 1910.

experiments indicated that the cost of conducting a leaching operation on this basis would be so great that its success would be more than doubtful. However, there is a large field for a leaching process which can recover the copper from the low-grade ore obtained from the silicious porphyry deposits with less loss and at no greater expense than that which is involved at the present time in using the system of concentration, where fully one-third of all the copper in the ore mined is lost and subsequent smelting of the concentrates. It is a difficult proposition but one which is attracting considerable attention at present.

# Dredge Installations During 1910

By John Tyssowski

There were 24 new gold dredges, of which definite information is available, built and installed in North America during 1910. The distribution of these installations was: Alaska 9, California 8, Montana 2, and Georgia, Idaho, Nevada, South Dakota and Yukon Territory one each. These dredges represent a digging capacity of approximately 2,745,000 cu.yd. per month. The accompanying table shows, in most cases, the place in which the dredges were installed, the number in each State, the bucket capacity in cubic yards and the name of the operating companies. This information is accurate, having been verified by the various manufacturers of dredges, and is complete as far as installations of any magnitude are concerned. The Union Iron Works and Risdon Iron and Locomotive Works of San Francisco, The Bucyrus Company of South Milwaukee, Yuba Construction Company, Marysville, Cal., Marion Steam Shovel Company, Marion, O., and Stearns-Rogers Manufacturing Company, of Denver, built and installed gold dredges in North America in 1910.

TYPE OF DREDGES BEING INSTALLED

In general, the dredges installed in 1910 were stronger and larger than the older ones which they replaced or supplemented. For the most part the dredges are to be operated by electricity where such power is available. In some particular cases, however, gasolene- or steam-driven machinery is necessary, as, for instance, in some parts of Alaska and Nevada. Most of the boats were provided with spud anchorage, close-connected bucket chains (except for the small dredges built for Alaskan use which are usually provided with open-connected chains) and belt-conveyer tailings stackers. The tendency toward the building of boats of large capacity was marked.

THE SEWARD PENINSULA

Dredging in the Seward peninsula<sup>1</sup> is assuming vast proportions and although the operating season is exceedingly short it is very profitable providing dredging operations are well managed and the dredge equipment is of the best design and construction. Many of the dredges for Alaskan use are provided with gasolene-driven

using crude oil as fuel it is expected to obtain a saving of one-third in the cost of fuel. The dredges for Alaskan use built by the Union Iron Works of San Francisco were provided with open-connected buckets of 2½ cu.ft. capacity. The machinery of these dredges is driven by gasolene engines. These boats were designed to dig to a depth of 16 ft. The

NORTH AMERICAN DREDGE INSTALLATIONS IN 1910.

Locality.	Operating Company.	Bucket Capacity, Cu.Ft.
Alaska (9):		
Seward Peninsula .....	Sewell Alaska Mining Co.	2½
Seward Peninsula .....	Arctic Gold Dredging Co.	2½
Seward Peninsula .....	Northern Dredge Build. and Const. Co.	2½
Solomon River, S. P. ....		
Solomon River, S. P. ....		
Otter Creek, S. P. ....		
Seward Peninsula .....	Wild Goose Mining and Trading Co.	3½
California (8):		
16 miles east of Marysville .....	Marysville Dredging Co.	8½
Oroville .....		
Redding .....		
Forest Hill .....		
Natoma .....	Natomas Consolidated of California.	15
Hammonton .....	Yuba Consolidated Goldfields.	15
5 miles north of Fort Jones .....	Siskiyou Dredging Co.	5½
Georgia (1):		
Dahlonega .....		3½
Idaho (1):		
Idaho City .....	Boston Idaho Gold Dredging Co.	15.
Montana (2):		
Alder .....	Poor Farm Placer Mining Co.	16
Magpie Gulch .....	Magpie Development Co.	
Nevada (1):		
Lovelocks .....		
South Dakota (1):		
Mystic .....	Castle Creek Dredging Co.	5
Yukon Territory (1):		
	Canadian Klondyke Mining Co.	16

machinery. A number of the dredges installed by the Risdon company employ coal and generate steam in water-tube boilers using compound-condensing engines. In small boats of this type that dig 1400 cu.yd. per day, about 3½ tons of fair coal is burned per 24 hours, but by

<sup>1</sup>"Dredging Conditions on the Seward Peninsula," by G. B. Massey, 2d. ENG. AND MIN. JOURN., Oct. 29, 1910, p. 859.

hulls being 60x30x4 ft. 6 in. in dimension and the total power equipment provided 85 horsepower.

The dredge for the Wild Goose Mining and Trading Company is for use at Nome. This dredge digs to a depth of 15 ft. and draws 3 ft. 4 in. of water. Its revolving screen is 4 ft. 6 in. in diameter and 23 ft. long. A belt conveyer 28 in. wide and 55 ft. long between centers

of pulleys is used for the disposal of tailings. Water is supplied from one 10-in. centrifugal pump. The digging ladder is of the latest type and the main drive of the same general description as used in the largest California dredges, driving from both ends of the upper tumbler shaft. This shaft is a nickel-steel forging 9½ in. in diameter. Buckets consist of high-carbon base castings, one piece, pressed-steel hood and a manganese lip, 1 in. thick and 8 in. wide.

#### CALIFORNIA INSTALLATIONS

According to U. S. Mint and Geological Survey figures, from 1898 to 1908, dredging operations in California produced \$25,277,877. Of this Butte county contributed \$15,049,946, Sacramento \$3,920,231 and Yuba \$5,151,242. In 1908 there were 65 dredges operating in the State from which a production of \$6,538,189 was recorded; in 1909, 64 dredges produced \$6,870,000. The dredging industry employed about 940 men in 1908 and about 932 in 1909. Nine new dredges were added to the equipment of the California<sup>2</sup> dredging companies in 1908, five in 1909 and eight in 1910. Of the dredges installed in 1910 the Yuba No. 13 of the Yuba Consolidated Goldfields and the Natoma No. 8 of the Natomas

<sup>2</sup>Notes on the Construction of California Dredges," by John Tyssowski, ENG. AND MIN. JOURN., Oct. 15, 1910, p. 765.

Consolidated of California were the largest. These two dredges were similar in many respects. The interesting dimensions of the Yuba No. 13 dredge are: Digging depth, 60 ft.; hull, 155x58 ft. 8 in. x 12 ft. 6 in.; ladder, length 129 ft., depth 10 ft.; stacker, length 140 ft., depth 7 ft.; conveyer belt, 42 in. wide; screen, 9x50 ft. 6 in.; area of gold-saving tables, 8000 sq.ft.; total power equipment, 720 h.p. These large dredges were supplied with two 14-in. centrifugal pumps and one 5-in. pump. The machinery weighs about 1,600,000 lb. without motors. The weight of the digging ladder and suspension tackle alone is greater than of the entire machinery for a 7½-cu.ft. dredge of the same type. Seven hundred and thirty thousand board feet of lumber were used in the construction of the hull. Buckets are close connected.

The Siskiyou dredge, although only of 5½ cu.ft. bucket capacity, is a thoroughly uptodate machine. The No. 3 and No. 4 boats of the Marysville Dredging Company have buckets of 8½ cu.ft. capacity. These dredges dig to a depth of 40 ft.; the hull dimensions are 37x102x8 ft. 8 in. and the motors total 227½ h.p. Buckets are close connected.

#### LARGE DREDGES FOR MONTANA AND YUKON TERRITORY

The new dredges for Montana and Yukon Territory have buckets of 16 cu.ft.

capacity. This is the largest yet installed. The Yukon boat is designed to dig to a depth of 45 ft.; the hull is 50x130 ft.; the ladder, 97 ft. long; stacker, 115 ft.; and there are 71 buckets in the chain. The main-drive motor on this dredge is 300 h.p., supplied with alternating current at 220 volts, 60 cycle and three phase. The dredge of the Poor Farm Placer Mining Company, installed at Alder, Mont., digs to a depth of 55 ft.; the hull is 58x150 ft.; digging ladder, 115 ft. long; stacker, 130 ft.; and there are 81 buckets in the chain. The gears on all the machinery in these dredges are provided with cut teeth.

#### OTHER INSTALLATIONS

The dredge installed near Lovelocks, Nev., digs to a depth of 20 ft. below water line. The main-drive engine on this dredge is a 100-h.p., multiple-cylinder, marine-type, gasolene engine and separate engines are provided on the centrifugal pumps, lighting system and winches. The dredge is equipped with patent revolving screen and gold-washing apparatus and a stacker made up of an endless chain of buckets.

Besides the dredges installed in North America, the Bucyrus, Yuba Construction and New York Engineering companies built dredges for use in the Columbian Republic, India and Siberia.

# Review of Cyanidation in 1910

By Philip Argall \*

There were no startling advances in cyanidation to chronicle for 1910, but rather a steady advance along all mechanical lines and as usual no real chemical progress; the year, it is true, has not been free from the ubiquitous process tinkers with their alleged improvements and modifications; their creations, however, as in the past, have fallen still-born on an expectant world or died in the hands of their progenitors.

Cyanidation has within a few years steadily driven amalgamation to the rear, has almost everywhere displaced the Patera process, and has annihilated the wonderfully ingenious and time-honored patio process so peculiarly applicable to Mexican ores and climate. The cyanide process has therefore risen from a tailing annex in which the refuse from the mill was given a final treatment irrespective of its physical condition, to be the main milling process, so that gold and silver ores are now usually prepared, not for amalgamation, concentration or for the older lixiviation processes, but preferably for cyanidation. Consequently in a re-

view, however short, of this process today, one must commence with the preparation of the ore.

#### PREPARATION OF THE ORE

Evolution in South Africa is toward the use of heavier stamps, coarser crushing in the batteries, and tubing the coarser sands. The advantages of the heavy stamp are summed up by its able protagonist, W. A. Caldecott, as follows: "(1) Reduction of the initial capital expenditure in erecting, say 200 stamps at 1750 lb. with accessories, in place of 280 stamps at 1250 lb. each. (2) Reduction in size of mill building almost proportionate to the lesser number of stamps. (3) Thirty per cent. less shafting, belts and other moving parts to maintain. (4) Thirty per cent. less labor required for dressing plates, lubricating moving parts, changing screens, and other work incidental to milling operations<sup>1</sup>.

The foregoing might be summarized as a brief for larger consolidated units, less costly to erect and man, but presumably of the same mechanical efficiency as the

lighter stamp, the weight of reciprocating metal being the same in either case. Mr. Caldecott, while limiting the maximum diameter of the feed to 1¾ in., states, "the heavier the stamp, the coarser the preliminary breaking admissible, and *vice versa*." In other words, the heavier stamp is made to do the work usually assigned to rock breakers and rolls in some of the best plants on this side of the ocean. I have long held that the modern practice of increasing the weight and range of reduction of the stamp is wrong: "That in attempting to do the work of rock breakers or rolls with a stamp, no matter what its weight, the result will invariably be a more expensive plant and one of impaired efficiency, as measured by the weight of rock crushed per horsepower-hour<sup>2</sup>."

#### NEW CITY DEEP MILL EQUIPPED WITH 2000-POUND STAMPS

The tendency in South Africa is, however, in the other direction and so we find the new 200-stamp mill of the City Deep mine, Johannesburg, equipped with 2000-lb. stamps in units of 10, each unit oper-

\*Mining and metallurgical engineer, Denver, Colo.

<sup>1</sup>Trans., I. M. M., Vol. 19, p. 71.

<sup>2</sup>ENG. AND MIN. JOURN., May 11, 1905.



ated by a 50-h.p. motor. It is significant to note that bearings are placed between each stamp stem, 11 in all, to support the cam shaft, lessen vibration, minimize breakages and incidentally increase lubrication and maintenance cost. There are nine tube mills 22x5½ ft. in this equipment, each operated by 100-h.p. motors.

**SINGLE- VS. DOUBLE-STAGE CRUSHING STILL A DEBATABLE POINT**

The new Randfontein Central mill is supposed to follow more conservative lines; it consists of 600 stamps of 1650 lb. followed by 16 tube mills 22x5½ ft. each, for a capacity of 150,000 tons per month. The stamps are operated in groups of 10, by 40-h.p. motors, the driven pulley set in the center between the 5-stamp mortars to reduce torsional

**HEAVY STAMPS CALL FOR COARSE SCREENS**

Mr. Way considers that the investigation of the Mines Trial Committee proved, "that maximum mechanical efficiency when using heavy-weight stamps is only obtained by crushing through correspondingly coarse screens. . . . The economic limit of the weight of these stamps, leaving out mechanical difficulties, appears to be reached only when they encroach on the province of the jaw breaker or gyratory crusher, with which they cannot compete either mechanically or economically." He appears to favor finer preliminary breaking and lighter stamps and believes it is open to question whether in some recently equipped mines the economic limit has not been exceeded in the over-anxiety of the designers to

passing 0.27-in. aperture screens—provide work to be done by the falling pebbles throughout the full length of the mill, whereas with finer feed many particles are early reduced to the required size and the pebbles near the outlet of the mill are not supplied with sufficient coarse particles to secure their full crushing efficiency. He stoutly maintains that the heavy-stamp and tube-mill combination is the best arrangement for the economic reduction of Rand ores to the desired fineness, the largest proportion minus 90 mesh (0.006-in. aperture), and that in view of the present practice discussion of the possibilities of lighter stamps is largely academic. C. O. Schmitt referring to the work of the Mines Trial Committee with stamps weighing 1400 lb. crushing through 3 mesh (0.27-in. aperture) for a duty of 15.1 tons per stamp day shows that the product of 17 stamps, 256.7 tons, was easily reduced to the required fineness by one 22x5½ tube mill. That in further crushing experiments made at his suggestion seventy-five 1640-lb. stamps crushing through 0.125-in. apertures in conjunction with four 22x5½-ft. tube mills gave a duty of 16.7 tons per day, he further compares on the basis of above experiments 75 stamps and four tube mills with 75 stamps and one tube mill in favor of the four-tube combination in capital expenditure, 30 per cent.; ordinary working cost, 17.5 per cent.; ordinary working cost plus capital expenditure 23.7 per cent.; cost alone, 15.5 per cent.<sup>6</sup>

COMPARISON BETWEEN COSTS AT THE NEW KLEINFONTEIN, WITHOUT, AND OTHER RAND MILLS WITH TUBE MILLS.

Name of Company.	Tons Milled per Month.	COSTS PER TON MILLED.						
		Reduction Expenses.		General Charges.	Total.			
		S.	D.		British Currency.	United States Currency.		
New Kleinfontein	38,599	S. 4	D. 0.748	S. 0	D. 6.146	S. 4	D. 6.894	\$ 1.11
Companies Using Tube Mills:								
Simmer & Jack	68,900	3	9.684	1	0.607	4	10.291	1.17
Knights Deep	49,499	4	2.022	0	11.350	5	1.372	1.24
Wit. Deep	36,723	4	6.92	0	8.70	5	3.62	1.30
Simmer Deep	48,952	4	5.504	1	0.671	5	6.175	1.34
East Rand Proprietary Mines	157,243	4	11.734	0	6.997	5	6.731	1.35
Rose Deep	39,883	4	7.736	0	11.541	5	7.277	1.36
Simmer & Jack East	29,727	4	3.632	1	4.233	5	7.865	1.37
Village Deep	32,970	3	10.783	1	9.128	5	7.911	1.38
Laipards Vlei Estate	16,119	3	9.437	1	11.201	5	8.638	1.38
Village Main Reef	43,600	4	8.713	0	11.982	5	8.695	1.38
Robinson Deep	51,366	4	3.552	1	5.581	5	9.133	1.40
Ferreira Deep	31,772	4	7.561	1	2.876	5	10.437	1.42
New Modderfontein	45,200	4	5.617	1	5.657	5	11.294	1.44
Crown Mines	121,100	4	4.739	1	6.886	5	11.625	1.45
Knights Central	22,378	4	5.91	1	6.09	6	0.0	1.46
Robinson G. M.	57,588	4	8.549	1	3.674	6	0.223	1.46
Jupiter	24,570	4	6.843	1	7.079	6	1.922	1.50
Wolhuter	27,150	5	4.618	0	10.959	6	3.577	1.53
Nourse Mines	37,928	4	6.410	1	10.381	6	4.791	1.56
New Goch	24,740	4	9.105	1	10.772	6	7.877	1.60
Van Ryn	29,852	4	8.303	2	0.073	6	8.376	1.62
Geldenhuis Deep	39,753	5	1.866	1	9.175	6	11.041	1.68
New Reifontein	17,317	4	6.456	2	8.352	7	2.808	1.76
West Rand Consolidated	17,672	3	8.248	3	7.633	7	3.881	1.78
Cinderella Deep	13,119	5	8.195	2	1.287	7	9.482	1.88
Meyer & Charlton	13,162	5	7.582	2	2.652	7	10.234	1.90
Rodeport United	17,683	5	6.643	2	5.551	8	0.194	1.94
Durban Road Deep	17,197	5	4.539	2	8.135	8	0.674	1.95
Treasury	8,873	7	2.09	1	3.48	8	5.57	2.05
New Heriot	11,583	6	8.216	2	0.216	8	8.432	2.11

**FINES SHOULD BE BY-PASSED AROUND STAMPS**

E. H. Johnson reports an instructive test whereby ten 1634-lb. stamps and one standard tube mill crushed 261 tons per 24 hours, all but ½ per cent. of the pulp passing 0.006-in. screen aperture; consuming 150 h.p. of which the stamps used 45, the tube 105. The duty is therefore 145 lb. per horsepower-hour. As compared with single stage, all stamp work, Johnson claims an increase of 32 per cent. in horsepower efficiency and 31 per cent. in grinding efficiency. This excellent result was obtained by equipping the stamps with screens of 0.284-in. aperture and by-passing the fines in the stamp feed, suitable for tubing, direct to the tube mill, thus eliminating from the stamp any semblance of fine-crushing. Johnson adds, "As a factor in gold-ore reduction, I am of the opinion that we are only just beginning to realize the possibilities of the tube mill. It has been too tenderly treated in the size of ore particles fed to

stress in the cam shaft, not usually a matter of much moment, but with heavy stamps little can be overlooked. Both of these great mills are based on step reduction, rock breakers, stamps and tube mills or as designated in Rand practice, single- and double-stage crushing, the preliminary breaking not being considered.

While the ore in the latter process is invariably reduced finer tending no doubt toward a higher extraction, yet on the point of single- or double-stage crushing metallurgists are not agreed even in Rand practice. E. J. Way holds that where a product is required with say 10 to 14 per cent. coarser than 60 mesh, the best and cheapest practice is to use fine screens in the mortar boxes and do without tube mills, but if a finer product is required he favors stamp-and-tube-mill units.

reap the benefits claimed to accrue from the use of the tube mill. He believes this impression is borne out by the reduction costs of the mines using tube mills as compared with the cost of New Kleinfontein, where crushing by the single-stage method is in use, and submits the accompanying instructive table of milling costs<sup>5</sup>.

**TUBE MILL NEEDS A COARSE FEED FOR MAXIMUM EFFICIENCY**

Caldecott, however, maintains that, "The greater the force of impact per unit area, the coarser the screen required for maximum efficiency," hence heavy stamps must have coarse screens or larger heads, he further maintains that the coarser product delivered by the heavy stamp increases the efficiency of the tube mill, due to the fact that such coarse particles—

<sup>4</sup>Journ., S. A. Assoc. of England, Vol. 15, No. 5.

<sup>5</sup>Including labor (white and colored), power, mercury, shoes, dies, screens, pebbles, liners, lighting, water, maintenance and general charges.

<sup>6</sup>Capital charges on the basis of 7 per cent. interest plus 3 per cent. for redemption of capital.

<sup>3</sup>Trans., I. M. M., Vol. 19, p. 120.

it up to the present, and its gluttony for work has not been properly appreciated."

#### AMERICAN PRACTICE DOES NOT FAVOR HEAVY STAMPS

The question of heavy versus light stamps, or in fact any stamp at all, is still an open one in this country; it is generally conceded, however, that the 2000-lb. stamp has probably reached, if it has not exceeded, the economic limit of a cam-operated machine, and encroached on the field of the steam stamp.

While watching stamp development and performance in the greatest goldfield in the world, where the largest and latest mills are operated under, perhaps, the best conditions and controlled and directed by a galaxy of metallurgical talent, one is not favorably impressed by the working cost. Take, for example, the last seven mills on Mr. Way's table, averaging about 14,000 tons per month, as more nearly representing the tonnage of some of our larger mills, we find the average milling cost is \$1.95, varying from \$2.11 with a monthly turnover of 11,583 tons, to \$1.78 with a turnover of 17,672. Admitting that it is seldom possible to compare the working costs in different mining districts with any marked accuracy, I will merely say, if this is the best attainable with modern stamps and tube mills on free-milling ore, those who have favored step reduction in rolls, chilean and tube mills have no cause for worry.

#### MAXIMUM EFFICIENCY OF STAMPS FOUND IN REDUCING FROM 1 3/4 TO 1/4 INCH

In the article previously quoted I endeavored to show, as long ago as May, 1905, that stamps were not efficient in the field of either coarse or fine crushing, and that their economic range had not been determined. Thanks to the work of the Mines Trial Committee and the able researches of Mr. Caldecott and others, we now know that on Rand ores, tube mills give maximum efficiency when fed with ore passing 0.27-in. screen apertures, the maximum battery feed is placed at less than 2-in., thus establishing the economic range of modern 1350- to 2000-lb. stamp operating on Rand ores from, say, 1 3/4 in. to 1/4 in., a seven to one reduction against the 100 to one of a few years ago. This, in my opinion, is one of the best and cleanest vindications of the correctness of successive comminution against one-stage ore reduction that has yet appeared. Having thus established the range of the stamp it remains to be seen if other machines will not reduce ores from 1 3/4 to 1/4 in. equally as well, if not better; my personal opinion is rolls would prove superior, a possibility not overlooked by Caldecott; or rolls and fast-running chilean mills would make a good combination. In the

former, the steps would be, rock breakers, rolls and tube mills, while in the latter chilean mills would come before the tube mill, a combination preferable where concentration is an essential part of the process. Either scheme would be much cheaper in initial cost than gravity stamps, much more compact and of higher mechanical efficiency. South African metallurgists were slow in taking up tube milling, yet the work accomplished by it under their direction, particularly with 1/4-in. feed, has placed the mining world under lasting obligations. These engineers have effectively exploded the time-honored fallacies that stamps are fine crushers and that amalgamation must begin in the mortar and be completed on plates in front of it, thus simplifying the process of ore reduction, and leaving to the realms of debate and future research, the comparatively simple problem: Required, the best method to reduce ore to 1/4 in. for tube-mill feed?

#### FAST-RUNNING CHILEAN MILLS FAVORED IN UNITED STATES

Fast-running chilean mills are held in high esteem in the United States and their use is extending. Six-foot mills running 33 r.p.m. on Cripple Creek ores will reduce four tons per hour, 60 per cent. of which will pass 150 mesh (0.03-in. aperture), the feed being previously rolled to pass 3/8-in. aperture. Ball mills so successful in dry milling, have not proved efficient in wet practice, the wear of the balls, plates and screens, heavy in dry milling, becomes prohibitive in the wet process. Grinding pans are little used today in the United States, the land of their development, nor has their use extended in Australia, where they were brought to a high state of efficiency as fine grinders in competition with tube mills; where amalgamation is a feature of the process as at Kalgoorlie, the pan is undoubtedly the machine required, but in straight fine-grinding one hears little now of competition between pan and tube mill. Apart from the fine iron disseminated in the pulp produced from pans, which, to say the least, is not desirable in cyanidation, the pan requires more attention than the tube mill and its range of ore reduction is much less. It is, however, extensively used in Kalgoorlie for grinding and amalgamating roasted ores.

#### RECENT TUBE-MILL DEVELOPMENTS

An important improvement in South African tube mills is to drive from the discharge end, leaving the working (feed) end free from gearing and drive obstruction. The tube mill developed in the cement industry is not efficient, when measured by the work done per horsepower, as is well shown by a recent improvement introduced in the same industry whereby, I am credibly informed, the capacity of a tube is doubled by the consumption of but 22 per cent. additional

power. The improvement consists in replacing part of the flints by steel cylinders 1/2 in. diameter by about 1 inch in length; these are placed in a separate compartment at the discharge end of the mill. The invention has not, to my knowledge, been tried in wet milling. It will be noted that the change substitutes rolls for spheres, which latter can only crush at points in contact, while the rolls should crush along their entire face lines against points, thus enormously increasing the crushing or grinding surface. This invention also introduces step reduction in the tube mill.

#### STEEL SHAFTING USED IN TUBE MILL FOR CRUSHING SURFACES

Another machine now being built in Denver, the Marathon tube mill, has a corrugated lining of hard iron and is partly filled with steel shafting, each piece practically the full length of the mill, giving a multiple-roll effect. It is claimed to be an exceedingly fine grinder; working tests are, however, lacking.

#### BATTERY AMALGAMATION DISPLACED BY TABLE AMALGAMATION

Amalgamation in South Africa is now removed from its old position in front of the battery; the amalgamating plates being assembled in a separate building where the precipitator boxes are also housed, thus all the gold handling is done in one place, away from grease and oil and, presumably, under ideal conditions. Shaking amalgamation plates are favored in some mills. On this side there is no particular change to note. Some of the large United States and Mexican mines have abandoned amalgamation, for one cause or another, sometimes for plate troubles, where cyanide solutions are used in the battery, and sometimes, it must be admitted, to guard against theft. In other cases it has been hard to decide if the saving by amalgamation was worth the cost, inasmuch as the gold would be eventually caught in the cyanide plant. Unless the gold is coarse, and easily caught, less than 20 per cent. saving by amalgamation is seldom worth the labor and expense incident to that process.

#### DOES CONCENTRATION PAY?

Concentration is also in varying esteem, having been abandoned in several mills and taken up anew in others. Where a fair proportion can be obtained as a concentrate, difficult to cyanide, it is usually good practice to remove it either for sale to smelters or to work up in the mill. In either case a rebellious substance is removed, thus shortening the cyanidation of the bulk of the ore, while when treated separately in the mill the concentrate can be given such special treatment as the case requires, fine grinding, stronger solution, or longer treatment, one or all, thus cheapening the entire process.



Crushing and concentrating in cyanide solution is now standard practice in many places where gold-silver telluride ores are treated; as for example in West Australia, in Mexico and Tonopah, Nev., and at Cripple Creek. In the latter district about 18,000 tons per month of sulpho-telluride ores varying between \$3 and \$3.50 per ton are now treated by this method in the mills of Stratton's Independence Limited and the Portland Gold Mining Company.

#### DRY MILLING

The reduction of ore in the dry state is usually necessary in roasting-cyanide plants, the first of which, the Metallic Works, was erected at Florence, Colo., in 1895, following a series of roasting experiments on a working scale. At Kalgoorlie, about 70,000 tons per month are treated in the cyanide-roasting plants, the greater part crushed in Krupp ball mills, which have been brought to a high state of efficiency and are giving excellent service. The Griffin mill is also in use there, but the ball mill has the preference.

#### CRIPPLE CREEK PRACTICE DIVIDED BETWEEN BALL MILLS AND ROLLS

About 45,000 tons of Cripple Creek ore are prepared for roasting every month, about half by ball mills and half by rolls; the ball mills crush through about 3/16-in. aperture, the ore is ground fine in Chilean mills after roasting. The roll plants crush to 12 mesh (0.042-in. aperture), the ore is then roasted, chloridized in barrels, ground in tube mills, and the residue from the barrels cyanided. These mills were, of course, built for the chlorination process, but in time it was found the tailings could be cyanided at a profit and the cyanide annex, when added, allowed much poorer and cheaper work to be done in the roasting and chlorination departments. About 6000 tons per month of semi-oxidized ore are prepared by roll plants for direct cyanidation each month in the Cripple Creek district and mostly cyanided in leaching tanks.

#### TREATMENT OF ORE AFTER ROASTING

After roasting, the ores are invariably wet ground in cyanide solution usually in amalgamating pans. This is the standard practice in Kalgoorlie, through which about 30 per cent. of the gold is recovered in amalgam. In other places the gold is caught in blankets together with the heavier minerals or partly roasted sulphides and the blanketings only ground and amalgamated in pans. After roasting, then, both processes are wet and the subsequent treatment similar.

This is necessary even in the all-slime plants, in order to return the sands to the tube mill. Cone classifiers are extensively if not exclusively used abroad. In North America, however, drag separators of various types have been long in use, followed by the much superior

spiral or helical classifiers. These give a clean separation not more than 6 to 10 per cent. slime in the sand or sand in the slime, ore that will pass 150 mesh (0.003-in. aperture) being designated slime in our practice. I have had spiral classifiers in use for about three years that deliver clean sand 5 in. above the receiving point and the clean slime 6 in. below it; one of the most perfect acting and least expensive machines, both in first cost, maintenance and operation, that I ever had the pleasure of using. Such a classifier meets all requirements. A clean separation of the slime from the sand is essential to good extraction and rapid leaching in the tanks. The slime-free sands can be sluiced direct from these classifiers to the leaching tanks and with a small quantity of solution will fill perfectly without mechanical distributors or manual labor at the tanks.

#### ALL-SLIME PROCESSES NOW LOSING FAVOR

Sand treatment is occasionally by agitation but usually by simple percolation in tanks. The all-slime method is not extending as rapidly as it did; there is a general return to sand treatment; fine grinding is expensive.

Slime treatment is invariably by agitation. The only agitators worth considering are in my opinion the Pohlé air lift and the large-volume slow-running centrifugal pump; other forms of mechanical agitators are not worth considering. By slow-moving centrifugal pumps I mean one speeded to overcome the hydraulic head which is seldom over 3 ft., including friction, whereas one usually finds centrifugal pumps used for agitation, running at a speed equal to a head of 40 to 60 ft. The Pohlé air lift, however, is the best form of agitator, first I believe applied to this work by Brown, in New Zealand.

#### QUESTIONABLE WHETHER THE PACHUCA TANK IS AN IMPROVEMENT

The tall, Brown (Pachuca) tank is, however, of no special advantage; almost any shaped tank with a conical bottom will do equally as well. I prefer tanks 30 ft. in diameter with peripheral overflow. These can be used at will for either settling, or agitating by means of the air lift. I believe it is a mistake to carry the discharge of the air lift to the top of the tank and prefer discharging 8 or 10 in. below the surface of the liquid, placing a perforated conical distributor over the discharge to direct the flow from the air lift toward the periphery of the tank. In this way two important advantages are obtained: (1), the air escaping from the lift keeps the upper portion of the charge in violent agitation, giving far better aeration than is obtained in the Pachuca tank, from which the compressed air escapes into the atmosphere and is lost; (2), the sandy portion of the charge escaping from the lift falls on an apron, directing it also toward the

periphery where, settling rapidly, it is again taken up by the air lift. In this way the sand receives brisk agitation and it usually needs such treatment. It must not be inferred that I advocate treating sands and slimes together, I refer only to the sandy portion of the slime charges. No inconvenience has occurred through the apparent separation of sand and slime in this system of agitators.

#### PACHUCA TANK USEFUL IN GIVING SCOPE TO WOULD-BE INVENTORS

The tall, slim Pachuca tank, however, is the height of metallurgical fashion today and, like the hobble skirt, must run its course. I do not condemn it, but merely show how, in some cases at least, better results may be obtained from standard, or less freaky apparatus. Any attempt to describe the imitations and variations of the Pachuca tank and the numerous complex and mysterious systems of patented piping with which it has been draped and garnished is, of course, out of the question. But, from this view point, the Pachuca tank has been, and is now, an unqualified success.

#### CONTINUOUS AGITATION GAINING GROUND

A battery of six Pachuca tanks 14 ft. 10 in. by 44 ft. 8½ in., at the Esperanza mill, Mexico, was fitted up last February for continuous agitation, by means of 6-in. pipe connections from a point near the top of one tank to a position near the bottom of the air lift in the adjoining tank. The pulp is fed into the top of No. 1 tank at the rate of 300 tons of dry slime and 540 tons of solution per day, each tank having the usual Pachuca air-lift equipment. The pulp gravitates through the series of six tanks with a friction drop of about 6-in. head between tanks. Apart from the time saved in filling tanks a gain in extraction of 1.3 per cent. gold and 1.5 per cent. of silver is reported and a saving of 25 grams cyanide per ton of ore treated.<sup>a</sup>

In wet milling with cyanide solution (crushing and concentrating) the process must, of course, be continuous so far as settling slimes and clarifying the solution for re-use is concerned. Some of these plants also carry out continuous agitation methods, and with uniform ores continuous agitation will, no doubt, soon become standard practice in combination with continuous-acting filters. The Esperanza work is, however, carried out on a large scale with results that show the continuous agitation is at least as good as the single-charge method.

#### VACUUM FILTERS APPARENTLY SUPERIOR TO FILTER PRESSES

West Australian metallurgists introduced the filter press into gold milling, and, I might say, perfected it; today the filter press remains the standard at Kalgoorlie, but, unlike the tube mill, also

<sup>a</sup>M. H. Kuryla. *Mex. Min. Journ.*, Aug., 1910: p. 45.

first used in ore treatment at Kalgoorlie, it has not spread over the world. The filter press is too costly in initial expenditure, in maintenance and in operation, so could not hold its own against the much cheaper and more efficient vacuum filters of American invention, the leading types of which, the Moore and the Butters, have with few exceptions met with unqualified success.

#### FIRST LEAF-FILTER PLANT ON THE RAND

The Butters company this fall started a 1000-ton plant, in perhaps the most critical metallurgical circle in the world—conservative in everything except the weight of stamps. This filter plant on the Crown Mines made a wonderful showing against the standard decantation process elaborated in Rand practice; and several other vacuum-filter plants, it is said, are under order. This is somewhat surprising on account of the immense capital tied up in the huge decantation plants.

Many efforts have been made to elaborate a continuous slime filter, one of the earlier successes being attributed to the Ridgeway, 10 of which are operated at the Great Boulder mill, Kalgoorlie. Other Ridgeway's have been erected in Mexico and elsewhere.

#### DRUM FILTERS STILL TOO COMPLICATED

The drum form of continuous filter, of which we may take the Oliver as a type, appears to be coming into use in the United States and Mexico; they all leave much to be desired, the complication of automatic valves on vacuum, pressure air and wash water prove troublesome and in the present state of the art the simpler form of leaf filter, now highly developed, appears to have the preference among large users.

#### ZINC STILL SUPERIOR TO ELECTROLYTIC PRECIPITATION

The simple zinc shaving of MacArthur

still holds the lead and is, I believe, preferable for rich solutions. The zinc-dust method, however, as perfected by Merrill is superior for recovering precious metals from weak and low-grade solutions. This process is coming into extensive use and deservedly so. It is important to note that electro-precipitation has made no progress notwithstanding the many shining lights that have introduced one or another of the various schemes and the lavish use of capital to promote them.

Electro-cyanide methods have indeed failed entirely in practical mill work, both in the solution of the precious metals and also in their precipitation. Meanwhile, the old process of MacArthur-Forrest aided by cheaper chemicals and power and by ever increasing mechanical improvements, goes steadily on conquering and to conquer stubborn and rebellious ores in every part of the globe.

## Stamp Milling in 1910

By Louis D. Huntoon \*

In reviewing stamp-mill practice in this country and South Africa during 1910 there is still to be noticed the general absence of preliminary hand dressing and mechanical sampling in this country.

The results of the discussion over the efficiency of the heavy gravity stamp as compared with the light stamp are that South African practice appears to favor the heavy stamp up to 2000 lb., whereas in this country stamps weighing from 1000 to 1200 lb. remain in favor. The new Ebner mill at Juneau, Alaska, is an exception; at this property stamps weighing 1400 lb. have been ordered. The heaviest stamps operating in this district are 1150 lb. The results from the 1400-lb. stamps will be looked forward to with much interest.

#### FINE GRINDING

For fine grinding of gold-silver ore the large mills still follow the practice of the last few years; the stamp mill is used primarily as a crushing machine preparatory to sliming in a tube mill. Since the development of the disseminated copper ores requiring fine grinding, mills on entirely different lines have been designed to pulverize the ores; rolls and Chilean mills have replaced the stamp and tube mills.

The advisability of retreating at the mills concentrates containing gold and silver, to save freight and smelting charges, has been investigated during the

last few years with the result that a few of the mills producing such concentrates have devised successful methods of extracting the gold.

#### HAND DRESSING

In South Africa, preliminary hand dressing before stamping is practised on a large scale on sized products, and about 20 per cent. of waste rock discarded, thereby greatly increasing the capacity of the mine and the profits per day and per ton of ore. In this country preliminary hand dressing is not in so great favor, and is only practised at a few properties on lump ore as delivered to the breaker from the mine bins. From the breakers the ore is conveyed to the stamp mill without further hand dressing. The possibility of introducing hand dressing on the product from the breakers is worthy of careful investigation.

#### SAMPLING PLANTS

Mechanical-sampling plants preceding stamp milling are also noticeable by their absence in most mills in this country. Samples are taken from the battery discharge, but this sample does not contain the rich sands retained in the battery and is not a sample of the ore being milled. Great care must be exercised in taking this sample as the slimes are liable to splash over the sides of the sampler and be lost, in which case the battery sample is not accurate and there is no check on the mill work.

With base metals, where the ore in general is worth much less per ton and

requires most careful milling to show a profit, accurate mechanical-sampling plants are installed. The excuse for not installing mechanical-sampling plants for gold ore is that a sample can be taken from the battery and the cost of the sampling plant and operation does not warrant it. When investigating this cost, it is found to be less than one cent per ton. The following costs were obtained in 1910 and illustrate how insignificant the cost is when the plant is properly arranged: Capacity of plant, 3000 tons per day; weight of sample, 120 lb. per day; cost of plant, \$7500. Cost of operation: 10 h.p. for operating, \$1.40 per day; 5 h.p. for drying, \$0.70; two men, \$4.60; maintenance, \$0.80; total, \$7.50 per day, or  $\frac{1}{4}$ c. per ton of ore.

#### SAMPLING AND ASSAY COSTS LOW

At the El Oro mine the total cost of sampling for May, 1910, including mine sampling, assaying, and supplies, was 4c. per ton. Over 8000 assays were made at a cost of 14c. per assay. In the Cœur d'Alene district, Idaho, the charges per ton for sampling are insignificant. At public sampling plants where the plant must be thoroughly cleaned after each lot is sampled, the cost is much greater and will vary from 20 to 22c. per ton on 100-ton lots.

#### CAPACITY OF STAMPS

The capacity of stamps depends upon a great many factors but only the size of the ore and weight of the stamp will be considered here.

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The size of ore fed to a stamp mill will depend upon the character of the ore and the weight of the stamp. Heavy stamps require a coarser feed than light stamps. The size should be such that the force of the blow will be dissipated in crushing the rock on the die and splashing the crushed material through the discharge screen. For crushing purposes, breakers are more efficient than stamps. The ore should be reduced with breakers as fine as is consistent with the successful operation of the stamp.

It appears from the investigations in South Africa that the capacity of the stamp increases in almost direct proportion to the weight. This has resulted in gradually increasing the weight for increased capacity until a new mill of 200 stamps, weighing 2000 lb. per stamp, has been erected.

South African practice has not been followed in this country. By increasing the weight and size of discharge the capacity of South African stamps has been increased from about  $3\frac{1}{2}$  tons to 8 tons and in one case it is 15 tons. By increasing the size of discharge in this country the capacity has been increased from about  $3\frac{1}{2}$  tons to five to seven tons with one or two exceptions where a nine ton capacity had been reached.

#### EFFICIENCY OF HEAVY STAMPS

The question has been raised as to the most efficient weight for gravity stamps, and upon this point opinions differ greatly. The series of tests made in South Africa, published in the *Transactions of the Institution of Mining and Metallurgy*, 1909, together with the discussions, indicates to me that heavy stamps are more efficient crushing machines than light stamps. The question as to whether the stamp mill, as a crushing machine, is as efficient as rolls apparently was not considered during these tests. Most engineers will admit that for crushing purposes only the stamp mill is not as efficient as rolls. The original stamp mills erected for treating Cripple Creek ore were soon rebuilt and the stamps discarded for rolls. This improved practice is still followed by the large mills.

The stamp mill, as a crushing machine, has lately been thoroughly tested in the mill of the Boston Consolidated Copper Company, treating the disseminated copper ore from Bingham, Utah. As a crushing machine it was not a success, and the stamps are now being replaced by rolls and chilean mills which will have a much greater capacity than the stamps.

#### FINE CRUSHING

The old practice of treating gold-silver ore was to crush with stamps, amalgamate on apron plates and con-

centrate the tailings, if necessary. With the improvements in the cyanide process the method of recovery has changed entirely in many districts, but no changes have been introduced for the preliminary crushing other than increased weight of stamps. The apron plates to the battery are being discarded, and shaking amalgamating plates introduced to save the coarse gold. The gold and silver remaining in the tailings are extracted by concentration and cyaniding, or by cyaniding direct.

The stamp mill as used today is primarily a crushing machine. In the new 200-stamp mill recently built in South Africa, with stamps weighing 2000 lb., the ore is crushed through 10 mesh, classified, and the coarse product from the classifier pulverized in tube mills. No amalgamation takes place until the ore is pulverized; the stamps and tube mills are used for crushing and pulverizing only. The products from the tube mills, together with the overflow from the classifiers, are combined and fed to shaking amalgamating tables.

#### STAMPS USED ONLY FOR CRUSHING

The new mill of the Tonopah Extension company also serves as an illustration of the use of stamp mills for crushing purposes only. The ore is crushed by stamps, concentrated, the coarse tailings pulverized in tube mills, and the product from the tube mills again concentrated. The pulverized tailings are collected and cyanided.

As shown in the flow sheet of the Goldfield Consolidated mill, the stamps are used primarily for crushing. The openings in the discharge screen are  $\frac{1}{4}$  in., giving a capacity of  $8\frac{1}{2}$  to  $9\frac{1}{2}$  tons per stamp. For finer grinding, chilean mills have been introduced similar to the practice of mills operating on disseminated copper ore. Tube mills are used for pulverizing. Many other mills using stamps as crushing machines could be mentioned but the above will serve to illustrate South African practice and two types of mills in this country.

#### CRUSHING DISSEMINATED COPPER ORE

Examining the practice followed in crushing disseminated copper ore, which requires the same general treatment as the gold-silver ore, there is no similarity. The copper ore is broken to  $1\frac{1}{2}$  in. and crushed with rolls at less expense than can be accomplished with stamps. The rolls have a positive discharge whereas the stamps have not. Chilean mills are, at present, receiving preference for finer grinding of copper ore. These mills have not a positive discharge and tend to slime the product which is objectionable for concentration. It is reported that one section of the Miami Copper mill will use rigid rolls in place of chilean mills. From the above it ap-

pears that the stamp mill should be abandoned when the ore contains no coarse gold and that rolls should be introduced in their place.

The economical limit of fine crushing with rolls is about 20 mesh. Beyond this tube mills and ball mills are more efficient. For gold-silver ore, tube mills are preferred and are being largely used. The discharge is not positive and the product is likely to contain a high percentage of slime. When slimes are to be avoided the ball mill is preferable to the chilean mill.

#### RETREATMENT OF CONCENTRATES

At several of the large gold mills the concentrates produced are being retreated and the gold extracted at the mill, thereby saving freight and smelter charges. The practice followed by the Goldfield Consolidated company is to first pulverize the ore and then concentrate. The concentrates are first run over amalgamating plates to recover coarse free gold and then cyanided by a special process devised by G. W. Hutchinson.

Experiments have also been conducted by Mr. Parsons of the Desert mill, Nevada, on the concentrates from the Tonopah ore, but the results did not warrant the erection of a plant.

At the Perseverance mine, about five miles from Juneau, Alaska, the concentrates assay from \$30 to \$40 in gold. The charges for haulage, freight and treatment amount to about \$14 per ton. To avoid this excessive charge a Middleton & Cobbe amalgamating pan was installed recently to retreat the concentrates. The results of the testing show that a large percentage of the gold can be recovered by amalgamation, and the pulverized concentrates reconcentrated, giving a product containing from \$100 to \$125 per ton and tailings containing \$2 to \$2.50 per ton.

#### ALASKA-TREADWELL TO RETREAT ITS OWN CONCENTRATES

The Alaska-Treadwell company, on Douglas island, Alaska, is also installing a plant to retreat the concentrates which assay about \$30 in gold. For years past these concentrates have been shipped to the smelteries along the Pacific coast. Freight and treatment charges have amounted to about \$10 per ton. The present plan is to classify the concentrates, recrusher the coarse material in tube mills and pass the product of the tube mills, together with the overflow from the classifier, over amalgamated copper plates. The tailings from the copper plates will be cyanided. It is estimated that the total cost of retreatment will amount to about \$3 per ton, thereby saving about \$7 per ton on 100 tons of concentrates per day, which is a good profit in itself.

# The Metallurgy of Lead in 1910

By H. O. Hofman \*

The improvements made during 1910 in the metallurgical treatment of lead ores were few, as the methods of smelting ore and refining lead bullion were already so well established that the practice had almost become standardized. There were a few exceptions to this general statement, but most of the changes that took place had to do with a mechanical device here and there which hastened and cheapened the operations heretofore carried out by hand.

If the practice shows considerable uniformity, the theory is being steadily advanced by the research that is being carried on in metallurgical laboratories. General chemical investigations, which for the last fifty years were more or less confined to organic chemistry, have in part made a change of front and turned toward the field of inorganic and with it, of metallurgical chemistry, since it has become possible to determine accurately the character and limit of many chemical reactions at elevated temperatures. Thus from metallurgical and purely chemical sources many processes which practice has developed receive explanations which fill existing gaps in the theory and broaden the field as a whole.

## COMPOSITION OF THE LEAD SILICATES

A very common compound in lead metallurgy is lead silicate. A few years ago Mostowitsch<sup>1</sup> shattered the generally accepted idea that we had to deal with chemical compounds by a series of careful experiments which appeared to show that lead silicates were solutions of lead oxide in lead glass. The more recent investigations of Cooper, Shaw and Loomis<sup>2</sup> proved the existence of the singulo-silicate,  $Pb_2SiO_4$ , melting at 746 deg. C.; of the bi-silicate,  $PbSiO_3$ , melting at 766 deg. C.; and of a eutectic,  $Pb_2SiO_4$ — $PbSiO_3$  with approximately 88 per cent.  $PbO$ , melting at 717 deg. C.; they also determined the freezing point of  $PbO$  as lying at 888 deg. Centigrade.

## DECOMPOSITION TEMPERATURES OF THE SULPHATES

In the roasting of a metallic sulphide there is almost always some metallic sulphate formed, and the latter is decomposed wholly at an elevated temperature, with the exception of lead sulphate, which gives off only in part its sulphur trioxide. The dissociation temperatures of only part of the metallic sulphates are known. The

investigations of Friedrich<sup>3</sup> gave valuable information upon this point. The temperatures for the leading sulphates are as follows:  $Fe_2 \cdot 3 SO_4 \rightarrow Fe_2O_3 = 705$  deg. C.;  $CoSO_4 \rightarrow CoO = 880$  deg.;  $NiSO_4 \rightarrow NiO = 840$  deg.;  $CuSO_4 \rightarrow 2 CuO \cdot SO_2 = 740$  deg.;  $2 CuO \cdot SO_2 \rightarrow CuO = 845$  deg.;  $CuO \rightarrow CuO \cdot Cu_2O = 1040$  deg.;  $ZnSO_4 \rightarrow 3 ZnO \cdot 2 SO_2 = 840$  deg.;  $3 ZnO \cdot 2 SO_2 \rightarrow ZnO = 935$  deg.;  $MnSO_4 \rightarrow ? = 1030$  deg.;  $Al_2 \cdot 3 SO_4 \rightarrow Al_2O_3 = 770$  deg.;  $Ag_2SO_4 \rightarrow Ag = 1085$  degrees.

The melting temperatures found are:  $MnSO_4$ , 700 deg.;  $Ag_2SO_4$ , 600 deg.; the transformation temperatures,  $ZnSO_4$ , 740 deg.;  $MnSO_4$ , 860 deg.;  $PbSO_4$ , 850 deg. (others found 845 deg.);  $Ag_2SO_4$ , 410 deg. Centigrade.

## THE NAME FOR BLAST ROASTING STILL UNSETTLED

The subject of paramount interest at present is that of blast-roasting, by means of which metallic sulphide is roasted and agglomerated in a single operation through forced or induced, instead of the common natural draft. Recent experiments appear to show that some metallic arsenides are amenable to blast-roasting, of which more below. Some attempts have been made to substitute for the generic term of blast-roasting given by Dwight, the word "bessemer-roasting"<sup>4</sup> and "blast and down-draft sintering,"<sup>5</sup> neither of which appears satisfactory. Following the second suggestion, "up- and down-draft roast-sintering" expresses the present state of the art, but the term is too long.

## BLAST-ROASTING ONLY A QUICKENED ORDINARY ROAST

Technical periodicals have offered many theories regarding the reactions that occur in blast-roasting since the process was first patented by Huntington and Heberlein in 1898 for the treatment of lead ores. In a doctorate thesis<sup>6</sup>, Paul Richter goes over the whole ground systematically, subjecting the different theories proposed to laboratory experiment, and feels justified in putting them all aside. He shows that blast-roasting is nothing more or less than an enforced ordinary roast similar to that in a reverberatory furnace, in which the reactions taking place with galena

may be expressed by  $PbS + 3 O = PbO + SO_2$ ,  $SO_2 + O = SO_3$ ,  $PbS + 4 SO_2 = PbSO_4 + 4 SO_2$ ,  $PbO + SO_2 = PbSO_4$ ,  $2 PbO + SiO_2 = Pb_2SiO_4$ ,  $2 PbSO_4 + SiO_2 = Pb_2SiO_4 + 2 SO_2$  (or  $SO_2 + O$ ). The large volume of air, forced or drawn into the ore charge, surrounds the single particles of sulphide, drives off the sulphur dioxide as soon as formed, and thus counteracts to some extent the formation of sulphate; at the same time it causes the oxidation to proceed at such a speed that the heat generated causes the resulting oxide to form with the accompanying gangue or the added flux a sintered mass. There are two statements in the thesis to which exception must be taken; one is that the silica necessary to the charge may be either free or combined; the other is that the composition of the gangue or of the flux added has no influence upon the result.

## CONDITIONS NECESSARY FOR SUCCESSFUL BLAST-ROASTING

For the success of a blast-roast, it is essential that the sulphurous gases formed be withdrawn as quickly as possible; that the heat furnished by the oxidation be sufficient for agglomeration and not in any great excess over the amount required; that the quality and quantity of diluent flux, or, the gangue, be such that it form with the oxide a sintered mass; that the size and form of ore as well as of diluent flux, be correct; and that the operation be carried out in the suitable manner.

The quick withdrawal of sulphur dioxide as soon as formed prevents its being converted into trioxide by catalysis and acting upon oxide or sulphide. As regards the heat set free in roasting, it is well to recall that the amounts liberated by the oxidation of metals, such as zinc, iron, nickel, lead, copper, per molecule oxygen, are much greater than is that by the burning of sulphur to sulphur dioxide, viz.,  $(Zn, O) = 84,800$  cal.,  $(Fe, O) = 65,700$ ,  $(Ni, O) = 61,500$ ,  $(Pb, O) = 50,800$ ,  $(Cu_2O) = 40,800$   $(S, O_2) = 34,630$  cal. Thus, a low-grade copper matte, or one that is rich in iron, will behave differently from one that is high-grade or poor in iron, and a lead matte differently from a galena concentrate, on account of the high temperatures developed by the first, as compared with the second. On account of the large amount of heat developed by the oxidation of arsenic per molecule oxygen, viz.,  $(As_2O_3) = 52,100$  cal., an arsenide will not be so readily blast-roasted as a corresponding sulphide, although the heat of

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<sup>1</sup>*Metallurgie*, 1907, IV, 647.

<sup>2</sup>*Am. Chem. Journ.*, 1909, XI, II, 461.

<sup>3</sup>*Metallurgie*, 1910, VII, 323.

<sup>4</sup>Editorial, *Met. and Chem. Eng.*, 1910, VIII, 222.

<sup>5</sup>*op. cit.*, p. 317.

<sup>6</sup>*Beiträge zur Theorie des Huntington-Heberlein-Prozesses und der ihr verwandten Verblaserverfahren*, published by Robert Noske, Borna-Leipzig, 1909.



vaporization of arsenious oxide has to be deducted from the above high value.

#### FIVE WAYS TO CORRECT EXCESS HEAT DEVELOPMENT

There are five ways open for correcting the heating effect of an excess of metallic sulphide: One is to add an extra amount of water to the charge, e.g., 15 per cent. as against the usual 5; another to roughly roast the ore in a fine-ore kiln or reverberatory furnace, and thus convert part of the sulphide into sulphate and oxide; the third is to dilute the ore with sufficient flux to reduce the calorific power of the ore mixture; the fourth is to choose a diluent of high specific heat; the fifth, a suggestion of Savelsberg, to blow in air containing less than the normal amount of oxygen. Wetting down the charge is the simplest expedient, but water can be used only in limited amounts. Rough-roasting not only decomposes part of the metallic sulphide, but changing this into oxide contributes thereby a certain amount of diluent and correspondingly diminishes the quantity of extraneous material that would otherwise have to be added. As a rough-roast in a mechanical furnace is a cheap operation, this method offers many advantages over the third, the addition of flux to the raw ores, because with this an economic limit is quickly reached, as it decreases the smelting power of the blast furnace for ore, the capacity of the shaft being taken up by flux. Dilution of air with fuel gases has not been tried.

#### EFFECT OF DILUENTS EXAMINED

The assertion of P. Richter that the character of the diluent had no decided influence upon a blast-roast is based upon the fact observed by him in roasting experiments made in an assay muffle, which showed that the oxidation was hastened about equally by the 16 diluents tried, namely, limestone, iron oxide, gypsum, caustic lime, dolomite, barite, witherite, baryta, cerussite, anglesite, lead- and copper-blast-furnace slag, ground brick, silicious gangue, "blue billy" (iron ore). As far as the mechanical effect of holding apart the sulphide particles and thereby favoring the speed of the roast is concerned, the statement holds true, but the thermal and chemical behaviors of the additions to a charge have to be well considered. It is essential for a blast-roast that complete oxidation of the sulphide be accompanied or closely followed by sintering, or fusing. The latter takes place at a slightly elevated temperature above the former; with silicate mixtures, the two curves usually run parallel. The specific heat of the flux, or, the gangue, must be such as to absorb any excess heat generated by the forced roast, acting as a

thermal balance-wheel which equalizes the temperature and holds it at a point at which roasting and sintering can proceed at the desired rate and in the required degree. If the specific heat is too low, the temperature rises too quickly and the charge fuses before it is sufficiently roasted; if it is too high, too much heat is absorbed, the temperature of the sulphide is too low for a perfect roast and especially for the desired sintering, with the result that part of the charge is imperfectly roasted and remains pulverulent. The following substances are arranged approximately in the order of their specific heats, the first having the lowest: Lead oxide, cerussite, anglesite, barite, copper oxide, witherite, manganese oxide, iron oxide, iron silicate, calcium sulphate, basic copper carbonate, alumina, silicate low in iron, hornblende, limestone, sandstone, ground brick, dolomite, clay, copper and lead blast-furnace slag, gypsum. As regards the chemical effect of the flux, it is essential that the mixtures have a composition which sinters at a low temperature, forming silicate. For example, with lead ores the composition is usually one which will result in a singulo-silicate of low formation temperature formed from the remaining components after the amount of lead and matte expected has been deducted. Of course, if the percentage of metallic sulphide is too low, with galena ore under from 7 to 10 per cent. sulphur, raw sulphide will have to be added to the charge.

#### SIZE OF GRAIN SAME AS FOR ORDINARY ROAST

The size of grain of the ore will be the same as that which has been found to be best for an ordinary roast, i.e., for galena about 8-mesh; the grain of the flux ought to be coarser with a galena charge, about 4-mesh; further, the grains ought to be angular and not rounded, in order that they may interlock, resist the pressure of the blast and keep open the spaces necessary to furnish free access to the air. The flux will therefore be crushed fine in rolls and not in ball mills or similar apparatus furnishing rounded grains.

As regards the mode of operating, it is essential that the components of a charge be intimately mixed; further, it has been found necessary to moisten the charge. The water acts in two ways, in that it prevents dusting and keeps down the temperature, excess heat being absorbed by vaporization of the water.

#### UP-DRAFT ROASTING DONE IN POTS

The apparatus<sup>9</sup> is conveniently classed as up-draft and down-draft. For the former the spherical or slightly conical cast-iron kettle supported by trunnions

is characteristic. Its form and mode of operating have been repeatedly described in connection with the Huntington-Heberlein, Savelsberg, and Bradford-Carmichael processes for blast roasting lead ores.

In the last year two improvements in the form and general arrangement of pots have been made. Thus, Baker<sup>10</sup> patented a pot of the usual form with grate and blast inlet beneath, different from the general type in that the conical hood covering the pot rests upon a separate support with which it forms an airtight joint by means of a sand- or water-seal. The gases set free in blast roasting are deflected by the hood, pass off between the hood and the rim of the pot, descend outside of the latter and enter a flue that is connected with an exhaust apparatus. Doors in the hood give access to the charge when the blast has been shut off. The recommendation for the arrangement is the reduction of volume of gas.

#### APPARATUS USED AT TORREON

Haas<sup>11</sup> described his blast-roasting in operation at Torreon, Mexico. The essential parts are a bowl-shaped cast-iron vessel, 6x12 ft., with grate, holding 10 tons of charge, supported by trunnions through which enters the blast, a stationary hood with doors delivering the gases to a balloon-shaped dust flue, a hopper for holding the prepared mixture supplied by a belt conveyer, a tilting device and an adjustable air supply. The discharged sinter-cake is handled from an overhead traveling crane. With a 400-ton plant of 20 units, each treating two charges per day, the cost of blast-roasting is estimated at 68c. per ton.

#### CONTINUOUS UP-DRAFT ROASTING

Bellinger's apparatus<sup>12</sup> is a departure from the common intermittent pot in that it is continuous. It consists of a horizontal traveling grate resembling an endless link belt, over part of which extends a vaulted roasting chamber connected by a pipe with a device for furnishing induced draft. At the feed end of the grate and outside of the roasting chamber are two hoppers: One feeds the ore mixture on to the grate to be ignited by a burner; the other feeds on top of the ore a bed of crushed limestone, coarse ore, or other suitable material which, serving as a filter, holds back the flue dust created by the power of the induced draft. The sintered ore is discharged outside of the roasting chamber at the end opposite the feed. Another apparatus to be mentioned was that of Vivian<sup>13</sup>.

<sup>9</sup>U. S. Pat. No. 942,810, 1910.

<sup>10</sup>ENG. AND MIN. JOURN., 1910, XC, 814.

<sup>11</sup>U. S. Pat. No. 942,052, Dec. 7, 1910.

<sup>12</sup>U. S. Pat. No. 950,798, March 1, 1910.

<sup>13</sup>W. Mostowitsch, private communication, August, 1910; Guillemain, *Metallurgie*, 1910, VII, 599.

<sup>14</sup>Hofman, *Bull.*, A. I. M. E., Nov., 1910.

#### USE OF DWIGHT-LLOYD MACHINE CONTINUALLY GROWING

Of the down-draft blast-roasting apparatus the Dwight-Lloyd roasting machines remained the sole representatives; however, a new device was patented by Perkins and Requal<sup>12</sup>. A general description of the Dwight-Lloyd machines, giving the leading facts, appeared in this paper<sup>14</sup>. The record during 1910 was satisfactory. The Metallurgische Gesellschaft, of Frankfurt-am-Main, Germany, the owner of the Huntington-Heberlein patents, thought it wise to purchase the European rights to the machines. In this country, the original 50-ton machine at Salida, Colo., has been supplemented by two large units of 100 tons capacity; the same is the case with the works at East Helena, Mont.<sup>15</sup> Similar news comes from Selby, Tacoma, Alton and Monterey.

It is interesting to note that the Savelsburg process in operation at the works of St. Joseph Lead Company, Herculaneum, Mo., is being replaced by the Dwight-Lloyd machines. The St. Louis Smelting and Refining Company, is duplicating its down-draft blast-roasting plant; in Australia the Sulphide Corporation at Cockle Creek has put in the machines, and the Broken Hill smeltery at Port Pirie has given up the Bradford-Carmichael process in favor of the Dwight-Lloyd machines. This record appears to show that the advantages claimed for continuous down-draft machines with a bed of mixture four inches deep, furnishing ready blast-furnace material, as against the up-draft intermittent pot, which with a charge from three to four feet deep furnishing a cake weighing from 6 to 9 tons which has to be broken for blast-furnace use, are being fulfilled.

#### IGNITION AND INCANDESCENCE TEMPERATURES OF ARSENIDES

Before discussing the new field of blast-roasting in the treatment of speiss, it is well to call attention to the experimental work of Friedrich<sup>16</sup> upon the ignition and incandescence temperatures of some artificial cobalt and nickel arsenides. The cobalt series of roasting tests, with material ranging in size between 0.1 and 0.2 mm., shows that cobalt arsenides of from 46.5 to 78 per cent. Co begin to roast at temperatures varying between 750 and 822 deg. C., and that the ignition and incandescence temperatures do not rise with the percentage of cobalt. In the nickel series, the arsenides varying in composition from 44 to 71 per cent. Ni shows, in 0.1-mm. size incandescence temperatures of from 500

to 1050 deg. C., which rise with the nickel contents. The same is the case with grains 0.1 to 0.2 mm. in diameter, excepting that the temperatures are higher, covering a range of from 680 to 1200 deg. Centigrade.

#### BLAST-ROASTING OF SPEISS

Guillemain<sup>17</sup> has experimented with the blast-roasting of lead-bearing speiss (German Pat. 1908, No. 195,465, Kl 40 a, Gr. 2.) the bane of the lead smelter. His charge consists of finely ground speiss mixed with limestone, or acid copper-blast-furnace slag, coarse sand, crushed brick and perhaps some lead matte for the control of temperature and copper content. In blowing sintering takes place only after a considerable part of the arsenic and antimony has been expelled. Thus, 12 tons of speiss of the composition Pb, 9.9; Cu, 6.65; Fe, 48.5; NiCo, 3.4; As, 18.5; Sb, 3.4; S, 6.2; Ag, 61.2 oz., mixed with flux to reduce the arsenic content to from 10 to 15 per cent., gave flue dust with Cu, 1.6; As, 47.8; Sb, 11.4; S, 0.88; Ag, 1.6 oz. and after fusion, concentrated speiss with Pb, 4.75; Cu, 8.15; Fe, 30.8; NiCo, 12.50; As, 20.6; Sb, 0.90; S, not determined; Ag, 72.9 oz. In blowing, the grate of the pot is covered with broken limestone; this is followed by glowing fuel, and the fuel by a second layer of limestone which distributes the heat. At first only one-quarter of the pot is filled with the charge, and the rest added when the oxidation is progressing satisfactorily.

An experimental charge of 500 lb. was blown in five hours and the arsenic content reduced to from 3 to 5 per cent. Leady speiss rich in arsenic, e.g., Pb, 4.50; Cu, 2.25; NiCo, 0.70; As, 40; Sb, 0.30; Ag, 802.1 oz., was found to have a melting point and to show a behavior in blast-roasting different from one that contained less arsenic, viz., Pb, 2.75; Cu, 1.00; NiCo, 0.50; As, 19.00; Sb, 0.42; Ag, 300.4 oz. The speiss with 40 per cent. As emits fumes of As<sub>2</sub>O<sub>3</sub> and Sb<sub>2</sub>O<sub>3</sub> until it has lost about 20 per cent. in weight. It then has become a porous spongy mass which is not liquefied by the heat generated in the oxidation of arsenic and antimony, and can be blown to sintering with much less flux than is required in starting with a low-arsenic speiss.

The asbestos industry in Germany is reported of late to have met with considerable reverses. In September last the German as well as the International syndicate had to be dissolved owing to new factories having been started which did not join the syndicates, with the result that a considerable overproduction, accompanied by a sharp fall of prices, occurred.

<sup>17</sup>Metallurgie, 1910, VII, 595.

## Bromine

The production of bromine in the United States in 1910 was as follows: West Virginia, 54,000 lb.; Ohio, 80,000 lb.; Pennsylvania, 75,000 lb.; Michigan, 641,300 lb.; total, 850,300 lb. The production in 1909 was 1,100,000 lb. These statistics include liquid bromine and the bromine equivalent of bromides. The output in 1910 was the smallest in years, the decrease being due to the low price during the first six months and the dull sale of salt. Four bromine plants in the Ohio valley were idle. The largest producer in the United States is the Dow Chemical Company, of Michigan.

During the first six months of 1910 the price for bromine was 10@11c.; in the later months, 14@15c.; in November the price was advanced to 17@18c., but no sales at that price have yet been reported. The Dow Chemical Company undertook in April and May to buy the outside bromine production and made contracts with some of the producers, but not all. This led one of the producers on the Ohio river to enter upon the manufacture of bromides.

The price of bromides was advanced by 2c. in May and 4c. more in November. The price for these salts has been controlled by the Dow Chemical Company since the Germans withdrew from this market in December, 1908. The sale of bromide and bromate of potassium for metallurgical purposes increased in 1910 and amounted to about 250,000 lb. Most of this went to Australia, but some was used in Colorado and Nevada.

The equivalent of bromine to potassium bromide is about 100:140. In recent years the price for liquid bromine has been above the bromide parity, owing to difficulties entailed by the pure-food and drug law of 1906. Since then it has been impossible to make U. S. pharmacopeia goods without purifying the crude bromine, which usually goes about 94 per cent. Br. This is a difficult process, costing 1/2c. per lb., besides involving a loss of 7 per cent. of bromine.

## Graphite

Messrs. Leonard Chapman & Co., of London, report the current price of graphite, under date of Dec. 9, according to quality, as follows:

Ceylon LL.....	£15 5s. od. to	£37 10s. od.
Ceylon OL.....	£10 9s. 6d. to	£37 9s. 6d.
Ceylon chips.....	£ 8 5s. od. to	£27 os. od.
Ceylon dust.....	£ 9 10s. od. to	£25 os. od.

The above prices are per ton of 2240 lb., c.i.f. London. The following prices per 2240 lb. are for purified, milled and ground mineral.

Ceylon 97 to 99%.....	£59 to	£63
Ceylon 90 to 91%.....	£40 to	£42
Ceylon 80 to 81%.....	£30 to	£32
Ceylon 70 to 71%.....	£27 to	£28
American large flake.....	£45 to	£49
American small flake.....	£35 to	£45

<sup>12</sup>U. S. Pat. Nos. 951,988, 951,989, March 8, 1910.

<sup>14</sup>ENG. AND MIN. JOURN., 1910, XC, 317.

<sup>15</sup>Smith, *Min. Wld.*, 1910, XXXIII, 459.

<sup>16</sup>Metallurgie, 1910, VII, 79.



# Mining in Colorado during 1910

By George E. Collins \*

Generally speaking, the mining industry in Colorado was moderately prosperous during 1910. The tendency, however, to a declining production of all the principal metals, excepting zinc, continued, and there were no discoveries reported of new mining districts, or even of important orebodies in existing districts, to counterbalance the gradual exhaustion of many of the larger mines, failing which the aggregate output cannot be indefinitely maintained at even its present figure. The only new development of first-rate importance was the accidental discovery of zinc carbonates and silicates at Leadville referred to below.

## PRECIOUS METALS

It is too early at the time at which this outline is written to forecast the output for the year. It is, however, considered probable that the production of silver decreased, while that of gold remained stationary. In Cripple Creek the relative position and output of the larger mines remained unchanged, the Portland, Vindicator, Golden Cycle, El Paso, Mary McKinney and Elkton being the largest producers.

The gradual unwatering of the district from the Roosevelt tunnel, which penetrated the fissured volcanic area at a distance of 15,500 ft. from the portal, and made connection with a hole drilled from the bottom of the El Paso shaft, will enable the present rate of output to be maintained for many years, possibly for another generation. There is, however, no reason to expect anything in the nature of a boom, or even a return to the output of 10 years ago. The bulk of the ore was treated by the Golden Cycle (cyanide) and the United States Reduction and Portland mills (chlorination); the ores of higher grade were consigned to the Pueblo smeltery. The new Portland and Stratton's Independence mills, treating low-grade dump ores by different modifications of water concentration and cyanidation without roasting, both proved successful, and will probably be followed by others.

As to the quantity of low-grade ore exposed underground in this district and likely to be available for such treatment, authorities differ, but it is improbable that this will counterbalance the exhaustion of the richer ores near surface.

## LEADVILLE PRODUCTION CHIEFLY FROM COMPLEX ORES

The Leadville district was still an im-

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portant producer of silver, mostly in connection with the great bodies of complex sulphide ores, the Iron Silver and Yak Tunnel groups taking the lead. While the Ibex is never likely to resume its former productiveness, it shipped high-grade ore from fissures in the granite. The importance of these fissures underlying the limestone-porphry formation, especially in their bearing on the prospects of gold production, is becoming generally recognized.

In the San Juan district, the gold-silver production continued large, especially around the district in San Miguel and Ouray counties, just east of Telluride.

In this small area are the five largest mines—the Camp Bird, Smuggler-Union, Tomboy, Liberty Bell and Revenue. Of these, however, the first two are nearly exhausted; and while the Argentine vein of the Tomboy still has a large ore reserve, the grade is gradually lessening.

At Silverton, the Gold King had its orebody cut off by faulting, and the Silver Lake shut down. The Iowa-Tiger, operated successfully by lessees, and the Sunnyside are today the most important producers. The immediate prospects of the San Juan point to a reduction in output. However, the district is far from exhausted, and many promising veins are virtually unprospected, while the known extensive bodies of complex ores will some day, with lower costs for labor, power and supplies, form the basis for a great and permanent industry.

## NEWHOUSE TUNNEL BENEFITS NOT YET REAPED

Gilpin and Clear Creek counties maintained a steady but probably a diminished production of both gold and silver. In the former, the Gregory-Bobtail finally closed down, and is filling with water. But around Nevadaville, at the other end of the district, the completion of the Argo (Newhouse) tunnel, approximately 22,000 ft. in length, is gradually draining the deep mines and will enable them to be successfully reopened within a couple of years. A start was made at the Gunnell—next to the Gregory-Bobtail probably the greatest producer—which is being reopened from the tunnel. It is significant that a large aggregate production was maintained from this district, even when the larger mines were mostly idle.

## GEORGETOWN MINES BECOMING EXHAUSTED WITH DEPTH

In Clear Creek, the conditions are similar, excepting that it is becoming gradually realized that the old silver mines, particularly around Georgetown, have become on the whole less productive in depth. Near Idaho Springs, the Gem, Lamartine and Stanley were operated in a rather small way by lessees; but there were several notably successful leases on smaller mines.

Creede and Aspen were large producers of low-grade silver ores, the former from various mines along the great Amethyst vein, the latter principally from the Smuggler and A. J. The Free Silver shaft is being unwatered; and when this task is completed it will open up considerable productive territory. Boulder county was not favored by any sensational discoveries; but in La Plata county small quantities of rich ores were again mined.

The gold-dredging industry in Summit county is now on a steady and profitable basis. In French gulch particularly the Reiling and Revett dredges yielded good returns.

## COPPER

The production of copper in Colorado was, as a rule, merely an incident in the mining of other metals. Few mines were worked primarily for their copper contents; perhaps the Frank Hough and San Antonio in the San Juan came near being purely copper-mines, and even these were often rich in silver. A production which, in the aggregate, was far from being inconsiderable was afforded by gold-silver ores accompanying copper in Gilpin, Lake and Chaffee counties, and in the San Juan district.

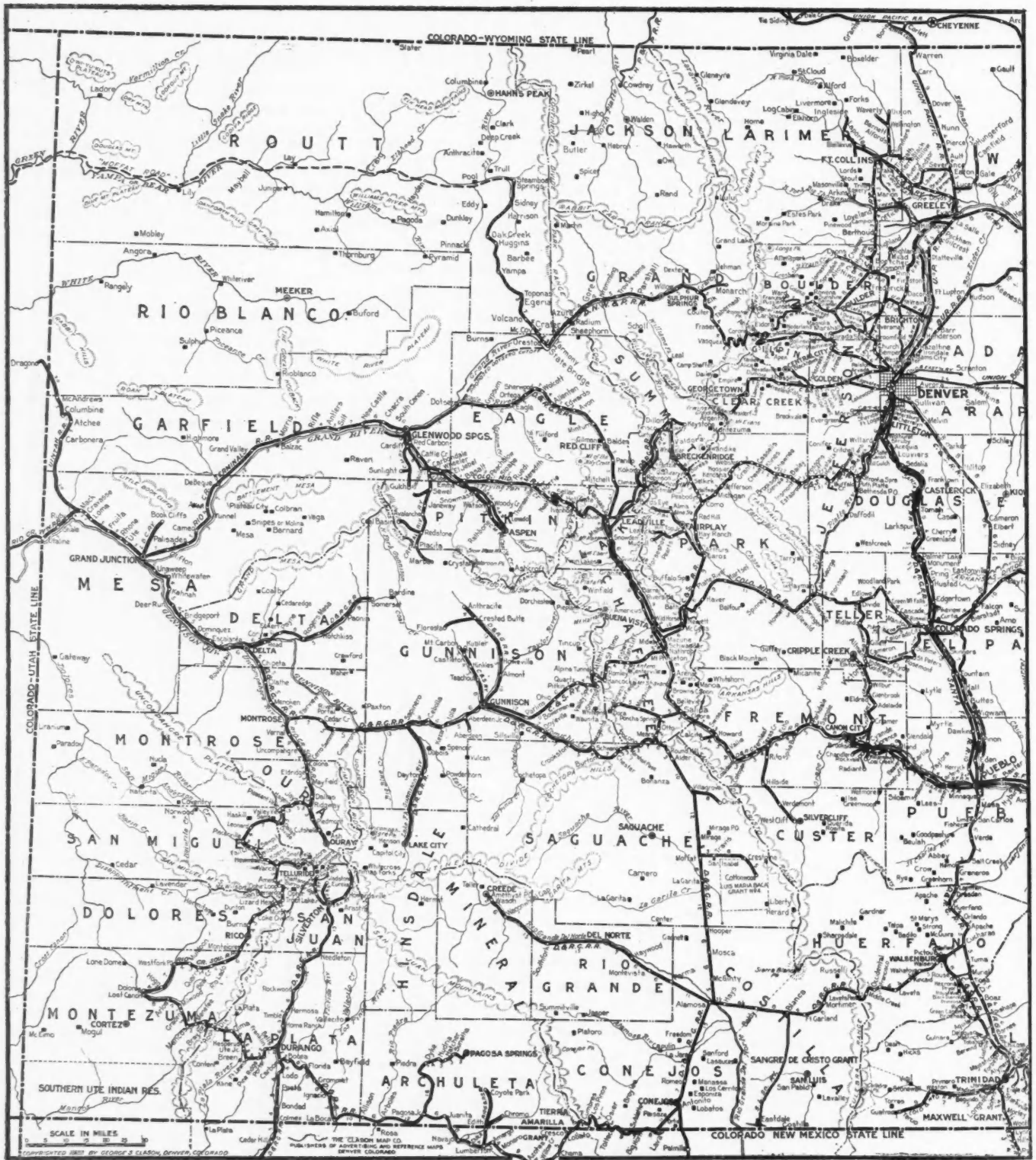
## LEAD AND ZINC

These ores usually occur together and are worked throughout an extensive area, particularly in the central portion of the State, generally associated with gold or silver, or both. The most extensive and easily available orebodies are at Leadville, and in the Iron Mask at Red Cliff. There are, however, other important replacement deposits in the sedimentary formation at Rico and Kokomo, and the Madonna at Monarch; and in fissure veins at the Wellington mine at Breckenridge, and in many places in the San Juan. Unfortunately these ores are usually associated with iron and copper sulphides, and sometimes with a gangue of rhodonite, as in the Sunnyside and

Gold Prince at Silverton. The conditions as to separation are therefore varied and difficult, and while the aggregate resources of the State, particularly in zinc, are great, its production is not

**DISCOVERY OF ZINC AT LEADVILLE**  
The sensation of the year was the discovery of important replacement deposits of zinc carbonate and silicate on the fringe of the exhausted sulphide ore-

per day, and should exceed this rate for many years. In addition, the quantity of ore of a zinc tenor too low to be available under present conditions, say, 10 to 20 per cent., seems to be large.



SKETCH MAP OF THE MINING REGION OF COLORADO  
Copyrighted by Clason Map Company, Denver, Colo.

adequately profitable under the present conditions, excepting in favorable cases. Furthermore, the fact that the individual orebodies are as a rule of small extent is a great hindrance to the adoption of advanced metallurgical methods.

bodies at Leadville, especially on Carbonate and Fryer hills, where the Morning and Evening Star, Maid of Erin, Henrietta and Wolfe Tone were found to contain large tonnages of such ores. The aggregate production reached 100 tons

**RARER METALS**

The production of tungsten concentrates in Boulder county was large, and the product maintained a sufficient price to afford adequate profit. Many of the individual occurrences are pockety, but



the ore frequently exists at considerable depths and the aggregate output remains steady. The less extensive occurrences of hübnarite in the San Juan have not been worked.

Little pitchblende was mined in Gilpin county this year, and the reported discovery of the mineral elsewhere did not result in actual production. The mill of the Vanadium Alloys Company at Newmire, below Telluride, was in operation throughout the greater part of the year, and additional discoveries of vanadiferous sandstone were reported.

#### SMELTING AND CHLORINATION

The American Smelting and Refining Company's plants at Pueblo, Leadville, Denver and Durango have continued to dominate the smelting situation, with some effective competition on the part of the Ohio & Colorado Smelting Company at Salida. The Modern pyritic plant at Utah Junction proved unremunerative, and was shut down early in the year, the Golden smeltery succeeding to its business. The latter charges a rate which, while somewhat lower than those of the American Smelting and Refining Company, may be remunerative; and with the assistance of mines under its own control may obtain a sufficient ore supply to justify continuous operation. The Künzel smeltery of Buena Vista had

a short and unsatisfactory career.

The Malm chlorination mill at Georgetown is not yet in operation. Whether or not this particular adaptation of the principle proves successful, it may lead to a solution of the problem of beneficiating mixed sulphide ores containing gold and silver.

#### GENERAL CONDITIONS

Excepting on the northern coalfield, the labor condition has remained satisfactory. There have been no strikes, and there is now some sign of improvement in the efficiency of labor, after the disorganized condition into which it was thrown by the domination of the Western Federation of Miners and the well meant, but ill-judged, eight hour law. Public attention has been widely directed to the decline of prospecting in relation to the smelting situation. The American Smelting and Refining Company, the so called "trust," has so generally been accused of using its commanding position to throttle the mining industry that the accusation has finally secured general acceptance and does just as much harm to the financing of new work as if it were really true. A commission, appointed by the Denver Chamber of Commerce and headed by Mr. Guiterman, the manager of the "trust," is now engaged in investigating the reason for

the decline of public interest in mining in this State.

On the other hand the American Mining Congress, as represented by some of its officers, has already judged the case and decided that it is due to the exactions of the smelters. Both sides are prejudiced, and the public pays little attention to either. Actually, excepting as to matters of detail, and particularly the practice of some smeltery officials of haggling over settlements and comparisons of assays, the mining industry has little to complain of; and certainly the smelteries are not making unreasonable profits in Colorado. But the harm is done all the same; and as a result prospecting is discouraged and little new work undertaken. I believe that a more liberal attitude on the part of the smelters, the abolition of petty haggling over comparisons, the simplification of schedules and, above all, the abandonment of special contracts, substituting public schedules which should be the same for small and large shippers alike, would do much to restore general confidence. But whether the American Smelting and Refining Company can afford to risk losing its present commanding position by abandoning these special contracts is another question, as to which no outside opinion is worth much.

## Mining in Texas during 1910

By J. K. Prather \*

In order to mine or prospect with any degree of safety in Texas, the land should be purchased outright. The price paid for mineral land is \$25 per acre. There is no law against prospecting, but the prospector does not like to open orebodies for the benefit of others who may be able to buy the land and get the benefit of his work. Thus the Texas mining laws are a hindrance to the proper development of the mining industry. The mineral products obtained in Texas are: Asphalt, clay, coal and lignite, gold, silver, lead, copper, lime, salt, petroleum, building stone, quicksilver and mineral water.

Coal was mined in 1910 in five counties in northern Texas, and in two counties in the southern part of the State. Lignite was mined in nine counties in central and southern Texas.

There was not so much activity in the quicksilver district as in the past. The Marfa & Mariposa and the Chisos companies are working steadily; the former, employing 35 men, produces 40 flasks per week, and the latter with 100 men produces 50 flasks per week.

\*Mining engineer, 421 Mesa avenue, El Paso, Texas.

The Texas Turquoise Company, near Van Horn, is mining some excellent turquoise gems which are polished at El Paso, Texas.

#### SILVER AND COPPER

Near the Shafter mine of the Cibola Mining Company is the Griffin mine, which is also producing rich silver ore. The Young-Wright mine has shipped some ore to the El Paso smeltery. The Shafter mine produced about 300,000 oz. of silver. This mine contains many miles of underground workings and has five shafts ranging in depth from 200 to 700 ft. The orebodies are from 45 to 50 ft. wide and 6 to 40 ft. thick. There is a 15-stamp mill on the property with 12 pans, six settlers and large storage tanks.

John Moffitt operated the Tamma silver mine in the Quitman mountains west of Sierra Blanca. The Little Lightning copper mine is one of the most promising in this district, and shipped some high-grade copper sulphide ore to the El Paso smeltery. John Gilcrease did some successful prospecting near Sierra Blanca.

#### RARE EARTHS AND TIN

Near Llano, Texas, the Nernst Lamp Company continues to operate its mine to obtain the rare-earth minerals for incandescent lamps.

The El Paso Tin Mining and Smelting Company is operating on the northeast end of Mount Franklin, about 16 miles from El Paso.

The company recently shipped one ton of tin assaying 99.8 per cent. pure metal, to Philadelphia, and has two tons more ready for shipment. Since October, 1910, more than \$100,000 has been expended on the property. The ore occurs in veins and pockets, and ranges from 1 to 20 per cent. tin. A quantity of ore has been blocked out and the deposit is both uniform and rich. Between 40 and 50 men are employed in the mine and mill.

The mill is a combination of Harz jigs and two Sutton-Steele pneumatic tables, one coarse and one fine. The smeltery consists of a reverberatory furnace with forced draft, using concentrates and ground anthracite coal in the ratio of 1 lb. of coal to 8 lb. of 60 per cent. concentrates.

# Mining in Montana in 1910

By W. P. Cary \*

The most important event of 1910 in Montana was the absorption by the Anaconda Copper Mining Company of the other operating companies which formerly constituted the Amalgamated and the further absorption, by the same company, of the Butte Coalition and the W. A. Clark properties. The Anaconda company thus became the only operating company of importance in the Butte district, with the exception of the North Butte, East Butte, Tuolumne and Butte & Ballaklava companies. At a meeting of stockholders held March 23, 1910, the Anaconda company increased its capital stock from 1,200,000 shares of a par value of \$25 to 6,000,000 shares of the same par value and amended its articles of incorporation to allow it the power to own and vote the stock of other companies as provided by the law enacted by the 1909 session of the State legislature. Following this absorption came a general reduction in the production of the Butte mines, the production continuing at the reduced rate during the remainder of 1910, when the Washoe smeltery at Anaconda produced 16,000,000 lb. of copper per month, while the output at Great Falls was about 6,000,000 pounds.

## BUTTE OPERATIONS CONTINUOUS EXCEPT IN FEBRUARY

Operations in the Butte district were continuous throughout 1910 with the exception of a short shutdown in February as a result of the difference between two unions of hoisting engineers in the camp. A new compressor plant of 3600 h.p. was built by the Anaconda company and preparations made for the introduction of air for the running of the main hoists. The Anaconda company operated a great number of properties throughout 1910, among the more important being the High Ore, Anaconda, St. Lawrence, Mountain View, Tramway, Rarus, Pennsylvania, Leonard, East and West Colusas, Mountain Consolidated, Parrot, Original, West Stewart, Never Sweat, Badger State, Diamond, Bell, Right Bower, East and West Gray Rocks, Gagnon, Belmont and Little Mina. From the High Ore mine a crosscut was run from the 2800-ft. level to a point under the Anaconda shaft and a raise started to connect with the shaft. At the Anaconda mine the long-smouldering fires in the old stope prevented the shaft from being used below the 800-ft. station, but about 400 tons were hoisted daily from the upper levels. In October the fire

\*Mining engineer, 413 State Savings Bank building, Butte, Mont.

was placed under control and the work of opening up the caved shaft below the 800-ft. level was begun.

## RARUS MINE PRODUCTION FOR 1910 ONLY 50 TONS PER DIEM

The St. Lawrence mine produced steadily until October, when mining was suspended to allow the retimbering of the shaft and the construction of new ore bins. At the Mountain View mine production averaged between 1000 and 1500 tons daily. The Rarus mine, one of the large producers of the camp in 1909, reduced its output to 50 tons daily, the bulk of the ore being hoisted through the adjoining Tramway shaft, which averaged 1500 tons daily. At the Pennsylvania mine considerable development work was done on the 600-, 700-, 1400-, 1500-, 1600- and 1800-ft. levels, and production the latter part of the year averaged about 800 tons daily. At the Leonard the old No. 1 shaft was retimbered and used for lowering supplies.

## WEST AND EAST COLUSA PRODUCED 900 TONS DAILY

At the West Colusa the shaft was retimbered, making the several compartments of uniform size, and the production averaged about 500 tons daily, mined from the 1000-, 1300-, 1400- and 1600-ft. levels, while the East Colusa produced on the average of 400 tons. The Parrot mine was not in active operation during the year, the only work done being the keeping of the shaft open. At the Never Sweat the wreck of the main hoist caused a shutdown for two months during March and April, after which production was continuous and averaged above 750 tons daily. At the Badger State the shaft was sunk from the 1400- to the 1800-ft. level and in the latter half of 1910 mining was done and production raised to 350 tons daily. At the West Gray Rock mine the shaft was enlarged from the 700-ft. level to the surface, making it three-compartment throughout. The East Gray Rock produced steadily on an average of between 300 and 400 tons daily.

At the Little Mina the shaft was sunk from the 1200- to the 1400-ft. level and the mine produced about 800 tons daily. At the Belmont mine the shaft was sunk to a depth of 1900 ft. and connections made on several levels with the Anaconda mine. At the Gagnon mine the new vertical shaft was sunk to the 1000-ft. level and production averaged 600 tons through the old incline shaft.

## NORTH BUTTE MINING COMPANY

The North Butte company operated the Speculator and adjoining properties through the Speculator shaft, but for the first half of 1910 the management observed such reticence that it was impossible to obtain any information concerning operations. It later developed that the quality of the orebodies on the 2000- and 2200-ft. levels was considerably below that of the 1600- and 1800-ft. levels. After this policy of extreme secrecy the management decided to issue statements at brief intervals for the information of its stockholders. The method of mining was changed from the mere rush to get out rich ore and pay dividends to the more conservative method, with due regard to development work and the blocking out of ore reserves. Production averaged about 1500 tons.

## TUOLUMNE COPPER MINING COMPANY

The Tuolumne Copper Mining Company continued to ship throughout 1910 at the rate of between 100 and 200 tons daily and also did considerable development work to establish the continuity of its vein. In July the North Butte Mining Company started suit against the Tuolumne for the purpose of determining the ownership of the disputed portions of the Jessie vein, but the suit was never pressed and was finally settled in the latter part of November by agreement.

The Butte & Ballaklava company early in 1910 made its 1400-ft. shaft three-compartment throughout and installed a new electric hoist. Shipments were made at the rate of between 100 and 200 tons daily until August, when the Anaconda Copper Mining Company started suit and enjoined the Ballaklava company from further mining on the disputed orebodies. The main action was not heard, however, and still remains to be disposed of. While restrained by the temporary injunction from mining, considerable development work was done on the 300-, 500-, 600- and 800-ft. levels.

## EAST BUTTE COPPER MINING COMPANY

The East Butte company, which acquired control of the Pittsmont mine, ceased all operations on the original East Butte properties and devoted all of its attention to the development of the Pittsmont. In November an orebody was discovered on the 800-ft. level which surpassed anything thus far found in the mine and the development work done to determine the extent of the body was extremely satisfactory. The smeltery on the property was operated continuously and, in addition to the East Butte ore, treated considerable custom ore also.



## DAVIS-DALY ESTATES COPPER COMPANY

The Davis-Daly company was handicapped in the early part of 1910 by trouble in getting the right to secure a tramway so that its ores could be hauled from the mine to the railway, but was finally successful. However no shipments were made and the only work done on the property was that carried on by leasers. The Raven Mining Company secured an agreement from the Anaconda company whereby it was allowed to work the Snoozer claim and preparations were made to mine. The Butte Central Copper company was able in the course of the year to free itself from debt and eventually began sinking its 500-ft. shaft an additional 500 ft. The Butte-Alex Scott Company entered the ranks of producers and made steady shipments.

## OPERATIONS IN CORBIN-WICKS DISTRICT

In the Corbin-Wicks district in Jefferson county a number of companies carried on operations, among them being the Montana-Corbin, Boston & Corbin, Corbin Copper, Boston & Alta, Minneapolis Corbin and Corbin Metal Mining Company. The Boston & Corbin sank its shaft from the 700- to the 900-ft. level and installed an electrically operated surface plant. The Boston & Alta sank its shaft 700 ft. but suspended operations the latter part of 1910, owing to financial tangles. The Corbin Copper Company built a concentrator and treated considerable ore, while the Montana-Corbin sank its shaft to the 400-ft. mark and shipped a few cars of ore, but became financially involved and suspended operations early in the summer.

## ZINC

The Black Rock mine of the Butte & Superior company, situated in the Butte district, was the principal zinc producer of the State. It secured a lease on one-half of the Basin Reduction Works and early in 1910 sent its first shipment of ore to Basin, the concentrates from the Basin mill being in turn shipped to a smeltery at Bartlesville, Okla. The mine produced steadily at the rate of about 350 tons daily, the ore coming from the 1000-, 1200-, 1400- and 1600-ft. levels. In March the company acquired control of the North Butte Extension's property and with it the water which was necessary for the operation of the proposed concentrator near the Black Rock mine. The Elm Orlu mine, belonging to W. A. Clark and also situated in the Butte district, produced considerable zinc ore, production averaging about 175 tons daily.

The ore was treated in the Butte Reduction Works' concentrator, which was retained by Clark when he sold the remainder of his mining property to the Anaconda company. The Emma mine of the Butte Copper and Zinc Company was sampled by experts representing Eastern men but no definite announcement of the result was made.

## GOLD AND SILVER

In Madison county the Apex Mining Company was incorporated and operated the mine of the same name continuously, treating its ore at a mill built on the premises. The Winnetka Mining Company, a new corporation, operated the Winnetka mine the latter half of 1910 with considerable success. The Conrey

Placer Mining Company, in addition to operating its three dredges continuously, built a new dredge with a capacity of 200,000 cu.yd. per month and put it in operation the latter part of 1910. Lincoln county, which had previously not been recognized as a gold producer of any moment, was the scene of much mining activity. Among the operating companies were the Victor-Empire, Lincoln Gold Mining and Shaughnessy Hill companies.

In August the forest fires which swept that part of the State destroyed the surface plants of a number of properties, which were rebuilt, however, before the end of 1910. In Granite county the Georgetown district was the scene of active operations. The Southern Cross mine shipped some ore, but most of the work was confined to development. Numerous other properties produced in a small way. In Ferguson county the Barnes-King Mining company produced steadily up to July, shut down for two months and then resumed. In Broadwater county, the Keating company installed a new surface plant and produced without interruption. The Black Friday sank its shaft from the 400- to the 500-ft. level and shipped thereafter. The Ohio-Keating and West Kendall were among the producers. In Silver Bow county the British-Butte company early in 1910 did prospecting work with a diamond drill to a depth of 1305 ft. without striking bed-rock and then suspended operations. In Lewis & Clark county a number of properties operated in a small way. Among them were the Bald Mountain, East London, Magpie and Jumbo.

## Eastern Oregon Operations in 1910

By F. W. Schofield \*

The year 1910 saw the beginning of a substantial and, it is believed, permanent and profitable renewal of mining activity in eastern Oregon, which, despite the fact that it has produced a total of approximately \$65,000,000 in gold, has suffered so severely from the disrepute gained through its former "wildcat" promotions as to result in the practical abandonment of operations.

Following the collapse in 1903 of the stock boom, mining went steadily downward until the panic of 1907, which caused the closing of the Oregon Smelting and Refining Company plant, at Sumpter, with the loss of a local market for ores, resulted in the abandonment of operations at the few remaining working properties; and at the close of 1909,

with the exception of the Columbia and Cornucopia mines, each having an output of about three tons of concentrates per day, production had practically ceased in eastern Oregon.

The purchase early in 1910 of the Sumpter smeltery by the Northwest Smelting and Refining Company and its preparation to resume operations at the plant, thus reestablishing a local market for ores, gave a stimulus to the mining industry, and the year showed a comparatively great increase in activity.

On the Snake river, the Iron Dyke mine, where extensive development work was carried on during the summer, promised to become an early producer of copper ore, but its work was hampered by suits instituted by the Government for alleged land frauds, which, together with present inability to raise

the money required for construction and equipment, resulted in a temporary cessation.

In the Mormon Basin district the Rainbow mine, so far the only property of established value in that district, is under option to the United States Smelting, Refining and Mining Company, and it is believed the purchase will be completed. The advent into eastern Oregon mining of a strong company of this character will do much to aid future operations at other properties.

Early in the year operations were resumed at the Highland mine, which, tied up with litigation, had been closed for a long period. The litigation was adjusted, indebtedness discharged and the property became a steady producer, furnishing a striking example of the success which may be had with eastern Oregon mines

\*Consulting engineer, Sumpter, Oregon.

where the efforts of the management are devoted to the economic operation and development of the property, instead of the sale of stock.

#### THE SUMPTER DISTRICT

In the Sumpter district, three properties, the Ibex, Imperial and Mammoth, resumed during 1910; the former two carried on extensive development, and the latter will continue in operation during the winter.

The Oroville Gold Dredging Company, which has had a drill at work during the summer, prospecting the placer beds along the Powder river, purchased some portion of the property held under option, and the beginning of

operations next season will demonstrate the value of the extensive dredging lands available in eastern Oregon.

In the Susanville district, where the value of the properties has been established by the past production of the Badger and Stockton mines, some development and prospecting were carried on in a small way, but lack of transportation facilities retarded activity. The Sumpter Valley Railway Company had located and planned the construction of a branch line from Austin to a point near Susanville, during 1910, but the bringing of indictments against its officers for complicity in alleged timber-land frauds, requiring the expenditure of their energies in other directions, resulted in the abandonment of

work on this extension, although its completion is promised during 1911.

The development during 1910 of two lead prospects in the vicinity of Cañon City, in Grant county, from one of which shipments were made, promises a possible future production of some lead ore for eastern Oregon.

While the closing of 1910 did not show as extensive an increase in mining activity as might be desired, this lack was in a great measure compensated for by the solidity of such organizations and resumption of operations that took place, and which by economical and intelligent management it is contemplated will demonstrate the intrinsic value of eastern Oregon properties.

## Mining in California in 1910

By Lewis H. Eddy \*

There was a general improvement and advance in the mining industry in California in 1910 as compared with 1909, but the total aggregate output was not increased to the extent that would have resulted from normal conditions and operations. The gold production is not likely to exceed that of 1909. The increase in the output of petroleum was not equal to what would have been expected under normal conditions. The tonnage and value of copper for 1910 will fall considerably below that of 1909. Other minerals and metals advanced in volume and in value of output, but not largely.

This situation here stated is due to three conditions that were unavoidable, and which indicate no diminution in mineral resources. The failure of the gold output to increase largely resulted from the dry season in the stamp-milling districts, and from the closing down of the copper smelteries, through which a great deal of gold production is obtained. The third cause for these results may be attributed to the withdrawal of oil lands from entry, and the consequent curtailment of the production of petroleum.

#### MOTHER-LODE DISTRICT SUFFERED FROM DROUGHT

In the Mother Lode district, while gold mining improved in the normal operation, the dry season materially affected some of the larger mines; particularly in Amador county, where some of the stamp mills were closed for lack of water. The Utica mine has recently operated only one of its mills. The South Eureka, which is one of the biggest producers, was closed for two months. But with all the closing from lack of water, all the mines of the Mother Lode did well, and but for this obstacle there would

have been a considerable increase in total production. The mines of the Mother Lode are not dependent on water so much for power as for its use in the batteries. The power generally is furnished by the California Electric Company. Oil-fuel power is employed in most of the larger properties for hoisting, as electric power is not in all cases adapted to nor available for that work. In the Grass Valley and Nevada City district, where there is a large dependence upon direct water power, the shortage of water was not perceptible. The closing of the smelteries in Shasta county, including the Bully Hill, the Balaklala, and the curtailment in the smelting operations of the Mammoth during a part of the latter half of the year, affected the gold output. But notwithstanding these obstacles, the increased production of the mines during the periods of favorable water season and during operations of the smelteries saved the production of gold from a larger slump than might have otherwise occurred. The stamp mills in Shasta county and other northern counties were not affected by any lack of water, and the hydraulicking operations which are largely in Trinity county had plenty of water for all necessary demands.

#### PROBABLE GOLD, SILVER AND PLATINUM OUTPUT \$21,000,000

A close estimate of the gold output of the State for the year 1910 cannot be made at present. In fact, the State Mining Bureau but recently issued its bulletin showing various other mineral outputs for the year 1909, and this does not include gold, silver and platinum. For the year 1909 these three minerals may be conservatively estimated at a value of \$21,000,000. It is doubtful if these

minerals for 1910 will exceed that figure.

The output of placer gold, which includes chiefly hydraulicking and dredging, is estimated to exceed the output of 1909; and this fact will aid in keeping the volume of production up to a fairly normal valuation. There was gradual improvement and advancement in gold dredging in 1910, and the output is estimated at more than \$7,000,000. The advancement in the progress of the industry resulted from the adoption of larger boats of improved pattern, which reduced the cost of handling the gravel, so that it was possible to handle gravel profitably that ran as low as 4c. per yd.; and in some instances gravel yielding only 2½c. per yd. was handled with profit. Three or four years ago gravel that ran under 10 to 11c. could not be handled with profit commensurate with the investment. There were no new districts opened up in 1910, but in each district there was an increase in the ground dredged, and an increase in the number of dredgers in operation.

#### SIXTY-THREE DREDGES OPERATING IN 1910

In 1910 there were 63 dredges in operation, including 30 in Butte county, 15 in Yuba county, nine in Sacramento county, and a total of nine more in the other dredging districts; three in Calaveras county, two in Siskiyou, and one each in Merced, Stanislaus, Placer and Shasta. In the late season of 1910 there were expected to be in operation three other large dredges, which were in course of construction. These 66 boats represented a total investment of more than \$7,000,000. There were some boats retired, but their retirement was due chiefly to the demands for improved patterns and larger boats. In the entire period of practical gold dredging, beginning

\*6 Ferry building, San Francisco, Cal.



with 1897, there have been in commission 104 dredges. Many of these were of small and inferior pattern, but in the earlier days of dredge mining answered the purpose of prospecting and developing in these various districts. The output of the dredges, as reported by the State Mining Bureau, beginning with 1898 and including 1909, has amounted to a total of \$32,147,877.

#### GOLD DREDGING AIDS HORTICULTURE

Including 1910, the total value of gold taken by dredges in California during the life of the industry will amount to nearly \$40,000,000. Besides this large addition to the mineral wealth of the

State, gold dredging has materially added to the value of the lands within the dredging districts, by the fact that it has increased the productivity. Five years ago there was a general complaint in the dredge-mining districts that this method of recovering the gold from the stream beds and the lands adjacent was destroying the horticultural and agricultural industries, but within this period there has been a gradual and is now a complete recognition of the fact that dredging operations have actually augmented the agricultural and horticultural territory, and increased the value of the lands for these purposes. The utilization of dredged lands for forest growth, particularly of

eucalyptus, has also added to their value. In the Oroville district, in Butte county, the increased value of dredged lands over the former soil has been proved in the growth not only of timber trees, but of fig, almond and orange trees, and grape vines, which have been more productive and profitable than the fruit-bearing trees and vines that were planted in the original soil. The fruit in this dredged land ripens earlier and possesses a superior flavor; and besides this there is less danger from frost, owing to the fact that the heat of the sun is longer retained by the heavy gravel intermingled with the soil. So far the work along this line has been largely of an experimental nature.

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## South Dakota Operations in 1910

### Special Correspondence

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To review adequately the mining conditions in South Dakota in 1910 one must begin with the labor difficulties which, starting in the fall of 1909, caused a serious drop in the annual production of gold, though this has now nearly regained its normal monthly average.

During its life of over 30 years, the Homestake had always been operated on the "open shop" principle, no strike had ever occurred and the relations between employer and employed had been unusually cordial. The current rate of pay was, and is, \$3.50 per day for miners and \$3 for helpers and shovelers, eight hours work constituting a shift. Some adjacent camps were already completely unionized, and a number of the Homestake men were members of the Western Federation of Miners. In the fall of 1909 the Federation commenced a campaign, at first quiet but later open, to compel the complete unionization of all departments of Homestake employees. The object of this agitation was avowedly to facilitate the collection of dues by the union, and it was freely stated that an increase in wages would shortly be demanded, which, in view of the low-grade ore handled, would have reduced profits to a minimum.

#### MINES CLOSED TWO MONTHS

The several aggressive steps taken by the local unions of Lead and Central City, and officially announced as unanimously indorsed by their members, including the refusal to work with non-union men after Nov. 25, 1909, led to the determination of the management to meet their action by closing the mine on Nov. 24 until it could be reopened on a strictly nonunion basis, the maintenance of the existing rate of wages and of the eight-hour shift being guaranteed. The management opened a list for those desiring employment, who were required to

sign a card to the effect that they did not belong to any union and would not join any while in its employ. In the meantime steps were taken to guard the property from violence. Toward the close of 1909 the superintendents of practically all other mines of any importance in Lawrence county advertised their intentions to adopt a similar non-union policy, and most of their miners went on strike in consequence. At first most of the union members hesitated to sign the Homestake card, but after hundreds had surrendered their union cards and signed preparatory to work, the local union took cognizance of the fact and posted a list of 50 names as "scabs," and a second list of about 30, intimating that these were the only defaulters. These men and a number of others then founded the "Loyal Legion" and the local nonunion paper published long lists of those who had signed. From that time they became less timid and the list of signers grew rapidly, so that sufficient men were available to equip all the surface works.

The foreign element was fully persuaded by its leaders that the mines could never be operated by any other than the men who had previously worked there. So firm was this conviction that, when hundreds of outside miners were openly brought in from Colorado, Missouri, Michigan and other mining districts, they were unable to realize the situation.

On the whole, considering the number of men involved, there were remarkably few acts of violence during the shutdown and resumption of work. This was due largely to the foresight of the Homestake management in protecting, at the outset, both employees and property by an ample number of armed guards, and to the stand of the Lead judges in impartially punishing sympathizers of either

party who created disturbances. A number of petty assaults occurred, however, in Lead and Terry, one policeman was shot by a Slavonian, and one Homestake employee died of injuries received in an attack. Simultaneous attempts were made to fire one of the cyanide plants and a boarding house occupied by "scabs," by means of phosphorus presumably contained in "Pettibone dope"; one hotel was burned and a powder magazine at Terry was blown up. A searchlight, installed on the Ellison hoist and covering the most important of the Homestake works, is still operated every night, and a sufficient guard is still maintained over the property.

In spite of the evident restoration of working conditions at Lead and Terry, the local organ of the unions continues to publish statements to the contrary, which are apparently believed in the outside mining camps from which subscriptions are being drawn. It is also intimated that only a fraction of the stamps in the various mills are being dropped; that empty ore cars are run to the mills as a bluff; that no dividends are being paid except to small local stockholders; that the rock mined is mainly barren porphyry, and that the mines generally are in a dangerous condition owing to the abolition of union labor. A large proportion of the foreign labor has left, and the decreasing hold of the union is manifest from the fact that the socialist-labor candidates polled only a small percentage of the votes cast at the recent election, although illiterate immigrants are allowed to vote on taking out "first papers" after six months' residence in the State.

#### RESUMPTION OF MINING

On Jan. 18 men went to work in the Homestake and the number was daily increased until, on Jan. 21, the

Amicus mill started crushing with 240 stamps. Other mills were gradually started until on March 3 the entire 1000 stamps were working at full capacity, since which time the full output has been maintained, while the usual monthly dividends have been paid since March.

The Golden Reward, the Mogul and Lundberg, Dorr & Wilson mills all obtain ore from mines in the Terry or Bald Mountain district. The first two operate mills near Deadwood, and the other near Terry, all using the Moore process. At the mines remote from the mills, the workings are scattered, and no attempt was made to resume work until the Homestake was well under way. Since that time they have gradually started and are all operating at full capacity.

The Wasp No. 2, south of Lead, lost its mill by fire early in the year, soon after acquiring some adjacent ground. A new mill of 300 tons capacity was built and started work about Dec. 1. Unlike other mines of the district, this ore requires merely a coarse dry crushing, with rolls, preparatory to leaching the entire product by cyanide; this fact and its nearness to the surface enabled it to make a low record for costs.

#### HOMESTAKE AID FUND AND NEW POWER PLANT

An "Aid Fund" or employees' insurance system was inaugurated by the Homestake company, to which both the men and the company contribute; and the company now furnishes free medical and hospital service and medicines to all employees and their families.

Work on the Homestake hydroelectric system on Spearfish creek was prosecuted throughout the labor troubles. The

bore of the last of the eight tunnels was completed in October, three of them being over 4000 ft. long, with an aggregate length of  $4\frac{1}{2}$  miles, and having a section of about 40 sq.ft. All were driven with Temple electric drills. The tunnels are being lined with Atlas cement concrete, and the ditches will be lined with the same material. The installation will include three Westinghouse 2000-kw. generators, ten 667-kw. transformers and three 3000-h.p. pelton wheels.

#### RECENT DEVELOPMENTS

The Black Hills Development and Financial Corporation, which had under bond a number of properties in the Northern hills, did some exploratory work in the carbonate district and shipped two carloads of ore from the dumps. The Golden Crest, the mill of which was completed in 1909 but not started, has closed pending the adjustment of differences between the managing director and stock- and bond-holders, a receiver being in charge. The Hidden Fortune has satisfied the receiver's claims, and the advertised tax sale has been postponed till early in 1911. The American Eagle mill, of 300 tons capacity, has been acquired by the Portland mine, which has hitherto been shipping its ore to the Lundberg, Dorr & Wilson mill. The Reliance recently effected a reorganization, and its mill on Annie creek is to be started as soon as a dam can be built to retain the tailings.

A proposal is on foot to erect a 400-ton smeltery near the Branch Mint mill in Galena district, to treat pyritic ore from the Gilt-Edge-Maid mine. An experimental plant will probably be put up

first to test the process, which was suggested by Paul Danckwardt. After extensive sampling, an attempt is to be made to dredge ground on Castle creek near Mystic, and ground below Deadwood is being tested with the same object in view. Hitherto no dredge has been operated in the State.

The finding of a large body of ore of more than average grade in the Golden Reward mine will stimulate exploration in the Bald Mountain district. Although highly sulphureted, it is probable that roasting will make it amenable to cyanide. The problem of treating the low-grade refractory "blue" ore at a profit is still to be solved and an effective solution will mean much to the prosperity of the Black hills.

Except a few shipments of lithia minerals from the Southern hills, little was done in the way of exploiting the rare-metal resources of the State.

The Westinghouse Electric Company operated five mica mines in the vicinity of Custer. No. 5, the Crown, was the main producer; sinking is in progress on No. 2, the White Spar. These mines produced 1,856,000 lb. of mica during the year.

#### GOLD PRODUCTION FOR 1910

The report of the State mine inspector, N. Treweek, gives the gold and silver yield for the year as \$4,921,000, produced by six companies, the Homestake contributing \$4,650,000. The State yield is the lowest for ten years, the highest having been \$7,545,000 in 1908. The ore mined and milled is estimated at 1,438,000 tons; 3150 men are employed in mining, 2900 of them by the Homestake.

## Mining in New Mexico

The most important development in mining in New Mexico in 1910 was in relation with the explorations of the "porphyry" copper deposits in Grant county, notably the Chino property, formerly the Santa Rita, at Santa Rita, and in the Burro Mountain district. In Otero county developments were carried on at the Tularosa and an experimental mill was erected. The Pinos Altos mine, Grant county, was taken under option by Corrigan, McKinney & Co., and is being exploited. In several of the older districts in the northern and central part of the State there was renewed activity and in some cases new capital engaged in investigations and developments. This is true in the Cerillos district in Santa Fe county, in connection with the lead-silver deposits, now chiefly valuable for zinc. In the Nogal district, Lincoln county, new operations were undertaken, among which was the reorganized Eagle

mining company; in the Black Range district of Sierra county a number of properties were under development during 1910, notably the U. S. Treasury.

In the Dona Ana district in the Organ Mountain section, work was at a standstill until the latter part of the year, at which time some properties, including the Bennett-Stephenson were reopened after reorganization. In the Magdalena district in Socorro county the Graphic mine was extensively operated by the Sherwin-Williams Paint Company and the Tri-bullion company shipped zinc ore regularly from the Kelly mine. In the Mogollon district, southwestern Socorro county, Canadian interests investigated the Cooney property but did not take it, and the Ernestine company operated regularly the Last Chance property. The Socorro company increased its mill capacity and operated regularly and profitably during the year.

At Jarilla, in Otero county, some gold-copper operations were carried on. The smeltery formerly erected by the Southwestern Smelting Company was transferred to other interests, reported to be the Phelps-Dodge company, and is idle. The smeltery, at Deming, was closed but plans for its resumption are under way.

The copper properties in the northern section, at Taos county, in the main were idle during 1910, but they were recently investigated and it is reported that some operations will take place in the spring. Mica deposits in northern New Mexico were operated. Prospects for increased activity in the New Mexico districts are considered good.

A very useful monograph<sup>1</sup> on the ore deposits in New Mexico was issued in 1910 by the U. S. Geological Survey.

<sup>1</sup>Professional Paper, No. 68, by Waldemar Lindgren, Louis C. Graton and Charles H. Gordon; U. S. Geol. Surv.



# Mining in Utah in 1910

By Edward R. Zalinski \*

At the time of writing, it is not possible to state the output of the different metals accurately, but from the tonnages available from Park City and Tintic, it appears that silver and lead production decreased somewhat as compared to 1909. The gold production was about the same, or slightly greater, the increase from low-grade ores balancing the lessened yield from silicious ores. The production of zinc was about the same, or greater, while copper showed a marked increase due to the output of the porphyry mines at Bingham.

The following ore tonnages from Park City and Tintic, up to Nov. 30, were obtained through the courtesy of the railroads. The Park City shipments include ore sent out via the Denver & Rio Grande

UTAH ORE SHIPMENTS FROM PARK CITY AND TINTIC IN 1910.

	Park City. Tintic.	
	Tons.	Tons.
January .....	8,765	22,619
February .....	8,328	27,026
March .....	5,619	31,547
April .....	8,899	23,941
May .....	8,288	26,209
June .....	7,893	29,519
July .....	7,252	25,786
August .....	7,090	28,757
September .....	5,902	24,623
October .....	6,441	22,929
November .....	6,925	24,400(b)
December .....	7,400(a)	26,124(b)

Total for year..... 88,802(c) 313,480(d)

(a) Month of December estimated.

(b) Partly estimated.

(c) Crude ore and concentrates. Deducting for moisture, 6 per cent., there would be 83,474 dry tons, as compared to approximately 93,000 dry tons in 1909.

(d) These shipments include iron ores from the Dragon Iron and Iron King mines, which averaged, approximately, 4200 dry tons per month, or 50,400 for the year. Deducting this, and allowing for 4 per cent. moisture, the average in Tintic ores, there would be 250,541 dry tons of lead, copper and silicious ores, as compared to, approximately, 260,000 dry tons in 1909. The copper ores are approximately, 46 per cent. of the total, the lead ores 50 per cent., and the silicious ores 4 per cent.

and the Union Pacific. The Tintic shipments include ore sent over the San Pedro and the Denver & Rio Grande. The tonnage for Bingham is estimated.

## BINGHAM PRODUCED 16,000 TONS PER DAY

As nearly as can be learned, the daily output of Bingham was in the neighborhood of 16,000 tons. This is an estimate based on the production of the Utah Copper, Bingham-New Haven, Highland Boy, Yampa, United States properties, Ohio Copper, Bingham Mines, and Utah Apex. It includes ore produced by the Ohio Copper, Bingham-New Haven, and Utah Apex, which was milled in the camp. Taking 16,000 tons per day, the monthly production was 480,000 tons, or 5,840,000 tons for 1910, as compared to approximately 4,200,000 tons in 1909.

\*Mining engineer, Salt Lake City, Utah.

The tonnage mined in Tooele (including Mercur), Beaver, and other counties, judging from past production aggregated approximately 448,000 tons. In round numbers the total estimated production of the State was in the neighborhood of 6,600,000 tons.

During the first four months of 1910, there was a slight ore shortage in the Salt Lake market, due to the poor condition of the roads at this season and to some loss in shipments from southern Nevada camps, caused by washouts. The deficit was largely in gold and silver ores, with some decrease in lead. The Utah Ore Sampling Company which succeeded to the interests of the Taylor & Brunton and Pioneer Ore Sampling Companies in Utah reported no appreciable decrease. This company operated samplers at Murray and Silver City, and sampled a large part of the custom ore from Idaho, Montana, Oregon, Nevada, and Utah. Later in the year the control of the Utah Ore Sampling Company was obtained by the Knight interests. In May and June there was an increase in shipments as is usual. Park City increased its shipments over what was shipped in March. Bingham produced about as usual, while the Tintic output was not far from normal. No ore was shipped from Alta and the Cottonwoods, or from American Fork at this season.

## SHORTAGE OF LEAD ORES IN LATTER HALF OF 1910

The supply of lead ores which came to the Valley smelteries during the latter half of the year was below the normal, owing to the decreased production of some of the Park City mines. The Silver King Coalition and Daly West both cut production, the former on account of the installation of a new electric-haulage system on the 1300-ft. and Alliance tunnel level, and the latter on account of the necessity of new development work on the lower levels. These two mines were the principal shippers to the American Smelting and Refining Company at Murray. There was an increase in lead production from Bingham, but this did not balance the decrease in lead shipments from Park City and Tintic.

## TINTIC SMELTERY CLOSES, MIDVALE GETTING ITS CONTRACTS

The United States smeltery at Midvale in February ran at full capacity, and treated approximately 800 tons of ore daily. Six furnaces were in blast on lead ores. After the closing of the Knight plant at Silver City in Sept., 1909, ores from the Colorado, Iron Blossom, and other Tintic mines were smelted

here. Only the lead furnaces were in operation during the year, as the copper plant was being redesigned to meet the requirements of the Federal court.

The American Smelting and Refining Company at the beginning of the year was running six furnaces on lead ore, and one on matte concentration, at its Murray plant, making seven out of eight furnaces in operation. Later in the year there were four and five furnaces in blast. The furnace for matte concentration was operated intermittently, when enough charge had accumulated. The matte, on account of the lead it contained, was shipped to Omaha for treatment. The Garfield smeltery increased its capacity by the addition of one reverberatory furnace and two converters, in order to meet the increased output of the Utah Copper. When the sixth furnace is in operation, the capacity will be between 200 and 225 tons of blister copper daily.

## GARFIELD SMELTERY MAKING 132,000,000 LB. COPPER PER YEAR

At the beginning of September, the Garfield plant operated three blast furnaces out of four, and ran five reverberatories. The daily output was nearly 200 tons of blister copper. About 2000 tons of ore, or 3000 tons of charge were smelted per day. The average monthly output was 11,000,000 lb. of copper, but it has been as high as 12,000,000 lb. in one month before the sixth reverberatory furnace was completed. At the beginning of December this furnace was being warmed up and the bottom smelted in, and it was expected to smelt ore before the end of the year.

The Yampa smeltery at Bingham employing 200 men closed down Aug. 1. Between 600 and 700 tons, largely from the Yampa mine, were smelted daily. The mine continued to operate, and shipped to Garfield.

## TOOELE BEGINS TO PRODUCE IN AUGUST

Work on the new plant of the International Smelting and Refining Company at Tooele was completed, and smelting of copper ore started. The Tooele Valley railroad, which connects the smeltery with the San Pedro was completed May, 1909. Following the opening of this line, work on the construction of the smeltery was started, and conducted on a large scale. All construction was completed Oct. 1. Fire was started in the first of the five reverberatory furnaces July 25. During August the first furnace produced matte, and two others were being warmed up. In the latter part of the year three furnaces were

smelting about 550 tons of ore per 24 hours; 400 tons of this being received from the Utah Consolidated, 100 tons from the Iron Blossom and Colorado, and 50 tons from the South Utah.

#### GENERAL SMELTING SUMMARY

The furnaces smelting ore in the valley toward the close of the year were as follows: The United States was running six furnaces on lead ore; the American Smelting and Refining Company, four lead furnaces; the Garfield smeltery, five reverberatories, and was warming up the sixth, recently constructed, and five Peirce-Smith basic-lined converters were in use, while three blast furnaces out of four were running. At the International three reverberatories and two converters were smelting copper ore.

#### BINGHAM & GARFIELD AND WESTERN PACIFIC ROADS OPENED

Beside the Bingham & Garfield Railroad, grading on which was started during the early part of 1910, the Western Pacific, crossing a relatively undeveloped mineral section of the State, was opened to passenger service in August. It runs south of the Southern Pacific, through Tooele county into Nevada. It passes nearer the Deep Creek section than any other road, the nearest point being Wendover, about 30 miles distant.

#### TRANSPORTATION FACILITIES INADEQUATE

The transportation facilities for handling the tonnage from Bingham to the mills at Garfield, while not sufficient at all times, were better than during the latter part of 1909, and the first months of 1910. In May and June a large tonnage was handled over the single line of the Denver & Rio Grande. On May 23, this road moved 217 cars for the Utah Copper in 10 hours, while on May 24, 378 cars were loaded, and sent out by the same company, and 24 cars from the United States Mining and Utah Consolidated, making 402 cars in 24 hours or approximately 22,000 tons of ore handled in one day.

The Utah Copper's contract with the Denver & Rio Grande for handling a maximum of 6000 tons a day was insufficient to supply the mills, and was stated by the company to have reduced earnings at frequent and extended periods. Grading was begun in April on the Bingham & Garfield Railroad, a new line backed by this company, in order to secure adequate transportation facilities for the mills when enlarged to a capacity of approximately 20,000 tons of ore a day. This road runs along the north side of Bingham Canon, and will connect the Utah Copper mines with the mills and smeltery at Garfield, a distance of 17 miles, as compared to 25 miles at present. The maximum grade is  $2\frac{1}{2}$  per cent. A bond issue for \$2,500,000 in 6 per cent. 10-year bonds was made, and a mortgage deed of trust filed Aug. 29,

in favor of the Guarantee Trust Company of New York, the Utah Copper being named as surety. The grading was largely completed, and work started on the three tunnels. A number of condemnation suits across mining ground in Bingham have resulted. The tunnels on the upper part of the line will be done about April, 1911, and it is expected that the road will be ready for traffic in the second quarter of 1911.

#### NOTABLE MERGER OF PORPHYRY COPPER COMPANIES

The Utah Copper absorbed the Boston Consolidated, the merger going into effect Feb. 1. It also acquired control of the Nevada Consolidated in March. Both of these properties were acquired by an exchange of stock, the Utah Copper having increased its capitalization from 750,000 shares to 2,500,000 shares for this purpose.

The Utah mill at Garfield was named the Magna, and that of the Boston Consolidated, the Arthur. A corps of independent engineers confirmed the company's findings that the machinery and method at the Magna plant were superior in costs and extraction to that at the Arthur. The stamps were removed from six of the 13 sections of the Arthur plant and chilean mills and rolls with Garfield roughing tables are being installed. When the improvements are completed the capacity will be 7000 tons per day. The Magna is treating 13,000 tons.

At the end of the third quarter the Utah Copper Company had 17 shovels stripping and mining, of which four were on Boston Consolidated ground. Three more were to be placed here, bringing the total up to 20 steam shovels. No surface ore was taken from the Boston section, and underground mining must be continued for some time, but will be abandoned as soon as possible. Work at the Boston sulphide mine was suspended. Copper Center gulch and other ground was secured for dumping purposes.

#### AERIAL TRAMWAY FROM UTAH CONSOLIDATED TO TOOELE SMELTERY

The Utah Consolidated, which shipped about 800 tons of ore daily the first part of the year, completed its smelting contract with the American Smelting and Refining Company July 10, and began shipments to the International. Much development work was done on the lower levels, and a sampling and estimating of the ore reserves made under the direction of R. H. Channing, consulting engineer.

#### UTAH CONSOLIDATED ORE RESERVES FORMERLY OVERESTIMATED

Mr. Channing's report gave 300,000 tons averaging 2.32 per cent. copper, 0.05 oz. gold, and 0.85 oz. silver in sight. Beside this, from a large tonnage shown by mine maps and records, a part of which is caved and inaccessible, there

may be recovered from 100,000 to 250,000 tons. Taking the highest figures this is about half of the tonnage reported by another engineer at the beginning of the year, which gave 1,121,360 tons of 2.3 per cent. copper ore, since which time 130,000 tons have been extracted. The output of profitable ore toward the end of the year was stated to be about 350 tons daily.

Two units of the Ohio Copper Company's mill at Lark were in operation in February and treated 1000 tons of ore per day, which concentrated about 20 into 1. The concentrates carried 23 per cent. copper. The cost of milling is reported to have been 38c. per ton, and cost of mining less than 50c. Freight on ore through the Mascot tunnel to the mill was 15c. a ton. Later in the year the tonnage was increased to 1500, 1700, and 1850 tons of ore per day. In November new equipment, including tables and Wall rolls was installed.

#### UTAH METAL MINING COMPANY HAS BIG TUNNEL PROJECT

The Utah Metal Mining Company, which is driving the 11,000-ft. drain and operating tunnel between Middle cañon on the Tooele side of the range and Carr Fork at Bingham, completed the preliminary work of installing its plant, and advanced the tunnel about 1800 ft. since April 1, which made a total length of 4500 ft. at the end of the year.

The Utah Apex developed a number of new bodies of lead and copper ore during the year. Some of these along the Dana fissure were opened for over 200 ft. The new occurrences of lead-silver ore making out along the limestone bedding from the fissures are of interest, as promising to open up large bodies of ore of this kind in a new section of Bingham. From 150 to 175 tons was mined daily up to Nov. 10, when milling operations were suspended in order to develop several important discoveries.

#### WORK OF THE U. S. SMELTING COMPANY

The United States Smelting, Refining and Mining Company worked its Bingham properties during the year, and shipped from 260 to 350 tons daily. In November and December the output was 600 tons a day. The Telegraph mine was worked by leasers and also on company account. A 50-ton cyanide plant was built by the Utah Leasing Company in order to treat silicious gold-silver ores from this mine.

The Centennial-Eureka mine in Tintic owned by the U. S. company produced copper ore carrying some gold and silver. An average production of 300 tons daily was maintained, except during a short period, when pumps were installed on the lower levels. A number of improvements were made. The Holden tunnel, 2160 ft. long, was driven to connect with the shaft at the 535-ft. point. Connections were made March 10. The tunnel effects a



saving in hoisting, pumping and bringing supplies up the hill. Ore bins of 700 tons capacity were cut in the shaft between the 500-ft. level and the tunnel. An electric-haulage system was installed, to take ore out on the tunnel level, and dump it directly into the railroad cars.

#### GOLD PRODUCTION

The Consolidated Mercur, by careful work made a profit of \$16,537, on ore of a gross value of \$613,148 about 638 tons per day were treated, the heads averaging \$3.59; the tails, 94c. The ore is continually becoming lower in grade. The Boston Sunshine mill at Mercur closed down about the middle of the year, after running 14 months and paying \$19,500 in dividends, because of lack of ore. Cheap power became available in the Gold Springs district in July, owing to the beginning of operations of the Gold Springs Mining and Power Company's power plant.

#### SILVER PRODUCED MAINLY IN THE TINTIC DISTRICT

The Tintic district in Juab and Utah counties and Park City, in Summit and Wasatch counties, furnished the greater part of the output. Salt Lake county also added to the production, by the silver in its copper and lead ores. The Iron Blossom in Tintic developed silicious ores carrying silver, but with the exception of a limited tonnage shipped to the smelteries did not produce extensively from this class of deposit, pending arrangements for possible cyanide treat-

ment. The Centennial Eureka ores, mentioned under copper, added appreciably to the output, as did also the Silver King, Daly West and other Park City mines. The Daly West drove its 1550-ft. level to the Daly-Judge lines for drainage purposes. The Daly West also connected with the Ontario drainage tunnel. There was no work done by this last mine during 1910 except to keep its tunnel open. The so-called Snake Creek drainage tunnel, 14,000 ft. long, and backed by Knight and Daly-Judge interests, is also being pushed toward these mines, and will, when completed, afford fine drainage and development facilities to all mines in the southwestern part of the Park City district. The Ontario, Daly and Daly West mines will also push their drainage tunnel to the Thompson-Quincy, a consolidation of the old Thompson and West Quincy companies.

#### ZINC PRODUCED MAINLY AS A BYPRODUCT

The zinc output for 1910 will probably show a small increase over last year. The principal source of zinc was as a by-product from Park City ores, while Bingham also contributed. Zinc ores proper were mined in Beaver county and at the Scranton mine in North Tintic. The output was shipped to Kansas, Oklahoma, and to points farther east.

The Park City mill of the Grasselli Chemical Company, using Sutton dry-tables, dielectric separators and dry-sizing apparatus, treated a large tonnage of zinc middlings from the Daly-Judge mill, and shipped zinc concentrates to its

refinery in Cleveland. The work of the Huff electrostatic separators at the Midvale plant of the United States Smelting Company was good and 45 tons of zinc concentrates were produced per day.

#### SOUTH-UTAH MINES AND SMELTERS AGAIN SHIPPING

The South Utah Mines and Smelters began milling operations Sept. 2. The mill was reconstructed and new equipment added. A new smelting contract was made with the International, by which concentrates were shipped to the Tooele smeltery. The first car of concentrates was received there Sept. 24, and toward the latter part of the year shipments of from five to seven cars a week were made. The reconstructed mill began handling 400 to 500 tons, which was gradually increased. The capacity is 800 to 1000 tons.

#### OIL AND CEMENT

More interest than heretofore was taken in the Utah oilfields, especially those in San Juan and Grand counties in the southern part of the State. A number of rigs were sent into the fields, and oil was encountered in several places.

The production of cement for 1910 amounted to approximately 3050 bbl. per day, as compared to 1400 bbl. per day in 1909. The Union Portland Cement Company, at Devil's Slide, produced 1800 bbl. per day; the Ogden Portland Cement plant, at Bingham City, 350 bbl.; the Portland Cement Company of Utah, at Salt Lake, 900 bbl. daily. These companies were the principal producers.

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## The Mining Industry in Nevada

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About four years ago, during the height of the Nevada boom, the JOURNAL published a series of articles on the Nevada gold and silver camps. A year later the JOURNAL made an exhaustive study of conditions at Ely, and several of the camps in that part of the State. The gathering of data on the mining districts in the western part of the State was hampered by the fact that most of the camps were young and but little work had been done in them. For instance, at the time of the correspondent's trip to Goldfield, ore had been struck only about three weeks before he visited the stope of the Hayes-Monette lease on the Mohawk. At Rhyolite only a little development had been done in the immense outcrops that characterize the camp. At Manhattan and Fairview little had been done and only at Tonopah was there any great amount of development.

Considering the fact that the camps were young, that the correspondent had to depend entirely upon the statements of

the people most interested in the booming of the mines for opinions in regard to the assays of the ore, and that practically everyone in Nevada was a "booster" in those days, the trip was made under conditions which made it difficult for any visitor to get accurate information, and certainly venturesome to publish opinions based on such information. The JOURNAL realized this when it undertook the work, but so great was the demand for facts about the region that it assumed the risk.

#### RHYOLITE OVERESTIMATED IN EARLY DAYS

In general, the articles succeeded in making a fair appraisal of the future of the different camps, but in regard to Rhyolite a great mistake was made, for in that camp not a single large mine has made good. The ore did not assay so high as stated. Work at the Montgomery-Shoshone has shown the truth of the statement that was made in 1906 that ore assaying from \$7 to \$10 could be treated at a good profit. But the ore

was not forthcoming. The only property that the article did appraise correctly was the Montgomery-Shoshone, which, although its shares were then selling at about \$16, was given but passing mention as the correspondent became convinced that the property was not as it was represented, although his information was of such a nature that he did not feel warranted in publishing it in the face of the opinion held all over Nevada at that time that the Montgomery-Shoshone was one of the greatest gold mines of the world. Fairview and Manhattan have followed the course that the articles indicated and the camps are still awaiting slow, careful development, and proper milling facilities. Rawhide is fast becoming but a memory. The resuscitation of Virginia City has not come, but it went so far toward success as to get the General Development Company to think seriously of trying to unite the different properties so as to do something with them, and the Comstock tunnel gives hope of new life for the camp.

#### NEVADA SENTIMENT NOW FOR DEVELOPMENT, NOT BOOMING

The booming that has characterized Nevada mining from its beginning seems now to be coming to the end. Nevada and Nevada mining men are beginning to realize that the mines have got to work their way instead of trying to ride on passes. A "wildcat" law has been passed to do away as much as possible with faking, and the mining men of the State are discussing the matter with the view of still further improving the law. Newspapers in the mining districts have printed editorials protesting against the outrageous prices at which, in some parts of the State, prospects are even now held. Everyone connected with mining seems to realize that the mines must show what they can do before the State can expect to get the money that it needs to go ahead with its development.

The confidence in the future is there. But the spirit of the confidence game has gone under cover, and it seems certain that the people of the State are determined to keep it there until it has died out.

#### LOCAL MINING PAPERS DOING GOOD WORK

Goldfield has a mining paper, the *Goldfield Tribune*, that is trying to tell the truth about the properties of the camp. Tonopah has a paper called the *Tonopah Miner*, the editor of which gets his information direct from the men in charge of the different properties. The news is reliable and in case one reads between the lines he can get a good idea of the state of affairs at the different mines, but the reader should remember that the editor of a local paper has to be diplomatic and as he lives in the community he cannot afford to go out of his way to tell the unfavorable things about the properties. Lukewarmness in praise in a local paper is about as far as the public can expect an editor to go.

But this willingness of the mine superintendents at Tonopah, in a camp where the ore conditions change suddenly, to try to give the public a correct idea of the condition of the mines, in spite of the knowledge that their candid declaration of what they think of the conditions of the mine is liable to prove greatly mistaken with further development, shows how much mining men in Nevada are trying to kill the stigma of the "hot-air" campaigns of the past. The policy of the Goldfield Consolidated company to give the shareholders each month an idea of the condition of its mines and the full report that the Nevada Consolidated company issued, indicate that mining in Nevada is coming to a sound basis.

#### FAIR DEALING A VALUABLE ASSET

Although Nevadans in the past have played fast and loose with the public, for the whole State cannot escape the

stigma of having been a silent partner of some notorious schemers, still it is believed that when conditions are such that one can find out without actually visiting the camp that practically nothing is being done at Rhyolite and that the last stopes of the Montgomery-Shoshone are almost cleaned up; when one perceives that such a mushroom camp as Manhattan was in its early days has settled down to sanity; when one sees that in the face of low copper prices and Nevada's disrepute the Yerington copper district has been able to get the money for a smeltery and a railroad; when one sees the Pittsburg-Silver Peak property developed into one of the best operated properties in the West in the last few years; when one sees Fairview and Wonder building mills but doing so only after the ore reserves indicate the need for them, when one beholds the camp of Austin promising to become again a producer, now that the electrostatic plant is in successful operation; when one gets information that leads one to believe that ore, such as made Goldfield leases famous, is being worked miles to the north at the camp of National, surely the time must be near at hand when the development of the large mineral resources of Nevada is going to forge ahead rapidly on a sane basis, and that in the next year or so Nevada will be rivaling even Arizona in mining activity.

#### GOLDFIELD

There were only two large producers at work in this camp at the end of 1910. These are the Goldfield Consolidated and the Florence-Goldfield companies. These two properties are notable in both still being in control of their original owners. The former paid the largest dividends in 1910 ever paid by any gold-mining company in a single year, while its advanced stand taken in regard to information given to its stockholders has already been commented upon. The Grizzly Bear lease, in this mine, is the deepest shaft in the camp, 1165 feet.

The Florence cleaned up low-grade ore left by leasers, and while there is not much ore developed, there are good indications of ore in the bottom levels. Earnings were erratic on account of this leasing work, but the company made about 20 per cent. of its par capitalization (\$1,050,000). The upper stopes of this mine are now well cleaned up and deeper development is a necessity. It is purposed to sink to about 1000 or 1200 ft. depth. Leasers took out over \$5,000,000 worth of ore from above the 350-ft. level in this mine (not all in 1910). Good ore was shown on the floors of the lowest levels, and as the deep developments in the Goldfield Consolidated are promising the results at depth in the Florence are also expected to give good results.

#### SMALLER PROPERTIES IN GOLDFIELD

The Combination Fraction produced

ore in 1910 and milled it at the Nevada Reduction Works, the heads averaging about \$25 per ton. The attempt to consolidate a number of small mines with the Jumbo Extension as nucleus was a failure. The Jumbo Extension produced by proxy during 1910, as a small area of ground was worked by the Goldfield Consolidated on shares.

In general it may be said that geological study points to there being good ore at depth at Goldfield, so that there is much to be hoped for in a general prospecting of the field on the low levels.

#### THE ELY DISTRICT

Production in the Ely district in 1910 was confined to the Eureka mine of the Nevada Consolidated, which produced about 65,000,000 lb. of copper. The production by months is given in a table elsewhere in this issue. The total would have been larger had it not been for the intentional curtailment inaugurated in August. Operations in the steam-shovel pit proceeded throughout the year with the smoothness of a well-oiled machine. It may be stated emphatically that they are not threatened either by influx of subterranean water or by unforeseen difficulties in pulling up the ore-cars over heavy grades as the pit becomes deeper. The conditions were well known before the pit was opened and satisfactory engineering plans were formulated after full consideration of all of them. According to the official report of the company for the year ended Sept. 30, 1910, the developments of ore amounted to 30,073,000 tons averaging 1.99 per cent. copper and 14,500,555 tons averaging 1.28 per cent. Of this total, 3,421,275 tons averaging 2.153 per cent. copper have already been extracted.

During 1910 stripping of the Liberty orebody was commenced and this will soon be ready for extraction by steam-shovel. The Veteran mine of the old Cumberland-Ely company, now absorbed by Nevada Consolidated, was idle during 1910.

#### GIROUX'S AFFAIRS STILL A SECRET

The Giroux company conducted extensive developments in its Alpha mine, completing the new working shaft, equipping it, etc., but no plans for the treatment of its ore were officially announced and certainly no construction was inaugurated. There was a good deal of talk about building a smeltery; also about shipping ore to Tooele; but just what is contemplated by the management is still a secret. The extent of the company's ore reserves is also a mystery, no official statement respecting them having ever been made by the present management, although it has been roundly criticized for its failure to do so. No efforts have been made to extract the disseminated orebody of the company.

Prospecting was carried on in 1910 by



the Ely Consolidated, Ely Central, Boston-Ely and one or two other companies, but it was more or less desultory, and such results as were obtained were in no way indicative of the development of any other big mine. The Ely Central company sank its shaft through the rhyolite, passing into underlying limestone and did some drifting in the latter. The company finally fell into difficulties and explorations were suspended in October. The Ely Consolidated prosecuted development work on some of the small orebodies and stringers in limestone that are characteristic of Ely and have not yet been found to amount to much.

#### EUREKA DISTRICT

Early in 1910 a large section of the Eureka & Palisade railway was washed out, and the company not being in a position to rebuild, the railway service was abandoned, and mining operations at Eureka had consequently to be suspended. Lately the Richmond-Eureka Mining Company bought in the railway and will repair it as soon as possible. Since the resumption of work on Ruby hill, operations have been confined to the old stopes, whence iron ore is extracted. The day when the company will begin deep prospecting is awaited with interest.

#### TONOPAH DISTRICT

The production of the Tonopah district, Nevada, for 1910 was 105,538 oz. gold and 9,954,455 oz. silver, or a total of \$7,436,393, as compared with \$4,887,905

in 1909. This is an increase of 42.18 per cent. in gold and 47.78 per cent. in silver over the 1909 production. Of this increase the Tonopah-Belmont produced about 75 per cent. and the Tonopah Extension 20 per cent. The latter was a new producer in 1910, the milling period covering only nine months.

The largest producer was the Tonopah Mining Company which paid \$1,400,000 in dividends during the year and has paid to date 685 per cent. on its original capitalization. An important addition to the surface plant was an enlargement of its electrical equipment by the erection of an accumulator and generator set. Development work amounted to 21,000 feet.

The development of the new orebody on the Tonopah-Belmont stimulated work on adjoining properties, among which may be mentioned the Jim Butler, Rescue-Eula and the Mizpah Extension. A large amount of exploration work was carried on northwest of the Montana-Tonopah at the Jack Rabbit, Mining Chance, Cronjje Fraction and Sampson. The production of the MacNamara company was less than in 1909, due to the fact that only high-grade ore could be shipped, the low-grade being held in reserve for future milling operations.

#### THE COMSTOCK

The revival on the Comstock lode proceeded from operations carried on by the United Comstock Pumping Association, which is driving the Comstock tun-

nel. On this project \$467,000 was spent in 1910, while it is reported that over \$1,000,000 in all was spent during 1910 in developing all the mines. The Ophir found promising orebodies at 2300 and 2400 ft. and is now sinking to reach 2500 ft. Its estimated production was about \$257,000.

The new mill at the mouth of the Comstock tunnel treated ore from the Con Virginia mine; the Yellow Jacket mill that from the Yellow Jacket, Crown Point and Belcher mines; the Butters plant that from the Mexican, Potosi and Chollar; and the Kinkead the ore from the Ophir, except some high-grade material which was sent to the Selby smeltery. A new 40-stamp mill was erected, the Rocky Point mill at Dayton, on the Carson river, intended to work the ore from the Hayward mine.

At the Con Virginia, the main shaft, known at the C & C, was sunk to the 2450-ft. level and the pumping plant, consisting of the Risdon hydraulic-elevator and the Riedler electric pumps was augmented by the addition of a Starrett pump. It is thought the combined plant will be able to take care of any water which may be encountered, down to 3000 ft. At the Ward shaft the new Scranton pumps, purchased at a cost of \$45,000, were installed and in a few weeks sinking will be resumed on the shaft, which is now down 2575 ft. The Yellow Jacket, Crown Point and Belcher mines, at Gold Hill will be drained an additional 800 ft. through this shaft.

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## Alaska in 1910\*

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The value of the mineral production of Alaska in 1910 is estimated<sup>1</sup> by Alfred H. Brooks at \$17,400,000, as compared with \$21,146,423 in 1909. Of this the estimated value of the gold production in 1910 was \$16,360,000, as against \$20,371,078 in 1909. The copper production in 1910 is estimated at 5,600,000 lb., valued at \$740,000, as compared with 4,424,705 lb. in 1909, valued at \$563,211. The value of all other mineral products including silver, lead, gypsum, marble and coal is estimated at \$300,000.

The decrease in the gold production is entirely due to the falling off in the output of Fairbanks, Seward peninsula, and some of the smaller placer districts. With the exception of the placer operations, the production for all the other mining districts increased. In spite of the decreased gold production and the handicap because of the delay in opening the coalfield, considerable advancements were made in the mining industry. Copper mining was prosperous and much

development work was done. More has been accomplished than in any previous year in the development of gold-bearing lodes. Much work was also done toward installing large mining plants for working low-grade placer deposits.

#### COAL AND OIL

Practically nothing was done in the coalfields except a few patent surveys. Most of the small mines which have in the past furnished lignite for local use, were closed in 1910 until the matter of granting patents should be finally decided. On the other hand, some new drilling was done in the Katalla oilfield. Current reports indicate that some oil properties were leased and preparations made to render the district productive.

#### RAILWAYS AND ROADS

The Copper River railway completed the construction of the line as far as Chitina, 131 miles from Cordova. The remaining 60 miles to the Bonanza mine are of easy construction, and the managers report that the line will be completed at an early date.

The Alaska Northern railway maintained communication over its 71 miles of track, which connects Seward with the head of Turnagain arm. This railway when completed will lead to the development of the Matanuska coalfields and the Willow Creek lode district, as well as other mining districts in the Susitna basin.

An important feature of the year was the transformation of much of the Valdez-Fairbanks trail to a wagon road. This new road, besides serving the terminal points, aids the development of several mining districts lying between. Important roads and trails were also constructed in other parts of the territory by the Alaska Road Commission.

#### LODE MINING

The marked advancement in lode mining in many parts of Alaska during 1910 is the most encouraging feature of the industry. This is in part reflected by an increase in the gold production from lodes, estimated at about \$300,000, and an increase in the copper of nearly

\*Abstract of preliminary report published by United States Geological Survey.

1,500,000 lb. Notable advances were made in the gold-lode districts of Juneau, Prince William sound, Kenai peninsula, Willow creek, Fairbanks, and the copper-bearing districts of Prince William sound and the Chitina valley.

The season was a prosperous one in the Juneau district, and much work was accomplished that will materially swell the gold production in the next two years. There were 13 productive gold-lode mines in operation in Alaska in 1910, one more than in 1909. Of the producing mines, six were in the Juneau district.

The only gold-lode mines operated in 1910 in southeastern Alaska, outside of the Juneau district, were two on Chichagof island, which had a prosperous season, and a small one on Prince of Wales island, which was worked part of the year. A large amount of prospecting of auriferous lodes was done in the region tributary to Valdez. This work was stimulated by the successful operation of the Cliff mine. Enough prospecting has been done on some other veins in this district to indicate that they are likely to be of commercial importance.

The only important advances in lode prospecting in the inland region were made in the Fairbanks district. Here the work of 1910 indicates a wider distribution of gold than has previously been known. The work was much stimulated by the erection of a 10-stamp custom mill at Chena. This, with the three-stamp mill at Fairbanks, makes it possible to test the ore. Practically all the prospects are on the railway which runs from Chena to Fairbanks, so that the ore can be easily sent to mill. Promising gold deposits are reported from Fairbanks, Dome, Vault, Moose, Esther and Cleary creeks.

Some advance was made in quartz mining in other parts of the Yukon district. Little appears to have been done in testing the gold lode of the Bonnifield country, which had caused much excitement in Fairbanks during 1909. Prospecting continued on quartz properties in the Chandalar district.

#### COPPER LODES

There were seven productive copper mines in Alaska in 1910, the same as in 1909. The copper production is about equally divided between Prince William sound and the Ketchikan district. There was a small increase in the copper output of the Ketchikan district and a large increase in that of the Prince William sound in 1910. In the Ketchikan district the Jumbo, Mount Andrew, It, and the Goodrow properties were operated during the year.

The most notable advancement in the Prince William sound section was made on the Beatson property, Latouche island. This property changed hands July 1, and has since largely increased its tonnage.

In the Chitina district some ore was

shipped from the Bonanza mine over the bucket tram to the terminal station at Kennicott, where it awaits the completion of the railway. Among the most important events of the year in the Chitina district appears to be the reported discovery of a large orebody on the Mother Lode property. There is now every reason to believe that the copper output will show a much larger percentage of increase in 1911 than in 1910.

#### PLACER MINING

The value of the gold production from placers in 1910 is estimated at \$12,000,000, as compared with \$16,200,000 in 1909. The best prospects of permanency in the placer-gold production lies in providing means for economically mining the gravels of lesser value. Until this has been accomplished it is to be expected that there will be large fluctuations in the annual gold production. The year 1910 witnessed considerable activity in enterprises looking toward this end, more especially in planning for or installing dredging equipments.

The gold production of Seward peninsula in 1910 was about \$3,600,000, as compared with \$4,260,000 in 1909. This decrease is chargeable to the working out of the bonanzas and the delay in the installation of large plants to handle gravel of lower grade. The water supply on Seward peninsula is not sufficient to warrant hydraulic methods except in a few favored localities. As a result, nearly all the operators are turning their attention to the installation of dredges. In 1910, six large dredges operated on the peninsula. Of these, three were at work on small creeks that traverse the tundra near Nome, two on Solomon river and one on Ophir creek. Successful hydraulic operations were conducted on the benches of upper Kougarok river, in the central part of the peninsula.

New placers were discovered in the Squirrel river basin, which is tributary to the Kobuk river. These are about 70 miles from tide water. So far as known the conditions seem to be favorable for the finding of other workable deposits. The rigors of the climate, the shortness of the season and the isolation of the district will always make operating expenses heavy.

#### IDITAROD DISTRICT

This district is about 400 miles from the Yukon river on the Innoko river. The district can also be reached by a 450-mile winter trail from Seward. In the summer of 1910 there were about 2500 people in the district and the gold production is estimated at \$350,000. Most of the streams in the district have gradients so low that the gravels have to be hoisted to an elevated sluice box. Much of the auriferous gravel lies on a granite bed rock, which yields considerable sand and many boulders. These conditions have

increased the cost of mining. It appears that the amount of proved placer ground is not sufficient to support the population now in the district. During the year a number of other placer deposits were found along various streams in this district, some of which may eventually prove to be of commercial importance.

The Innoko district had a fairly prosperous season, but reported no discoveries of importance. The producing creeks are Ophir, Yankee, Little and Spruce. The value of the gold production for 1910 is estimated at \$200,000.

#### FAIRBANKS DISTRICT

The estimated value of the gold production of the Fairbanks district in 1910 is \$6,100,000, as against \$9,650,000 in 1909. This is due to the fact that many of the richer placers have been mined out and that no effective work has been accomplished for mining low-grade gravel. Plans for dredging some of the shallower creeks have been made, but nothing tangible has been accomplished. There was some scarcity of labor at Fairbanks in the spring, owing to the exodus to Iditarod and on some of the creeks the water supply was inadequate. It is estimated that about 130 placer mines were operated in the Fairbanks districts during the year. This is a falling off of over 50 per cent. of the average of previous years. About 1200 men were employed in the operations during 1910.

#### OTHER DISTRICTS

The Hot Springs district of the lower Tanana valley had a prosperous season. The largest production was derived from Solomon and Cache creeks and their tributaries. The output of the Rampart district lying adjacent to and north of Hot Springs was considerably less than 1909. Little Minook creek is still the chief producer in this field, Hunter creek being second. The decrease in output is due in part to the fact that the hydraulic plant on Hoosier creek was not operated in 1910. It is estimated that 33 men worked on 18 claims in this district during the winter. The gold production of the Salchaket region in 1910, somewhat exceeded that of 1909. There was little mining activity in the Bonnifield district, except on Gold King creek.

The value of the gold output of the Birch Creek district is estimated at \$225,000. A small hydraulic plant on Eagle creek was successfully operated through the summer, but the larger plant on Mammoth creek was somewhat hampered by lack of water. There was a considerable falling off in the gold output of the Koyukuk during 1910, as compared with previous years.

This loss is largely chargeable to the decreased production of Nolan creek. A shaft was sunk for 335 ft. on Wiseman creek and an iron pipe was driven 30 ft. deeper without reaching bed rock.



# Mining in Mexico in 1910

By Kirby Thomas

As a whole, the mining industry of Mexico during 1910 marked time. The aggregate output of the base-metal mines apparently decreased, as compared with 1909, and the precious-metal output did not show more than the expected normal increase, due to the perfecting and completion of large plants under way since the previous two years. There were no notable new districts opened up in 1910, or in fact in several years, and the expectations of immediate great widespread results from the application of the cyanide process to the treatment of low-grade silver ores in the old silver districts were not yet fulfilled in many cases. The smelting industry of the country was hampered by the upward revision of freight rates on the Government-controlled railroad, and had to meet the new condition of a scarcity of silicious ores, due to the spread of the cyanide process in the silicious-ore camps of all Mexico. The introduction of cyanidation of concentrates, as in Guanajuato, indicated the approach of yet another encroachment on the preserves of the customs smelteries, which have been such a prominent and dominant factor in the Mexican mining situation since about 1890, when they were forced into the country by the Wilson tariff on lead into the United States. A continued and acute uncertainty as to political matters and an unrest on the part of the Mexicans of all classes over the actual and alleged shortcomings of the Government put a damper on the local initiative in mining and, in a minor way, affected adversely new foreign commitments in mining. It must, however, be stated that in 1910 large capital from abroad did not show any timidity about Mexican investments, and in fact the financial necessities of the Mexican owners of mining properties, and their willingness to let outsiders do the work of development, made the Mexican offerings during the year past especially attractive and numerous, particularly, as compared with the halcyon days before 1907 when every "gringo" became in his own mind, and in the eyes of the Mexicans, a "millionaire" as soon as he crossed the Rio Grande, and any old (especially very old) Mexican mine was considered worth at least a paltry million, or generally several million, if it could be secured on a bond with a moiety of American dollars, expanded 100 per cent. in the process of exchange into pesos. At the present time real mines in Mexico can be bought cheap, but it takes real money to buy them. This, of course, is good for legitimate mining.

## SOCIOLOGY AND POLITICS

There continued to be the inevitable repulsion between the races, as the foreigner gained and held prestige in the mining and in other development undertakings in Mexico, but this is a sociological problem in the main and does not affect the progress or profit of the great mining business of the country. Anti-American riots, now known to have been part of the political program of the opposition party in the country, attracted the attention of the newspaper readers to Mexico in November, and these were succeeded by an armed campaign, dignified by the "border" correspondent into a revolution. Whatever the truth or significance of these internal political turmoils may have been the fact of the studied protection of the rights and prop-

erty of Americans and all foreigners by both sides and the strong belief by Mexicans and by Americans in Mexico that intervention (the "Big Stick") would follow any actual antagonism or jeopardization of American interests minimized any bad effect that revolution talk or incipient revolution might otherwise have had on proverbially timid capital.

project planned and partly realized by Col. William Greene, the railroad south from El Paso into the rich heart of the Sierra Madre, has come into strong constructive hands, the F. S. Pearson interests, and was extended, probably with the ultimate view of reaching a Pacific port, and a consolidation with the railroad westward of Chihuahua was effected. Other important railroad extensions, particularly in the plateau section of Mexico, have been held in abeyance during 1910 from various causes. It is probable that some of these extensions and branches will be built during the coming year, and the effect of such expansion of the trunk-line railroad system on mining is already being anticipated in a number of districts now greatly limited by lack of transportation.

## ZINC TARIFF STOPS MINING

The building and extension of hydroelectric projects was important during 1910, particularly in the Jalisco districts and at Guanajuato, Aguascalientes and San Luis Potosi and in Chihuahua. Plans were formulated in the latter part of the year for a very extensive hydroelectric installation on the Rio Balsas which will supply all of the important camps between the Balsas and the city of Mexico with electric power.

The continued low price of zinc and the conditions imposed by the American tariff in 1909 have practically closed this important developing branch of the mining industry of northern Mexico. Some of the companies have continued to ship, during 1910 under contract, but most of the companies have ceased to operate and so far no satisfactory arrangements have been made for continuing shipments on a large continuous scale to European treatment centers. The zinc deposits of northern Mexico have proved to be extensive and important and the industry has great possibilities under favorable conditions as to market and transportation. Several concessions for the erection of zinc treatment plants in Mexico have been granted, but so far none of them have materialized, and it is the opinion of those who have studied the questions that the conditions are not generally favorable to a local zinc-smelting enterprise of any moment in Mexico.

## OIL DEVELOPMENT IMPORTANT

The development of oil in the Tampico field continued to be very important. A number of companies are now operating on a dividend basis and the field has expanded largely and strong interests have come into it. The development in

MEXICAN MINERAL EXPORTS FOR THREE MONTHS.

Classification.	1910-11, July, Aug., Sept.	1909-10, July, Aug., Sept.
	Pesos.	Pesos.
Gold (coined, foreign).....	3,035	3,035
Gold in bars.....	16,934,578	13,476,964
Gold in other forms.....	415,548	645,482
Total gold.....	17,350,126	14,125,482
Silver (coined, foreign).....	6,320	20,140
Silver in bars.....	17,787,124	17,080,427
Silver in other forms.....	1,218,979	1,857,365
Total silver.....	19,012,423	18,957,932
Total gold and silver.....	36,362,549	33,083,414
Antimony.....	407,069	513,457
Asphalt.....	65,759	90,613
Copper.....	5,777,328	6,575,698
Marble (bulk).....	4,923	50,056
Graphite.....	6,320	11,450
Lead.....	1,524,510	1,633,446
Zinc.....	159,782	426,834
Other mineral products.....	75,266	141,305
Total of all mineral products.....	44,383,506	42,526,173

## RAILROAD DEVELOPMENT

The extension of the Southern Pacific railroad system on the west coast of Mexico was the most far-reaching factor in Mexican mining during 1910. This line is now nearing connection with the plateau trunk-line system at Guadalajara, and it has extended important branches into Sonora localities of known great mining possibilities. The important

Veracruz has not been so important. This is controlled under a concession to an English syndicate represented by Sir Weetman Pearson. Reports are current of oil indications on the west coast in Sonora. No information has become public concerning the success or failure of the extensive deep drilling operations in northern Chihuahua carried out under the backing of the Hearst interests. The government of Mexico has granted concession for the free import of oil into Sonora to the Cananea company and to other companies—a policy which is not likely to be extended if the Mexican fields developed sufficient output to take care of local demands. Among the strong interests in the Tampico field is the syndicate representing the Harriman-Southern Pacific interests, which syndicate has acquired extensive and important holdings and the basis of a supply of future fuel for the extensive railroad operations in Mexico, projected and under construction.

#### TRADE AND MINING STATISTICS

The advance in the production of the precious metals in Mexico is strikingly shown in statistics given out at the time of the recent inauguration of President Diaz (Dec. 1, 1910). These figures show that in 1884-5, the beginning of the Diaz regime, the gold product of the country was 1,804,688 pesos and the silver product 33,226,211 pesos. And for the fiscal year 1909-10 the gold was 44,881,620 pesos and silver 77,076,097 pesos.

The restoration of trade and industry in Mexico in 1910 can be measured by a comparison from the latest available official statistics of exports and imports. They cover the first three months of the fiscal years 1910-11 including July, August and September. The total value of the imports in that period in 1910 was 53,095,992 pesos against 39,879,667 pesos for the corresponding period of 1909. The total value of the exports for the same period for 1910 was 70,592,089 pesos as against 60,926,128 pesos for 1909. This is an increase in imports of 33.14 per cent. and in exports of 15.87 per cent.

The mineral products exported for the first three months of 1910-11 were valued at 44,383,506 pesos as compared with 42,526,173 for the same period of the previous fiscal year. This is deceptive as the increase is in gold exports, presumably for settlement of interest and trade balances. The consistent decrease, as shown in the table herewith, in the base mineral exports, which practically measure the production as far as these metals are concerned, is notable and is not easily explained on the face of the available data.

#### MILLING STANDARD HIGH

The mining camps in Mexico continue to make low-cost records in the treatment of silver ores by cyanidation. Dur-

ing the stress of the continued low price of silver, these mills were compelled to meet price conditions uncalculated on at the time the properties were taken over.

As a result, the cost has been reduced much below the estimates. With the continued small advance in the price of silver during the latter part of 1910 these companies have had the satisfaction of a considerable increase in earnings. This is particularly true in Guanajuato and in Pachuca. The companies operating at El Oro continue to make excellent records in the matter of cost and saving, and on the whole have attained a high state of progress in the treating of the silver-gold ores of that camp by milling and cyanidation.

#### REVIEW OF STATES

Besides the brief outline given below of operations in various States, a more detailed review of several of the principal mining States of the Republic follows this article. Discussion of the general situation as to the various metals is given place in the respective general articles elsewhere in this issue.

#### SONORA

At the beginning of 1909 the mining locations in Sonora numbered 5391, representing 300,655 acres. During 1910 it is estimated that more than 800 additional locations were made. The State provided nearly one-fifth of the total mineral export of Mexico during 1910. Activity was greatly increased by the cessation of all Indian troubles and the important railroad extensions completed and projected.

During 1910 the Pacific Smelting and Mining Company was put on an operating footing and is in the field for ore contracts for the Fundicion and Guaymas plants, greatly stimulating small mining operation. The Cananea operations are reviewed in Dr. L. D. Ricketts' article elsewhere in this issue.

In the central part of Sonora many suspended or abandoned prospects were revived and strong companies came into the field, as the Cole-Ryan interests at the San Antonio and the Mines Company of America at La Dura and the Creston-Colorada. The Altar district continued to attract attention and large operations to treat the cement gold-gravels were undertaken, notably by the O'Neil syndicate. The operations at the Pilaes mine at Nacozari, at Las Chispas, near Arizpe, and the Lucky Tiger were conducted on a large and profitable scale.

#### BAJA CALIFORNIA

There was but little new development in mining in Baja California during 1910. Several gold and copper companies continued to operate successfully. The Boleo copper mines were operated on the same large scale. Some explorations

were undertaken in the Pacific Coast districts. In the San Antonio district, Compañía Metalurgica de California installed a cyanide mill and the Progreso company operated at full capacity.

#### DURANGO

The conditions in Durango during 1910 were but little changed. The operation of mines and smeltery at Valardeña continued active and successful and the Mapimi district kept up its output and some new work was begun. At Avino, the English company continued shipping on a small scale. In the Topia camp several companies continued operations and at Guanacevi more extensive operations were carried on during the year. Some important discoveries were made in this district. The Indé and El Oro camps were quiet. Recent negotiations and reorganizations promise to restore this rich region to activity. A projected railroad from Tepehuanes to Indé is being financed and also a line to El Oro.

#### TEPIC

In Tepic mining was stimulated during 1910 by the advance of the coast extension of the Southern Pacific to the Santiago river. Much prospecting and exploration were carried on in anticipation of better transportation conditions. Mining in Colima was practically at a standstill during the year.

#### MICHOACAN

Outside the Dos Estrellas mine of El Oro district there was little mining activity in Michoacan in 1910. The Talapahuajua camp continued quiet excepting one or two minor development undertakings. The French interests owning the Inguaran mines continued to wait for needed railroads and the copper district about Morelia was only active in a small way. The Dos Estrellas company continued its operations on a large and successful scale and held its rank as one of the most profitable mines of Mexico. Its stock is now largely held in Paris. The projected extension of the Southern Pacific railroad from Guadalajara to Mexico City will open up part of the State.

#### MEXICO

The El Oro district continued to output gold and silver in excess of any other Mexican district during 1910, El Oro, Esperanza, Mines of Mexico and Dos Estrellas being the principal producers. The explorations of other properties were continued during the year with good results in the Descubridora. The result of explorations in the developed mines has been very satisfactory.

In a new district the San Vidal company is developing with great promise. This lies northeast of El Oro and the same geological features prevail.

In the Sultepec, Temascaltepec and Zacualpan districts considerable develop-



ment was carried on and some mill building, notably the Seguranza. These districts await the extension of a railroad from Toluca. A description of the year's progress at El Oro will be given in another article.

#### PUEBLA

The Teziutlan copper smeltery was in operation about six months in 1910 and at the close of the year was operating one stack on ores from the Teziutlan mines chiefly. Little progress was made during the year in any of the other districts of the State, most of which are yet in the prospective stage. A railroad from Teziutlan to a gulf port was projected and may be built.

#### ZACATECAS

The districts of the State of Zacatecas maintained fair activity during 1910. In the important section in the northeast

part of the State of the Mazapil Copper Company (British) operated lead and copper properties extensively. The properties of the Smelters' Securities company and others also maintained a fair output. In the western part of the State in the operations were limited awaiting the building of the long projected railroad to connect with the National Railways. In the southern part of the State the Pinos camp has been active and the Benito Juarez at Salinas began production. In the district at the city of Zacatecas mining has been quiet. English interests acquired the Rio Tinto on the Cantera vein and are unwatering. El Bote produced regularly and handsomely. New cyanide equipment was installed. The San Roberta, under option to the Cape Copper Company, reverted to Juan Petit. El Eden mill was in operation on zinc ores from the Quebradillas. Negotiations for

the sale of the Veta Grande properties are under way. The Zacatecas Mining and Metallurgical Company erected a 30-stamp cyanide mill in the gold-belt south of the city of Zacatecas. A sub-ventioned custom milling plant was erected in Zacatecas. The whole district promises greater activity.

#### MORELOS

The Santa Rosa Quicksilver company, operating about 20 miles northwest of Cuernavaca in Morelos, installed an 8-ton Scott furnace during 1910. No data of operations are available. The deposit is large and has been worked for centuries. William Niven controls deposits of rose garnet in Morelos. The manganese deposits at Buena Vista on the railroad between Cuernavaca and Mexico City were not worked owing to the freight conditions.

## Mining in Sinaloa during 1910

By E. A. H. Tays \*

Mining on the west coast of Mexico did not feel the effects of the 1907 panic until the beginning of 1909, and it took all of 1910 to overcome the mining inertia this caused. Although active mining, with the exception of two or three old camps, was practically at a standstill for nearly two years all over Sinaloa, there was activity in all the 10 districts in the locating of claims. Taking 10½ months in 1910, there were recorded 338 denouncements (locations) embracing a total area of 3901 hectares, or 9639 acres, recorded year. The greatest number were in the northern district of Fuerte, but the district of Cosala takes rank for area, it reaching 829 hectares (one hectara equals 2.471 acres), while Sinaloa was second with 825 hectares.

The greatest mining activity was in the districts of Sinaloa and Cosala, due, perhaps, to each having a going mining camp within its boundary. The activity in the district of Sinaloa was more general, while that in Cosala was confined in large part to the region around Guadalupe de los Reyes. The districts of Mazatlan and Culiacan made the poorest showing for the year, there being but 15 denouncements, covering 139 hectares, in Culiacan, and 18 denouncements, covering 180 hectares, in Mazatlan. Parts of all the 10 districts of the state are highly mineralized. Those that show minerals over the whole area are Fuerte, Sinaloa and Badiraguato, so it is natural that the greatest number of locations should have been made in these, thus equaling just about 45 per cent. of the total locations for the State.

\*Mining engineer, Fuerte, Sinaloa, Mexico.

#### FUERTE DISTRICT

The district of Fuerte, although rich in mineral veins from the coast to the mountains, has no developed mines nor reduction works within its boundaries. The Choix Consolidated Company owns a number of good copper prospects, and it is reported that the company has ordered a 100-ton smelting plant and expects to erect it at Choix. Development was done on several veins in the vicinity of Madriles, and an American company was at work in the old Las Papas camp. Isolated locations were made on placer ground, several in the vicinity of Fuerte and San Blas.

#### SINALOA DISTRICT

In the district of Sinaloa is the famous gold camp of San Jose de Gracia. During 1910 work on the Rosario group was suspended due to barren zones and to a lawsuit. The Jesus Maria y Anexas company had another good year, shipping, monthly, 50,000 pesos and having large reserves developed. Numerous locations were made in the lead-silver-copper zone northeast of Ocoroni. Locations were also made nearer the coast, on large veins, on the Tetamecha ranch. The outlook for this district is promising.

#### MOCORITO DISTRICT

In the Mocorito district are many large veins, especially around the Cerro Agudo section, and copper, gold and silver indications are abundant. The only active camp was Palmarito, owned by a Philadelphia company. This company modeled its milling plant and treated successfully the silver ores that had proved rebellious.

#### BADIRAGUATO DISTRICT

In the Badiraguato district the Trigo or Tedras mines, worked from 1883 to 1894 by the Anglo-Mexican company, were relocated. These have produced 7,000,000 ounces of silver, which cost the company about 240,000 pesos more than the value of the silver recovered. It is believed that the mine has over 100,000 tons of ore actually blocked out, assaying an average of 14 oz. silver per ton. This mine was developed to 1400 ft. in depth, with the dip. There are several promising sections in this district, and numerous locations were made around Soyotiro, Santiago de los Calballeros and San Luis Gonzaga. This district has the disadvantage of being off main transportation routes, and freight must be carried on the mule or the burro. The San Javier silver mines in the district have been closed for several years, but, during 1910, Americans secured old tailings, and will treat them by cyanidation.

#### CULIACAN, COSALA AND SAN IGNACIO

The Culiacan district, although one of the most central and accessible, is the most backward in mine development. The San Lorenzo section is the most important in a mineral way, and some day will become one of the notable producers in the State.

The Cosalá district is one of the leading mining districts in the State and has several active centers, of which the well known Guadalupe de los Reyes camp is the most important, yielding about 1,000,000 pesos a year for many years. The mining activity in this district was gen-

eral; and while much was in the section surrounding Guadalupe de los Reyes, the San Jose de las Bocas and Nuestra Señora sections came in for their share.

The San Ignacio district, though essentially a mining section, because of lack of transportation facilities was little exploited. There was no active camp in the district, but it has many important mineral zones, the most important perhaps being Jocuistita.

#### MAZATLAN AND CONCORDIA DISTRICTS

The Mazatlan district is the least important in mineral resources, as the

greater part embraces the coastal plain. However, the northeastern section is wholly mineral. A new camp, Metates, was opened up during 1910, and is producing. Locations were made recently near the city of Mazatlan, at the water's edge, and development is said to be showing up a gold-bearing vein. The Pacific Smelting and Mining Company acquired the concession for a smeltery at Mazatlan.

The Concordia district ranks fifth in importance, and it has two of the most important centers in possibilities in the state, Panuco and Copala. At Copala,

however, the Butters company ceased all mining operations. The general mineralization in this district, together with the accessibility of its principal camps to Mazatlan, will in time commend it.

The Rosario district is one of the most noted in the State, due to the *antigua* mines in the Rosario camp, owned for years by the Bradbury estate of Los Angeles. No developments of note were made during 1910, but the advent of the Southern Pacific will help the district materially, the Rosario camp being especially favored. Plomosas is a camp in this district of future importance.

## Northeastern Mexico

By Henry C. Schmidt \*

During 1910 mining in general was quiet in northeastern Mexico owing to the low price of metals, and the heavy duty on zinc ores into the United States. Nevertheless, there was a certain amount of steady work carried on in the larger mines. Some of the mines are in a bad way owing partly to the lack of systematic development, while others seem to be reaching the end of their orebodies. No new discoveries of any importance were made, and unless some discovery is made the mining industry in this part of the country will continue to decline. Both the smeltery of the American Smelting and Refining Company, and the No. 2 smeltery ran at full capacity, smelting lead ores. The Mexican Ore Purchasing Company ran a calciner at Monterey and also shipped crude zinc ores to the United States and Europe.

#### NUEVO LEON AND COAHUILA

The district around Lampazos, Nuevo Leon, was quiet. A little prospecting was done in a small way. The Fraternal shipped some ore. Near Villaldama, the Cruz del Aire mines were lately sold to a French company. The new owners finished the tram, and are developing the mines in an energetic manner. These mines have a promising future. The tram was built by A. Leschen and Sons Rope Company, and has a capacity of 100 tons of ore per day. At Vallecillo nothing was done in the zinc mines, though it is reported that they will soon start milling again. Minas Viejas continued to mine low-grade zinc ore in a small way and to calcine the same. The Soledad was a heavy shipper of lead ore. Recent examination showed about 100,000 tons of high-grade lead ore in sight in these mines, which are under option to a French company and reported sold.

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In Montañas practically nothing was done during 1910. At Palo Blanco, the Palo Blanco Mining Company started up, after a shutdown of a couple of months. A good grade of zinc ore was mined in a small way, most of the work being confined to development and prospecting.

#### DEVELOPMENTS IN THE VICINITY OF MONTEREY

On Mitre mountain close to Monterey, several prospects were worked energetically. Chief among these was the Centenario Mining Company, which began to ship about 100 tons per month of lead ore of good grade. The General Escobedo developed favorably. On the Sierra Madre, near Monterey, the San Pedro and San Pablo mines of the Mexican Lead Company produced at the rate of about 2000 tons per month. Development continued in the Zaragoza y Anexas property. The Mineral Belt Railway suffered severe damage in the floods last summer, but was immediately repaired.

In the Cabrillas district, Coahuila, the Paloma and Cabrillas shipped steadily large quantities of lead and zinc ores.

#### TAMAULIPAS

In San Jose, Tamaulipas, several sales took place during the last two or three months and considerable work was done. It appears that this camp will come to the front again, as good copper and zinc ores are being mined. San Nicolas, Tamaulipas, continued quiet. Several mines were worked. After the heavy rains there was plenty of water and considerable ore was concentrated in hand jigs and about 300 tons of silver-lead concentrates shipped per month.

In the Rampuhuala and Dulces Nombres districts, Tamaulipas, the principal work was done by Salinas Caute and L. Vogelstein & Co. of New York, zinc-carbonate ore being extracted, over 1000

tons of this ore averaging 45 per cent. zinc having been shipped from Santa Engracia, principally to Europe. Some of the ore was calcined before shipment. In the Llera district three lead-silver properties were developed, one of which commenced shipping to Monterey. In the southern part of the State the oil excitement continued and several producing wells were brought in. There are 30 companies at work and preparing.

#### OPERATIONS IN SAN LUIS POTOSI

The Candelario & Filosofal mine at Catorce, San Luis Potosi, was taken over by a Monterey company and energetically opened. This is a promising property. A few years ago a large bonanza was taken out, but nothing was done at the property for more than a year. Catorce was quiet otherwise, though, there was again talk of starting cyaniding in this camp. Large quantities of silver ores suitable for this process and carrying from 400 to 500 grams of silver per ton can be had here in dumps and mines.

La Paz, at Matehuala, continued active. Santa Maria de la Paz, La Esmeralda and Dolores y Anexas all produced steadily. Improvements were made at the smeltery of the American Smelting and Refining Company at this place and Matehuala promises to be an important smelting center. This district has not received the attention its value merits; but it can be confidently stated that it is about to come into its own.

At Charcas, the Tiro General shipped heavily. This property was under option and was examined by French engineers. The Bufo continued development. Large quantities of zinc blende were uncovered here, and tests made with a view to erecting a concentrator. The copper mines of the district were nearly all closed, only one or two being worked in a small way.



# Aguascalientes Operations in 1910

By Bruno Newman \*

The Aguascalientes smeltery is still operating at reduced capacity; only three of its nine copper furnaces are in operation. The lead furnace was started in October on an accumulation of lead ores which will soon be exhausted.

The districts contributory to the Aguascalientes plant have not increased their output to any extent, although prospecting and development were started recently, and the competing smelters are making good rates to shippers, particularly in Asientos. In this camp, with a small reduction on the silica charges or an increase in the iron or lime payments, the smelters could easily stimulate a larger production. Gabriel Chavez, who recently purchased the Socorro mine, encountered a good streak of copper ore, 1½ m. in width, and opened a good tonnage of this ore.

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The Nopensada mines of the Asientos mining company started work again and shipped three to four cars per week to Aguascalientes. The Alta Palmira mines, belonging to the same company, shipped two cars weekly, and are trying to lower the water to increase the output. The Lead's Queen properties, under rental to the R. S. Towne interests, encountered a large body of copper ore and the mine is shipping the ore to San Luis Potosi. The Tepozan mine found some good ore in its drift, the work being under the direction of T. M. Hamilton. At the Purisima mine, the drift south was continued on the Purisima vein toward the intersection of this vein with the Veta Rusia and Santa Rita veins.

The Santa Francisca mines of the American Smelting and Refining Company have pulled the lowest sinking pump in order to install a large station pump to handle the water at the seventh level. Diamond drilling was discon-

tinued, and no ore is being shipped to Aguascalientes; about ten thousand tons are being piled on the dump monthly, possibly for future milling purposes.

At Tepezalá the Guggenheim mines continued their monthly output of about three thousand tons, and Charles Lucas, in charge of these mines, blocked out a large tonnage.

At Teocaltiche, near Paso de Sotos, W. N. Musgrave started operations at the tin properties, which are under lease to the Canadian Tin Mining Company, for exploration purposes. These mines belong to Mr. Rettich and associates; prospecting had been done previously, and new property was acquired.

During November a large number of denouncements were made at the Aguascalientes mining agency, most of them being in Asientos near the Lead's Queen properties operated by the Towne interests, others in the tin district of Teocaltiche and some in Tepezalá.

# Mining in Oaxaca in 1910

By A. E. Place \*

Business conditions in Oaxaca improved steadily during 1910. Among the more important changes that were beneficial to the miners was the completion of the railway into Taviche by the National Lines of Mexico, and the subsequent placing of an ore-purchasing agency and sampling works by the Aguascalientes smeltery at the new terminus. The reduction of rates for freight and treatment was such that ores assaying above 60 oz. of silver can be shipped at a profit. Several important strikes of bonanza ore, notably in the Sanford mine, operated and owned by the San Geronimo Mining Company of Mexico City, in the El Duende, under lease by J. Sibley of Chicago, the San Francisco, the Conejo Blanco and the San Juan mine did much to call the attention to the possibilities of other properties. In consequence work was actively started on the Boston, Esperanza, Purisima, Andes-Bullion and a number of other good properties, and some of them are already meeting with good success. Perhaps the most vigorous impetus was received when the famous San Juan litigation was ended, the San Juan mine going back to Charles Hamilton and his associates in the Compañía Minera San

Juan de Taviche. This mine is now producing over a carload per day of sorted shipping ore, reported to liquidate at from 2000 to 3000 pesos per car. The ore-shoot recently opened on the third and fourth level east is said to measure 126 m. in length. Direct-acting hoists were ordered for the mine, as well as a complete electric installation, and sinking to the 1500-ft. level will be continued, immediately upon arrival of the new machinery. The prospects for the custom mill contemplated by Dr. Howard A. Kelly and associates are favorable. A most thorough sampling of all of the more important mines of the nearby camps showed ample resources in milling ores. Titles to the mill site and water rights were recently turned over to the new company.

In San Jose and San Martin active mining is going on in several places. In the Natividad del Valle, owned by the Mimiaga family of Oaxaca, who have been operating a 20-stamp mill for five years, active prospecting above the 200-ft. level led to the discovery of some large bodies of milling ore, and a materially increased output of bullion. This level is the deepest working in the mine. The entry of Montreal capitalists, influenced by Captain Seely and Henry

Domville, who purchased the famous San Martin mine, was welcomed. After fixing up the shafts, and unwatering the mine, a first shipment was made a short while ago that netted them about \$250 per ton. It is reported that the same group of capitalists purchased the Conejo Blanco mine in Taviche, now in bonanza.

In Totolapam two custom mills were built in 1910. One of 10 stamps, on the Victoria Tapada mine, and one at the Soledad mine. Both will be ready for work in January. Active prospecting of the country revealed ores in several places that assay half an ounce gold and 90 or more ounces silver at the surface.

In the Sierra Juarez camp several examinations were made of the large old mines of the Manchega group, but the ore in sight did not satisfy the purchasers. It is hopeless to look for bodies of high-grade, or docile ores in mines where the *buscones* have had sway for a number of years. The Rescate mine and mill were in constant operation by the Old Mexico Mining Company.

In the Talea camp, the Santa Gertudis is shipping. At Cahonos, the mines owned by the Mineral de Cahonos, a Louisville, Ky., company, developed high-grade milling ores. In San Fernando, a Springfield, Ill., company purchased the lead and silver mines owned by the San Fer-

\*Mining engineer, Oaxaca, Mexico.

nando Mining Company of Oaxaca. They have a permanent force of some 300 men developing. The mines are not expected to produce until the lead smelteries are completed.

The gold belt was rather quiet in 1910. Wenzeslao Garcia installed a stamp mill in Peras. The ores come from the surrounding mines. The El Carmen mill increased to 10 stamps and in addition to these, there are many arrastras running throughout the gold belt treating ores that will average from one-half to three ounces gold.

Investigations by John T. Birkinbine

and others, acting for the Oaxaca Coal and Iron Company, demonstrated beyond a doubt that good coking-, as well as fuel-coal, exists in commercial quantities to the west and south of Tlaxiaco. Plans are under way to open this region by railway from the north via Puebla, as well as from the south, via the Rio Verde. The exploitation of these coal and iron deposits will prove important.

Other projects are the extension of the National lines to Tlacolula, thus bringing in touch with this center the important mining camps of Magdalena, and of Tlacolula.

Captain Seely and associates were actively pushing the railway enterprise, that involves the building of a line from Acapulco to Salina Cruz along the Pacific coast, and the connection of Oaxaca with this line via the Rio Verde. It is also contemplated to relocate the Oaxaca smeltery at some point on this road, where limestone and iron ore can be had. The most strategic point may be the junction of the Rio Verde with the Rio Penoles, which dominate the entire western half of Oaxaca, the coal and iron fields and the south and east of the State of Guerrero.

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## Hidalgo Operations in 1910

### Special Correspondence

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During 1910 important development and exploratory operations were carried on in the northern part of Hidalgo in the Zimapan region, chiefly by the Robert S. Towne interests and by the Cortez Association, a Boston company. The Honey railroad was extended and its completion will facilitate operations in a notably rich region and also permit the development on a larger scale of the iron deposits of the State. Attempts to revive the milling and mining operations at Zimapan were hampered by lack of capital.

#### PACHUCA DISTRICT

The results of the development in the important camp of Pachuca, including the tributary camps of the Real del Monte and El Chico, during 1910 gave assurance of renewed vitality for the camp for many years to come. The Real del Monte y Pachuca company, the principal operator in the district, inaugurated a number of improvements in the mining operations.

It is reported authoritatively that in the working mines of this company at the levels as deep as 1500 ft. the veins continue to carry a rich average content and in some cases show richer than in the levels above. The company is doubling the capacity of its Loreto and Guerrero mills. Electric transportation has been installed in the Girault tunnel and a 40-km. aerial tram is being built to bring the ores from Barron mines to the Loreto mill. The company is planning to open new mines during 1911.

The Santa Gertrudis company was constructing its large cyanide plant all year and it is nearly completed. Developments in the mine resulted in a large increase of ore reserves and the vein was reported to have improved, particularly in depth.

The San Rafael Company continued to

develop on the 500-m. level, with successful results. The mill worked on dump and mine ore. Exploration was carried on to the north of the Viscaina vein in search of new veins. The output was about one ton of silver each week.

La Blanca company continued developments on the oreshoot of the Santa Gertrudis vein as well on the new Northwest vein. The discovery of some faults and dikes in the northeast portions of the mine introduced new problems, but they do not affect the conditions of the operation. The ore reserves are reported to be increasing. A 300-ton cyanide plant was completed and running well.

El Bordo mine was reported to have developed a large tonnage of ore and to have discovered "fillings" enough to justify a cyanide mill which will probably be built on the site of Hacienda de Purisima Chica in Pachuca, the pulp being brought from the mine by a pipe line, a distance of 2 kilometers.

The Guadalupe-Fresnillo company is building a 100-ton cyanide mill using Chilean mills and Pachuca tanks. The mine has a moderate ore reserve and a large dump. Capital was raised to operate the Maravillas company on a larger scale. The company owns extensive territory in the Pachuca district. Much interest has been shown in the developments of the Santa Gertrudis lode in the Sonora y Ures mines and in the Santa Ines y Carretero. The former company has recently acquired La Fé and Trydimita properties. La Fé is on the continuation of La Blanca lode. The Santa Ines y Carretero is sinking to 250 m. The Santa Ana mine developed a large orebody, and supplied the San Francisco mill, the capacity of which was increased. La Union mill at Pachuca, another custom mill, treated about 100 tons daily, mainly from the San Rafael mine.

The Coscotitlan plant for the treatment of the tailings in the Pachuca river achieved a notable metallurgical success and is now operating profitably. Other plants are being built to treat tailings.

#### OFFICIAL REPORT ON SANTA GERTRUDIS OPERATIONS

The following data of the operations at the Santa Gertrudis mine are from the report of the stockholders at the meeting in London, Dec. 8:

Since the Santa Gertrudis property was acquired by the Camp Bird, Ltd., operations were greatly retarded for want of power. This difficulty was overcome by the starting of a subsidiary of the Mexican Light and Power Company. The installation of this new power plant, removed one of the most difficult and expensive items in mining at the camp.

The developments in the 17th level of the Santa Gertrudis proved the width of the vein fully equal to, and the grade in excess of previous estimates. The developments above the 17th level are proving satisfactory and indicate that far too little credit was given to the probable production of that section of the mine. In this part of the mine, in which much work was done by former operators, it was impossible for the engineers inspecting the mine to estimate the ore reserves. Since the new operations began, systematic work has resulted in satisfactory development. In September the vein was cut on the 18th level, approximately 110 ft. below the 17th level. It is 16 ft. wide, 8 ft. of which assays \$20 per ton. Drifting east and west is now being carried on with good results. The ore exposed above the 16th level in the old workings, while not blocked out, should yield at least \$2,000,000 profit, being twice the amount of the original estimate.



There is every indication that the ore-body continues below the 18th level. Little progress has been made in drifting on this level, due to lack of pumping power. The most important feature is that work accomplished throughout the mine fully confirms the original estimate.

The new plant of the milling company will consist of a 60-stamp battery, 10 tube mills, 49 cyanide tanks, precipitation and filter-press plant, and other necessary machinery. This plant, which is now in course of construction, will have a daily capacity of about 600 tons, and it is hoped will be ready for operation about May, 1911. The Guadalupe mill, which has a capacity of 250 tons per day, began operation in March and treated, to the end of October, 43,000 tons of low-grade ore, leaving a small profit, which has been utilized in the further development and equipment of the mine.

The Santa Gertrudis company also owns two claims, La Necesidad and Guillermo Segura. The shaft on these claims, 400 ft. deep, was retimbered. In a crosscut at a depth of 270 ft., the vein averaged for a length of nearly 30 ft., \$17 per ton over a width of 20 in., while the face of the drift showed \$26

ore. These two claims constitute an excellent prospect, but it will be some months before systematic development can be done. Should the development prove satisfactory it will constitute a mine independent of the principal Santa Gertrudis property.

#### REAL DEL MONTE DISTRICT

The Real del Monte y Pachuca Company controls the principal mines of the Real del Monte camp. Extensive improvements in the mines were made during the year. La Reina company developed a satisfactory orebody and is exploring on a north and south vein. The company will sink the San Pablo shaft to cut the Viscaina vein and to explore for the Santa Gertrudis vein, which it is thought extends to the property. The San Felipe Company is reopening the San Felipe shaft and developing.

#### EL CHICO DISTRICT

In El Chico district, outside of the Arevalo company and the Tetitlan mine a few other mines worked on small scale. The cutting of the Arevalo vein by the Nepton tunnel at 2160 m. opened a large

field for exploration. In the Arevalo the lower level of the mine is 70 m. above the level of the tunnel. About 300 ft. of drifting at the level of the tunnel on Arevalo vein will reach one of the orebodies. The Arevalo cut vein by the Nepton is 40 ft. wide. The tunnel cut another vein 7 ft. wide, mainly zinc and lead. The Arevalo company is planning a 100-ton cyanide mill. A company was organized recently in Pachuca for the erection of a 100-ton custom mill in El Chico. It is probable that not all the El Chico ores are suitable for cyaniding. A new company is being organized for the prospecting of territory east of the Arevalo properties.

Work on the narrow-gage railway from Pachuca to the Real del Monte and El Chico is progressing. The line to Real del Monte will be finished by March, 1911. The grade is about 7 per cent. in reaching Real del Monte. The Mexican Light and Power Company extended its service to Pachuca during the year, with the result of greatly cheapening and increasing mining and milling operations.

The Pachuca, Real del Monte and El Chico districts together will soon have a mill capacity of 3000 tons daily.

## Mining in Chihuahua in 1910

### Special Correspondence

In spite of drawbacks, such as low metal prices, the United States' tariff on zinc ores, the frequent shortage of ore cars and the comparatively small amount of new American and foreign capital diverted to Mexican mining investments, the State of Chihuahua made marked progress during the year 1910. This progress is shown in an increased output of gold, silver, lead and copper, with but a small decrease in the zinc tonnage considering the handicaps attendant on its advantageous marketing. Just what the total metal output was cannot be arrived at at this time, but a conservative estimate places it about 20 per cent. in excess of the preceding year. The largest increase was in gold and silver, while the lead tonnage remained about normal. Upward of 20 properties operated at a handsome profit, while twice as many more made ready for early dividend earning by the addition of modern milling plants.

Important features of 1910 were the revival of mining in such old camps as Cusihiuriachic, Guadalupe y Calvo, Ocampo and San Pedro; the erection of a dozen or so cyanide plants of capacities varying from 20 to 300 tons with plans announced for as many more; the enlargement of the Chihuahua and Terrazas smelteries; railroad con-

struction completed and announced; important ore discoveries in Ocampo, Chiniipas, Santa Eulalia, Conchos River and Naica sections; an absence of undesirable promotions in Santa Eulalia, Naica and other older producing sections; better ore transportation, notably in the latter two camps; and the advent of financially able English and French companies.

#### DIVIDEND COMPANIES

The following companies have made public dividend distributions: Batopilas Mining Company, gold-silver; Dolores Mines Company (Mines Company of America), gold-silver; El Rayo company (Mines Company of America), gold-silver; Cigarrero Mining Company, gold-silver; Rio Plata Mining Company, silver; Cienega Mining Company, gold; Gibraltar Mining Company, lead-silver; Compañia Minera de Naica, lead-silver. In addition, such companies as the San Toy Mining Company, Chihuahua-Potosi Mining Company and Santa Eulalia Exploration Company (now the Exploration Company of England and Mexico), all with properties in the Santa Eulalia camp; the Yoquivo Development Company, Cusi Mining Company, Republica Mining Company, Santo Domingo Mining Company, Sierra Mining Company, Bar-

ranca del Cobre Mining Company, all in the sierras west of Chihuahua City, San Diego Mining Company at Santa Barbara, and the various units of the American Smelter and Refining Company at Chihuahua, Santa Eulalia and Santa Barbara have returned substantial earnings.

There were also other properties individually operated, of which no detailed record is available but which proved profitable, as was the case with leasers, notably in the Parral section. The Rio Tinto Copper Company with mines and reduction works at Terrazas also operated profitably until its shutdown in July to permit of the installation of a second furnace and converters.

#### PARRAL AND GUADALUPE Y CALVO

Parral and Guadalupe y Calvo attracted particular attention on account of milling plants. In the former, the first 250-ton unit of the Palmilla Milling Company cyanide plant was completed, while the 300-ton cyanide mill of the Veta Colorado Mining and Smelting Company and 500-ton zinc reduction plant of the San Francisco del Oro Mining Company were in process of erection and improvements were made at the zinc mill of the Arizona-Parral Mining Company and at plants of other companies in the camps tributary to Parral. At

Guadalupe y Calvo, La Fe Mining and Milling Company had in operation a 25-ton cyanide plant which is being doubled, while the West Coast of Mexico Mines Company is erecting a 250-ton cyanide mill and a third company has in prospect the erection of a cyanide mill. With the operation of the several Parral plants which will permit of the economical handling of large tonnages of low-grade ores now unmarketable, the camp's outlook for 1911 is exceedingly bright.

#### SANTA EULALIA AND OTHER DISTRICTS

Santa Eulalia furnished nothing unusual, but the producing and developing companies have made a number of important ore discoveries. There was but one noteworthy property transfer, namely the Buena Tierra mine of the Santa Eulalia

Exploration Company to the Exploration Company of England and Mexico. The installation of aerial trams facilitated increased ore production.

The old silver camp of Cusihiuriachic gave unmistakable proof of again becoming one of the State's most important silver producers and according to reports there will be several old mines on the shipping list again within a few months. The railroad is completed to the camp and this will greatly aid in its progress.

There was active prospecting along the building line of the Mexico-Northwestern Railway from Casas Grandes to Madera and many denouncements were made in new sections. This line also gave impetus to operations in the Guaynopa and other old lead-silver and silver

districts where reduction plants are planned for, awaiting railroad service.

The operations of the Candelaria Mining Company at San Pedro were of note on account of regularity of lead-silver ore production and the installation of heavy pumping machinery. Normal conditions prevailed in the northern camps about Villa Ahumada and Casas Grandes and new discoveries of copper-gold and lead-silver ores were made.

During the latter months of 1910 shipments of zinc ore were suspended by nearly all the large producers, mainly on account of the tariff on zinc ores into the United States, but a small production is now being made to European points. German and French companies are acquiring a few properties and the outlook for increased production is encouraging.

## The Mining Industry in Jalisco

By A. S. Brady \*

The year 1910 witnessed the completion of a power-transmission line into the Hostotipaquillo district by the Chapala Hydroelectric and Irrigation Company of Guadalajara, and delivery of power will be commenced early in 1911. Towers were erected as far as the El Favor mine, and from a switching station there, power will be sent to adjacent properties over wires strung on steel poles. From Lo de Guevara, a point on the Jalisco link of the Southern Pacific, near Magdalena, a branch tower line extends to the Embocada camp of the Amparo Mining Company, in the Etzatlan district. Pending the completion of a new hydroelectric plant on the Santiago river, power will be supplied from one of the old plants of the Chapala company. The properties that are certain to receive current during 1911 are El Favor, Casados, Mirador, Amajac, Espada, Marquetas and Mololoa. The Cinco Minas and Mina Grande may be added to the list.

#### HOSTOTIPAQUILLO DISTRICT

At El Favor the El Favor Mining Company has a 20-stamp concentrating and cyaniding plant, built in 1909, still awaiting power. New equipment, including two additional tube mills (making a total of four) were installed and machinery rearranged. By coarse crushing and re-grinding it is expected to put through at least 120 tons daily. Development during four years has proved a large tonnage in the mine, and stoping will be commenced as soon as power reaches the mill. All mine workings were connected with the main transportation tunnel, and ore will be taken to the mill over a sur-

face tramway. The El Favor Company is controlled by Makeever Brothers, of New York, who also control the Mirador, a new enterprise. It was decided to install a plant for the Mirador adjoining that of El Favor, using the same building. There will be 15 stamps, with concentrating and cyaniding equipment. The Mirador properties are near El Favor.

In January, 1910, the Marcus Daly estate closed a deal for the old Cinco Minas, paying approximately 500,000 pesos for the properties, and in September the mines were transferred to the Cinco Minas Company, capital \$500,000, organized by the Daly interests as a close corporation. The year's development of the Cinco Minas was satisfactory and a recent estimate placed the proved reserves, inclusive of those left by former owners, at close to 500,000 tons. Plans were made for 250-ton direct-cyaniding plant, but due to the recent appearance of some zinc at depth equipment orders were not placed. During 1910 the Dalys purchased valuable water rights on the Tecomil arroyo, in the Tequila district, and if negotiations in progress with the Chapala Hydroelectric Company fail, an independent hydroelectric plant will be built. Shipments of rich ore were made.

Machinery for the first unit of a 200-ton reduction plant is being assembled at the Casados mine by the Consolidated Mining Company. During 1910 ore to the value of 150,000 pesos, taken out in development, was shipped. The workings were increased to nearly two miles. Power drills will be installed as soon as power reaches the mine. Casados ore shows a greater percentage of gold than any other Hostotipaquillo property. In

ore recently encountered the gold represented 35 per cent. of the total value.

The Amajac Mines Company began remodeling the old Amajac reduction works and it is expected to have the modernized plant in commission early in 1911. The company owns the Refugio, Animas and Tres Estrellas mines, and carried on development with good results.

The Virginia & Mexico Mine and Smelter Corporation, which inaugurated the first modern reduction plant (Marquetas) in the district in July, 1909, shut down some months ago. Serious metallurgical difficulties, due to a high percentage of manganese, were encountered. The Espada Mines Company, developing the Espada, Deseada and San Jose mines, made arrangements to use the mill. An aerial tramway will be installed.

A deal for the old Mololoa mine was recently made with the Mololoa Mining Company, of Toronto, Canada, by W. M. Mathews, of Hostotipaquillo, and the latter is now in control. Recent development opened a body of high-grade ore, and shipments are being made.

#### ETZATLAN DISTRICT

In the Etzatlan district in the first 11 months of 1910 the Amparo Mining Company milled 57,474 tons of ore, producing 1,252,663 pesos. The returns to Jan. 1, 1911 are expected to raise the total to over 1,500,000 pesos. The company paid quarterly dividends of 3 per cent. on \$2,000,000. Additional reduction equipment was installed, and the main shaft carried to 1000 ft. The company is ready to receive power from the Chapala Hydroelectric Company, and a saving in operating expenses is expected in 1911.

\*Guadalajara, Jalisco, Mexico.



The old Candelaria and adjacent properties, near Ahualulco, were taken over some months ago by J. B. Shale, of New York, and the Shale Mining Company organized. An old tunnel and drift were cleaned out, and a new tunnel driven 350 ft.

#### AMECA DISTRICT

In the Ameca district, late in 1910, French interests purchased a block of the stock of the Magistral-Ameca Copper Company, of Los Angeles, Cal., providing funds for increasing the capacity of the concentrating plant at the Magistral mine to 150 tons daily. When the plant was inaugurated, about June 1, the Elmore flotation process was a feature. This was abandoned. Mine development continued during 1910 with satisfactory results. The Almoloya Mining Company, of Mexico City, operating a small concentrating plant at the Almoloya mine, paid dividends of 8000 pesos. The plant will be enlarged in 1911. The Regina Mining Company, at San Martin Hidalgo, failed to obtain a satisfactory extraction in the treatment of its gold ore by cyanidation. Work on copper properties, under development for several years, was continued, and reduction facilities planned.

#### BOLANOS AND SAN SEBASTIAN DISTRICTS

In the Bolaños district the famous old silver mines of Bolaños were purchased during 1910 by the Bradbury interests of Los Angeles, Cal., owners of the Minas del Tajo, Rosario district, Sinaloa. The Mexican Mines Company, capital \$500,000, was organized. Pumping equipment for the unwatering of the mines was ordered, and old buildings and roads re-

paired. A modern reduction plant will be erected. The Rosario Mining Company, owning mines near San Martin de Bolaños for several years, resumed development late in 1910. Minnesota capitalists, headed by ex-Governor Lind, arranged to reopen the old Zuloaga mine, owned by Patrick Fitzgerald.

In November, 1910, the Porvenir tunnel of the Tajo Mining Company, driving for the last three years, cut the old Tajo vein, in the San Sebastian district, at a depth of several hundred feet below the *antigua* workings. Additional equipment is being installed at the Tajo plant, and by February it will be in shape to handle 100 tons daily. Equipment for a 250-h.p. hydroelectric plant, utilizing the water flowing from the Porvenir tunnel, is arriving at the mine. It includes 3000 ft. of pipe. The water will fall 600 ft. English interests recently made a deal for the Los Reyes properties, owned by a Guadalajara company, and are now in charge of operations. Some reduction machinery was purchased during 1910 by the Navidad Mines and Reduction Company, operating the Navidad mines and mill.

#### AYUTLA AND OTHER DISTRICTS

In the Ayutla district the Carrizo Copper Company increased the capacity of the concentrating plant at the San Felipe mines to 100 tons daily, and placed it in commission late in 1910. The company's 30-ton smeltery, at the town of Ayutla, was idle, but there are plans for smelting in 1911. The San Miguel Gold Mining Company was organized in Indianapolis by Gen. A. L. New to take over

the San Miguel gold properties near Ejutla. Limited development of its copper properties was in progress by the Los Ailes Mining Company.

In the Mascota district the Lupita Mines Company opened bodies of milling ore in the extension of its property, purchased from the Dwight Furness Company, of Guanajuato, and operated the mill. A cyanide annex was installed. The company recently treated several hundred tons of high-grade milling ore from the San Jose de la Agujas mine of H. M. Sunde. Some rich ore was also shipped from the Sunde property. Several attempts have been made to sell the mines and mill of the Lawson-Mexican Development Company at court auction, for the benefit of creditors, but without success. At each successive attempt the price was reduced 10 per cent. The court will soon offer the properties at 37,214 pesos.

#### TULA IRON OPERATIONS

In the Tapalpa district the Mexican Iron and Steel Company, of Boston, remodeled the iron foundry at Ferreria de Tula, and purchased a traction train for the transportation of iron ore from the mines to the plant, 23 miles. During the year the company increased its investment to nearly 500,000 pesos. Payments on the purchase price of the Tula iron mines, timber and lands, 1,000,000 pesos, represent the greater part of this amount.

In the Tecalitlan district, late in 1910 a 20-ton concentrating and amalgamating plant was placed in commission at gold and gold-copper mines owned by A. J. Stewart and G. S. Johnston.

# Guanajuato Operations in 1910

By A. S. Brady \*

The principal operations in the State of Guanajuato continue to be in the district of the same name. Active operations were carried on throughout 1910 at the Pozos camp in the southwest.

Dwight Furness writes concerning the Guanajuato district: "The production of the camp held its own, with a gradual increase in efficiency of treatment and a decrease in the cost of treatment. Development was pushed forward more than at any other much larger percentage of the ores treated now come from new ore mined, instead of from the dumps. The gross production in concentrates and bullion ranges from 12,000,000 to 14,000,000 pesos per year. Several new mills: La Tula, Tajo de Dolores or the Providencia, will start early in 1911. Active work is

being prosecuted in the Oro Grande mines, so that during 1911, there will be a notable increase of production."

During 1910, the Guanajuato Power and Electric Company began work on a third hydroelectric plant on the Angulo river in the State of Michoacan, which will double its total capacity, giving it over 20,000 h.p. The new plant will be completed early in 1911. The company, through its subsidiary the Central Mexico Light and Power Company, purchased the San Luis Potosi power plant for \$700,000, and built a transmission line to San Luis Potosi, 87 miles in length. The earnings of the company increased during 1910, and dividends were continued.

The Oro Grande Mines Company, capital \$9,750,000, organized to reopen the old mines of La Luz and build a 1000-ton plant, early in 1910 made a deal for the mines and mill of the Guanajuato

Amalgamated Company, at La Luz. Payment was made in Oro Grande stock, and indebtedness of 211,000 pesos was assumed. Profitable milling was in progress at the Amalgamated plant for several months, the net returns ranging from 15,000 to 20,000 pesos monthly. The money has been applied to development and the payment of the indebtedness. An attempt to place a large block of stock in France has not yet borne results.

The Adolph Lewisohn interests, of New York, now owners of the old San Cayetano properties, spent from 5000 to 6000 pesos monthly in development work and proved a large tonnage. The long tunnel, driven by former English owners  $2\frac{1}{4}$  miles, was carried into the Mexiamora property, and old workings unwatered. A big reduction plant is planned. During 1910 an option on the adjacent La Joya group was arranged.

\*Guadalajara, Jalisco, Mexico.

The Peregrina Mining and Milling Company is treating from 4000 to 5000 tons monthly from the properties of the Cubo Mining and Milling Company. An aerial tramway was installed for ore deliveries several months ago. The Pinguico Mines Company milled about 150 tons daily, part of which was secured from the Cedros property, under option to the Guanajuato Development Company for several years. For several months no high-grade ore was shipped by the Pinguico. The San Matias custom mill of the Mexican Milling and Transportation Company was operated under lease by E. J. White with small profits.

During the greater part of 1910 the Guanajuato Reduction and Mines Company put through an average of 22,000 tons of dump ore and mine fillings. The profits earned were sufficient to pay 6 per cent. on the bond issue of \$3,000,000. It is hoped to arrange for new development in the Rayas and other old mines during 1911.

The Mineral Development Company continued driving the crosscut planned to intersect the Mother Lode and prove the Guanajuato district at depth. It was started just below the 600-m. level of the Nueva Luz shaft and it is estimated that at present progress the Mother Lode will be reached in February. The federal government is paying a subsidy of 150 pesos per meter for work below the 500-m. level of the shaft.

The production of the Guanajuato Consolidated Mining and Milling Company averaged over 100,000 pesos monthly. The Carmen Gold Mining Company, controlled by the Guanajuato Consolidated, showed a small profit during the year. The Humboldt Mining Company, of Mexico City, owning a property adjoining the Pinguico, resumed work several months ago and continued its shaft to a depth of 400 m. Crosscutting is now in progress, with the hope of encountering the Pinguico vein. The properties of the American Mining and Milling Company were shut down during the year.

The El Monte gold mine, owned by J. B. Rocha and associates, netted from 25,000 to 50,000 pesos monthly during 1910. Much rich ore was shipped and some lower grade treated in arrastres. At the Pasadena property, adjoining the El Monte, a shaft is being put down to encounter the El Monte vein.

It is expected that the plant of the Tula Mining Company will be ready for operation in January, 1911, and that of the Providencia Mining and Milling Company in February. The former is one of 10 stamps, and the latter of 40. The progress at both plants will be concentration and cyanidation. Several years' tonnage is blocked out in the Tajo de Dolores mine of the Providencia company.

## Mining in Nicaragua in 1910

BY T. LANE CARTER\*

The serious revolution commenced in 1909 was brought to a close during 1910, but as these Central American revolutions are not serious to mining as a rule, 1910 was a satisfactory year on the whole for the mining industry in Nicaragua. The first act of the Estrada revolutionists was to reduce the outrageous tariff imposed by Ex-President Zelaya. This reduction in taxation was of great assistance to the miners, so that even with the disadvantage of the revolution, eastern Nicaragua had a better year than it has had for some time past.

The war interfered seriously with mining operations in the Rama district. On the Topaz mine, near Rama, several battles were fought, and in consequence this mine was compelled to stop all work. In the Pis Pis district the mines ran fairly well, but a scarcity of labor was felt.

The normal output of gold in Nicaragua is about \$1,000,000 per annum. The output for 1910, however, will not come up to this amount. The probable figure will be \$800,000. Statistics in this country are unsatisfactory and it is difficult to get at the exact figure, as the gold is not reported in fine ounces but in bullion.

Little or no attention has been paid to any mining in Nicaragua except gold, as all indications point to the fact that the mineral wealth of Nicaragua is in that metal. Some lead-silver ores are known, and it is also reported that coal has been found. There are a number of copper prospects, but under the present conditions, base-metal mining does not appear attractive.

The country suffers from lack of transportation. Now that there is every indication of the abolishment of the concessions, large tracts of land will be thrown open to prospectors. During the year 1910 a number of mining engineers visited Nicaragua. The indications are that American firms will become interested in the country. Most attention, at present, is being given to the Pis Pis district. All the engineers who have examined the Bonanza mine in this district have been impressed by its great possibilities. Recently native prospectors have reported rich finds of free gold ore in the Bana Cruz district which is not far from the Pis Pis. In the Oconguas district the La Luna has been working one Huntington mill. Compared with the Pis Pis and Bana Cruz districts, the Oconguas country has the serious disadvantage of being lower and less healthful. Great interest was taken in La

Leonesa mine which is being developed under the direction of H. C. Hoover. The outlook for 1911 in Nicaragua is favorable. The progress no doubt will be slow but there can be no question but that in time Nicaragua will have a flourishing gold industry.

## Salvador

In Salvador in 1910 the Butters properties, the Salvador and the Devisadero, were operated continuously, producing about \$125,000 per month chiefly in gold. The plant was extended during the year. Mina Gigante at Jocoro operated its new cyanide plant continuously and other properties were developed. As a whole the mining industry did not make the advance the richness of the deposits justified according to official reports, the chief reason being lack of transportation.

## Cuba

The shipments of iron ore from the Daiquiri iron mines near Santiago de Cuba operated by the Spanish-American Iron company during 1910 amounted to 676,000 tons. The production of the Mayari iron mines, which is the new property of the same company on the north coast of Cuba, amounted to 410,000 tons for 1910. The average annual production of the Daiquiri iron mines is 500,000 tons. The estimated production of the Mayari property for 1911 is 800,000 tons. The Ponupo Manganese Company shipped from its iron mines near Santiago de Cuba during 1910, 165,000 tons. The production from this property during 1911 will be 200,000 tons. The manganese mines of this company are not in operation. At the Mayari property the Spanish-American company installed a 12-kiln nodulizing plant which has a capacity of 1600 tons of nodulized ore per day. At present about one-half the ore is shipped in its raw or natural state and one-half nodulized.

The Juragua Iron Company, a subsidiary of the Bethlehem Steel Company, shipped about 300,000 tons during the year.

Most of the Cuban iron ore came to the United States.

Some development of the gold district, near Holguin, in the province of Oriente, was undertaken during 1910. The Holguin-Santiago, El Mejor (American companies) and the Cuban Gold Mining Company, of Havana, are in the district. Gold is in veins and alluvial deposits. The district was anciently worked by the Spaniards.

The Cuba Copper Company of New York, operating at El Cobre, produced in 1910 about 50,000 tons of silicious ore running from 5 to 12 per cent. in copper. Most of this was shipped to the United States, a small amount going to Europe.

\*Mining engineer, Osgood, Carter & Co., First National Bank building, Chicago, Ill.



# Mining in South America in 1910

The Andean countries during 1910 showed a most important awakening in mining, due chiefly to the advance influence of the Panama canal. In these and all of the South American countries the great obstacle is the slowness of the progress in railroad building, due to great physical difficulties, to sparseness of settlement and to the difficulty in rescuing the necessary foreign capital. In Brazil, Argentine, Bolivia, Ecuador, Peru and Chile, the railroad progress was marked and many new roads are projected or under construction. A general review of the several countries follows. It is regrettably impossible to secure satisfactory and timely statistics of South American mining.

## ARGENTINE REPUBLIC

In an able and trenchant article by Salvador Mesquita, presented on the occasion of the Industrial Exposition at Buenos Aires (August, 1910), the recognized backward state of the mining industry of the Argentine Republic is attributed mainly to the defective national legislation; the need of technical schools fostered by public funds; the failure of the banks to recognize or aid mining financially; and the lack of competent geological and technical literature on the industry and the districts, and of official maps and mineral surveys. He ably draws a parallel and contrast with the conditions in the United States and urges the government to recognize the importance of developing the mineral resources of the country and to take action to remove the obstacles under which it is now struggling. The article is an explanation of the failure of this South American country to develop in a relatively important way its mining industry.

The same author describes in a pamphlet the tin deposits of San Salvador in the province of Catamarca in the Sierra of Zapata. These were originally located as silver mines and abandoned. In 1906 Sr. Mesquita discovered tin in the samples of the ore, and denouncement and development followed. The tin is found in a granite formation. A typical analysis shows tin oxide, 14.52 per cent.; iron oxide, 2.75; copper oxide, 0.22; combined water, 2.31, lime and magnesia, 0.23; silicious gangue, 79.97 per cent. The property has been equipped and is operating. The possibilities of increased quantities of tin being secured from Argentine deposits are mentioned by Consul-General R. M. Bartleman, of Buenos Aires. The San Salvador mine has, according to the report, 2000 tons of mineral waiting for machinery to treat it. No tin has yet been exported from Argentina, lack of railway transportation being

a detriment in development. The cost of transporting a ton of mineral from the mine in question to the seaboard is approximately \$25, pending the completion of the railway line to Cerro Negro, now under construction.

Several British companies have in recent years undertaken development of mining prospects, principally in the provinces of La Rioja and Catamarca. In the former the Famatina Development Company, Ltd., during 1910 completed important improvements of the smelting plant, including converters. Apparently little has been done in gold mining in Argentine, although several vein deposits have been exploited in a small way by local interests. Recently examinations of gold-gravel deposits near the Bolivian line in the province of Salta are reported, and also investigations of the Rio Negro area in the south for dredging have been undertaken.

The coal developments in Argentina continue to be of increasing importance, although in 1909, the latest available statistics, the coal imports were valued at \$15,687,000.

In 1909 the total mineral-product imports amounted to \$64,378,000. The mineral exports of the first six months of 1910 were only 307,927 pesos (gold).

A Chilean company is operating gravel deposits at the head of the Neuguen river by sluicing. Dredging operations in Jujuy province commenced in 1908 are reported to be discontinued. Tungsten deposits are being operated in La Carolina district province of San Luis, the product being shipped to Europe.

## BRAZIL

Manganese ore and monazite continued to be the important and distinctive mineral products of Brazil in 1910. Gold operations and diamond mining are attracting more attention in Brazil, as the country is opened up by railroads which are rapidly being extended into the interior under the backing of foreign capital. During the year, American engineers studied the iron deposits of southern Brazil and American geologists have demonstrated that the coal deposits extend from Sao Paulo to Rio Grande do Sul. Placer operations were under way on the Kaka river below Guanay. Mercury was produced in the State of Minas Geraes.

## BOLIVIA

The impetus to mining in Bolivia began with the program for the government financing of a railroad system for the country during 1909. Tin was the principal mineral export. The Andes Tin Company erected a hydroelectric

plant using the waters of the glaciers. The mines are between 16,000 and 17,000 ft. above sea level. The principal mineral zones being developed on a large scale are: The extensive region which, commencing in the basin of the Inambari river, extends from the western confines of the country to Upper Paraguay, and contains the placers of San Juan del Oro, Suches, Tipuani, and a number of others equally important; the district commencing in Lopez and continuing southward through Chayanta, Chichas, Mendez, Cinti and Acero and terminating in the plains of Santa Cruz; and the zone, which is the richest and most important, extending to Carabaya, Peru, and to the sources of the Madre de Dios, Acre, and Purus rivers. From 1540 to 1750, the gold mines of Bolivia produced \$2,100,000,000. From 1750 to the beginning of the nineteenth century, the mines and placers situated in the provinces of Larecaja and Caupolican produced \$14,000,000 gold, and from 1818 to 1868 the output was 150,770 oz. of gold. The product in gold of the other mines and placers of the nation, from the middle of the eighteenth to the latter part of the nineteenth century, is estimated at \$125,000,000.

## COLOMBIA

The attention of foreign capital was turned toward Colombian mining operations in 1910 in a notable way. The American-British interests controlling the Oroville, Cal., dredging operations took extensive options in Colombia on gold-gravel deposits and carried on explorations with reported satisfactory results. Other American companies investigated the field. Several American companies which undertook dredging operations in the country a few years ago have been compelled to reorganize or discontinue, chiefly by reason of lack of sufficient capital. Several smaller gold-quartz operations, chiefly by English and French capital, were undertaken, in the southern part of the country. Canadian interests investigated the petroleum deposits near the Caribbean coast, and the results are reported good. The country continues to produce some platinum from the placer operations. The Government canceled the lease of its emerald mines to an English syndicate and operated them itself successfully. The new mining code is considered very liberal.

## ECUADOR

The United States Gold Dredging and Rubber Company, of New York, has acquired extensive placer properties in Ecuador, and recently announced that a dredge was contracted for. The property

is in the province of Esmeraldas. An English syndicate is negotiating for the petroleum fields of Ecuador in return for a loan to the Government. A French syndicate took a contract on extensive mineral lands in the province of Esmeraldas. At the mouth of the Santiago river at La Tolita active mining operations were carried on during 1910. The railroad to Quito is completed, and a contract was let to extend it to the Province of Esmeraldas.

The mineral deposits of the country have as yet been only slightly developed. The country is reported rich in gold, mercury, copper, iron, lead and coal, while silver deposits also exist but are not worked. In Esmeraldas platinum is reported. Petroleum was found in paying quantities on the coast. Sulphur deposits were reported in several localities. Owing to lack of transportation, development of the interior coal deposits is retarded.

#### PERU

The Cerro de Pasco company during 1910 increased its output largely. The re-

ported shipments to the United States for 10 months were 32,000,000 lb. of copper as against 22,000,000 for the same period of 1909. The production for October at La Fundicion plant of this company is reported from Peru at 4,926,217 lb. of copper bullion.

The Huancavelica copper mines are under option to an American syndicate and were examined recently by Frank Klepetko. It is expected that development will be undertaken on a large scale.

The Ferrobamba, a newly discussed copper deposit, is under option to A. C. Burrage, of Boston, until June, 1911.

British and French capital organized the Aporoma Goldfields, Ltd., to operate at Aporoma in the Province of Sandia, department of Piura, 155 miles from Tirapata on the Southern Railway of Peru and 365 miles from the port of Mollendo. It is a placer deposit and is described as being the bed of a former river now elevated by geologic forces. The gold is fine and is reported to run 40c. to the cu.yd. Hydraulic mining will be practised. G. Allen Crane, London, is engineer and manager. Production is expected within 18 months.

The only other large placer operation in Peru is the Poto controlled by Argentine capital.

A sulphur property in the department of Piura is reported to be yielding 150 tons daily.

Coal of good grade was developed recently in the Chimbote and Huarez districts. Oilfields in several districts are producing. Recently oil was found near Lake Titacaca. The Zoritos wells are reported to yield 15,000 tons of oil per annum.

#### VENEZUELA

The most important mineral product of Venezuela, asphalt, is controlled by an American company. Troubles over the concessions were adjusted in 1910 following the change of the control of the Government. The iron deposits on the Orinoco river were under negotiation, but owing to complications with the Government, they are yet unworked. Gold mines in the south of the country were investigated by American engineers and also the magnesite deposits on the island of Margarita.

# The Mining Industry in Chile

By H. K. Masters\*

The exports of Chile to the extent of 86.1 per cent. are mineral products, 72.62 per cent. being nitrate of soda. Export duties, which in 1909 amounted to 62.71 per cent. of the total customs receipts, and paid 39.64 per cent. of the annual "budget," are collected on exports of nitrate, iodine and bar silver, containing less than 50 per cent. silver. Nitrate pays an export duty of \$1.23 per 100 kg. Iodine pays 46 cents per kg. Since 1908 bar silver, less than 500 fine, pays 40 per cent. of its value as export duty. This measure was adopted to prevent the purchase and export of the silver coin in circulation in the country at such times as the depreciation of the paper money made this business profitable.

The government is friendly to mining and the mining code in force since 1888 is liberal.

#### GENERAL MINING STATISTICS

Gold and silver have long ceased to be of importance in Chilean mining and whereas the average annual production of gold in the decade from 1801 to 1810 was 100,000 oz., the maximum annual production during the last decade was only 61,322 oz. in 1907, nearly 80 per cent. of which was contained in copper ores. The maximum reported produc-

tion of silver was 7,080,000 oz. in 1887, which had fallen to 1,425,000 oz. in 1909, of which 62 per cent. was contained in copper ores.

The maximum reported production of copper, in the year 1876, was 52,308 metric tons, which had fallen to 25,829 in 1906, in spite of the high price of the metal for that year. It rose again to 42,096 tons in 1908 and 42,726 in 1909. This increase was due entirely to the Collahuasi district, which has been developed during the last five years, and shipments from which in 1909 amounted to 48,065 metric tons of 27 per cent. copper ore. Practically the entire production of this district came from two companies, La Poderosa and La Grande. The shipments of bar copper from Chile average about 20,000 tons annually, of which amount the two smelteries at Guaycan and Lota contribute over 60 per cent. in the well known form of "Chile bars."

Manganese ores were exported to the amount of 51,682 tons in 1907, but the price does not permit profitable working in Chile at present.

The total value of the metals produced in Chile to the end of the year 1907, as given by the *Estadística Minera de Chile*, from which all the figures in this article were taken, amounted to \$1,173,247,886. In 1909 the value of the metallic products was \$10,433,560. The

total value of the mineral production of Chile up to the end of 1907 is estimated at approximately \$2,500,000,000. The maximum yearly production was reached in 1907 with \$104,236,000. From 1903 to 1909 there has been an average yearly increase in the value of Chile's mineral products of approximately \$5,000,000. The production of Chile's mines amounts to 43.3 per cent. of the total value of her mineral, agricultural and manufactured products.

#### COAL AND IRON

Coal was first produced in Chile in 1840 and the total production up to the end of 1907 was 24,787,767 tons, valued at approximately \$100,000,000. The production reached a maximum in 1908 of 939,836 tons, valued at \$4,784,620. The total consumption of the republic in 1908 reached the figure of 2,631,731 tons, so that the imports of coal from Australia and England amounted to over 1,600,000 tons in that year. Of the total amount consumed 39 per cent. is taken by the mining industry.

Iron has never been produced in Chile until the year 1910, when a French syndicate, which holds valuable concessions from the Government, completed a blast furnace at Corral, a port in southern Chile near the city of Valdivia, to make pig iron, using green wood as fuel, by the Prudhomme process. The iron ore

\*Mining engineer, 609 Scott building, Salt Lake City, Utah.



and limestone for this furnace will be brought from the provinces of Coquimbo and Atacama in vessels owned by the syndicate, which commenced operations at the furnace in March, 1910.

#### CHILEAN NITRATE INDUSTRY

The nitrate industry is the greatest of all the industries in Chile and the present annual production is over 2,000,000 tons, valued at approximately \$75,000,000. From 1878 to 1907 the total value of the nitrate output was approximately \$1,000,000,000. Iodine, which is produced as a by-product of the nitrate industry, was exported to the maximum quantity of 564 metric tons in 1905, valued at \$2,564,630. Exports of nitrate in 1909 amounted to 2,133,970 tons, of which the United Kingdom took 32.8 per cent., Germany 26.9 per cent. and the United States 21.5 per cent., the remainder going principally to France, Holland and Belgium in the order named. The two northern provinces of Tarapaca and Antofagasta divide the exports about equally.

Since 1903 stocks of nitrate are reported to have increased at an average rate of 5 per cent. yearly. In 1909 the world's consumption is reported at 2,046,230 tons and the average English price for 112 lb. of 95 per cent. nitrate was 8s. 6½d. The *Estadística Minera de Chile* estimates the nitrate deposits still remaining at 340,000,000 tons, equal to 136 years' supply taking 2,500,000 tons yearly as the world's requirements. There are 30,000 men employed in the nitrate industry whose average wage is about 5s. 6d. The capital invested is English, German and Chilean.

#### THE COPPER INDUSTRY

The copper industry employs 15,000 men, who work 280 days in a year for an average wage of about 80c. per day. In 1909 there were 500,532 tons of 9.22 per cent. copper ore, containing 46,135 tons of fine copper. Exports of ore were 15.53 per cent. of the total tonnage, containing 40.59 per cent. of the copper produced. To produce these 500,000 tons of ore over 800 so called mines reported operations, giving an average per mine of 625 tons, or only two tons per day. Three-fifths of the total tonnage comes from 75 mines which report a production of over 500 tons yearly, so that the other 725 reporting mines produce only 258 tons per year or less than one ton daily. An inspection of these figures gives one a fairly good idea of the condition of this industry. Properly speaking there is no well organized mining industry in Chile, except the nitrate industry. The metalliferous mines of the country are largely in the hands either of poor *mineros* without capital to exploit their properties, and who, by the hardest kind of hand labor, manage to mine a few *quintales* of ore

daily, or of men whose income is derived from some other business—who may be either professional men or merchants—and who employ miners to work their "mines" when the price of the metal produced permits them to do this at a profit.

Most of the ore produced must be transported to the nearest smeltery or railroad on the backs of pack animals and this is very expensive. In years of insufficient rainfall forage for these animals is very scarce and in some cases freighters cannot be found, even though excessively high freights are offered. The railways owned by the government have cheap freight tariffs and no complaint can be made by the ore producer on this score.

When ore must be transported over railways owned by private individuals, as is largely the case in the northern provinces, there has sometimes been just cause for complaint. On the whole, however, transportation difficulties are no greater in Chile to-day than were those encountered and successfully and swiftly overcome in the early days of mining in western United States, though it may be unreasonable to expect that the obstacles that do exist in Chile today will be overcome as quickly.

The construction of the "Longitudinal" railway by the Chilean government, which will connect the southern provinces with those of the north, will mean much to the mining industry. This work is being actively carried forward at present in the provinces of Aconcagua and Coquimbo.

#### OPERATIONS IN 1910

No new mining enterprises of importance were undertaken in Chile during the year 1910, but existing companies maintained more or less their usual output. The Braden Copper Company, in the province of O'Higgins, reports 7,500,000 tons of 2.93 per cent. copper ore developed and is constructing a concentrator to treat this ore on a large scale. This is a Guggenheim property. The important *Compañía Poderosa* of Collahuasi, with mines situated 15,000 feet above sea level, close to the Bolivian boundary, in the province of Tarapaca, will show a diminished output for 1910 and is reported as unable to make a profit on the present price of copper, even though its shipping ores contain over 20 per cent. copper. This company is owned in England, though there are quite a number of Chilean shareholders.

Boston capitalists are financing a thorough prospecting of the deposits of oxidized copper ore in the province of Coquimbo at Almendral. Leaching on a small scale is carried on there, but no information has been given out as to the results of the exploratory work. The Central Chili Copper Company of London is maintaining its usual output from its mines and smeltery at Panulcillo, in

the province of Coquimbo, and is developing ore in its Ascension mine of better grade than the average. This company ships matte to the Nichols Copper Company of New York.

#### CALDERA AGAIN SHIPPING MATTE

The Caldera smeltery, owned by the Edwards estate, has never been the success that was anticipated and its converters were not operated during 1910. A contract was made with Lota and Guayacan for refining the matte. This was practically forced upon the Caldera plant by the necessity of preventing competition in ore buying by Lota and Guayacan in the Copiapó district. Caldera has never been able to get enough ore to keep the smeltery running at over half-capacity. The French company which owns mines and smeltery at Naltagua, in the province of Santiago, had some difficulty in getting a sufficient ore supply for its furnaces and its plant was evidently erected far in advance of the development of its mines.

The leaching plant built by the *Sociedad Chilena de Fundiciones*, the largest producer of bar copper in Chile, at Guayacan, was operated during 1910, but results were far from satisfactory.

The total tonnage of ore treated in Chile in 1909 was 422,782 tons, containing 6.48 per cent. copper. The figures for 1910 will not vary greatly from those of 1909. About 90 per cent. of the ores are now smelted in blast furnaces as against only 55 per cent. in 1903, and 31.5 per cent. of the bar copper produced is converter copper, compared with 10 per cent. in 1903. In the latter year only three smelteries were equipped with converters. There are now ten plants so equipped. There are 30 smelteries in operation in Chile, only two of which, Panucillo and Catému, treat over 40,000 tons of ore yearly. Fourteen treat less than 5000 tons.

#### LABOR CONDITIONS

Labor has been more or less equal to the demand during the last few years, though the North continually draws men from the central provinces, such as Coquimbo, thus creating a scarcity of labor in certain sections. With the tendency to lower wages in the nitrate fields, due to the low price of nitrate and to the rising "exchange" of the Chile paper "peso," and the growing knowledge in the South of the hardships of life on the *pampa*, this migration of the workmen from the central provinces to the North will gradually diminish. Strikes are rare in Chile, principally because the Chilean workman is exceedingly improvident and unable to sustain any struggle with his employer. He is a very independent laborer and almost impossible to drive. He is, however, susceptible to flattery and can be coaxed. Physically he is a splendid animal.

# Ontario Mineral Production in 1910

By Thomas W. Gibson \*

The aggregate value of the minerals produced in Ontario in 1910 was about \$30,000,000, being much the largest on record, and exceeding that for 1909 by at least \$3,000,000. Silver, pig iron, nickel and copper are the chief metallic products and all four show large increases. The output of non-metallic substances remained on the whole about the same.

## SILVER

The chief, practically the sole, producer of silver is Cobalt, the mines of which have been steadily worked. Developments during 1910 include the introduction and general adoption of water power for operating the mines, and the extension of concentration processes for low-grade ores. Both compressed air and electrical energy are supplied from Ragged chute and Hound chute on the Montreal river and from the falls of the Metabichouan at Bass lake, with decided advantage to the mines the cost of power being reduced from \$125 or \$150 to \$50 per horse power per annum. Eleven of the mines are now equipped with concentration plants, as against seven last year.

The output of fine silver for the nine months ended September 30, 1910, was 19,791,033 oz., and the probable yield for the year will be about 27,000,000 oz., an increase of about 1,000,000 oz. over 1909. Including 1910, the production of silver from the opening of the mines in 1904 has been over 90,000,000 oz. The principal producers are Nipissing, Crown Reserve, Kerr Lake, Temiskaming, La Rose, McKinley-Darragh-Savage, Buffalo, Coniagas, O'Brien, Trethewey and Hudson Bay. The original Cobalt area remains wonderfully productive and has not been equaled by any of the newer camps. Of the latter, Gowganda and South Lorrain are proving to contain promising deposits, such as Millerett and Miller Lake-O'Brien in the former, and Wettlaufer in the latter.

Shipments from Cobalt mines for 1910 will aggregate about 33,000 tons as against 30,677 tons in 1909. The proportion of concentrates is much larger, say 6000 tons as against 2948 tons in 1909. The average silver contents of the ore shipments during the first nine months of 1910 was 767 oz. per ton, and of the concentrates 990 oz. In 1908 the ore shipments averaged 736 oz., and in 1909, 809 oz. per ton. Most of the high-grade ores and much of the concentrates are now refined into merchant-

\*Deputy minister of mines, Provincial Government, Ontario.

able bars at the Copper Cliff, Deloro and Thorold smelters in Ontario. A good deal of the low-grade material goes to Denver, Colo., Perth Amboy, N. J., and other United States smelting points.

## NICKEL

The Sudbury nickel-copper mines maintained their supremacy during 1910, and in fact improved their position. The output during the first nine months was 13,905 tons of nickel as against 13,907 tons for the whole of 1909. For the calendar year 1910 the yield was probably 18,000 tons, nearly twice the production of five years ago. The furnace product is a bessemer matte containing, say, 80 per cent. of nickel and copper, which is sent to the United States and England for refining and separation of the metals. The larger proportion of the product is made by the Canadian Copper Company, whose principal working mines are the Creighton and Crean Hill; the remainder is from the works of the Mond Nickel Company, which is now operating the Victoria and Garson mines. The extensive smeltery of the former is at Copper Cliff, and is in every way a modern and efficient plant; the Mond Nickel Company's furnaces are at Victoria Mines, but a removal is contemplated to a point farther east more conveniently situated as regards the Garson deposit. Both companies now operate their mines and works by electrical power generated by the Canadian Copper Company from the Spanish river, and by the Mond Company from the Vermilion river. The Dominion Nickel-Copper Company, formed a few years ago, to exploit orebodies on the northern nickel range, has not yet begun actual mining operations. It has been constructing a spur line into the mines from the Canadian Northern railway. The nickel contents of the ores of the Cobalt silver mines are inconsiderable compared with those of the Sudbury ores, and are really a negligible quantity.

## COPPER

Most of the copper is found associated with nickel in the ores of Sudbury, and forms a constituent of the matte produced in the furnaces of the nickel companies. The output for the first nine months of 1910 amounted to 7168 tons, at which rate the product for the year would be, say, 9500 tons. For 1909 the production was 7933 tons. The non-nickeliferous copper sulphides of the north shore of Lake Huron and elsewhere do not yet contribute largely to the output.

## GOLD

The recent discoveries in the Porcupine area, which lies about 100 miles northwest of Cobalt, proved sufficiently substantial to warrant a considerable amount of development work. Fortunately, the leading properties fell into the hands of men capable of thoroughly testing them without calling on the public to subscribe. The Timmins, Dome and Foster claims are being vigorously exploited, and later finds similar in character are also undergoing development. Small stamp mills have been at work during the past summer on the Timmins and Dome properties, and will be replaced by larger plants, now that the winter roads permit of machinery being taken in from the railway. The surface showing of gold at some points was extraordinary, and the feeling in the camp itself has never been other than optimistic.

The Ontario government has announced that it will build a branch line into the camp from the Temiskaming & Northern Ontario railway. The point of departure will probably be near Kelso station, the distance from which to Porcupine is about 30 miles. The actual output of gold for the year, mostly from Porcupine, will be about 2000 oz. The gold occurs in quartz veins found both in Keewatin and Huronian rocks, also in veins of ferruginous carbonate cut by numerous quartz stringers.

## IRON

Helen mine, Moose Mountain, Atikokan and Bessemer (Hastings county) mines produced 121,488 tons of iron ore during the first nine months. The total yield for 1910 will probably be less than in 1909; pig iron to the extent of 319,698 tons was produced up to the end of September, 1909. The total output for 1910 was probably about 425,000 tons.

## COBALT

The cobalt constituents of the silver ores from Cobalt camp have by their abundance demoralized the market for cobalt oxide, which is now down to 80c. per lb., with prospects for a further fall. The Canadian refineries are beginning to offer oxide for sale, and also shipping mixed oxides of cobalt and nickel for final treatment abroad. New uses may be found for cobalt; one of these is in making an alloy with chromium for fine cutlery, which is claimed to be non-corrodible. Meantime other sources of cobalt supply, notably the deposits of New Caledonia, have practically ceased production.



PETROLEUM AND NATURAL GAS

The decline in production noticeable for a number of years past continued. In 1900 the yield was about 34,000,000 Imperial gal., in 1905, 22,000,000 gal., and in 1910 it will probably not exceed 11,000,000 gal.—a decrease from 1909 of about 3¼ million gal. Tilbury field has fallen off markedly, and the older districts of Petrolea and Oil Springs are likewise diminishing in yield. The industry has the stimulus of a Dominion government bounty of 1½c. per gal. of crude product, yet the refining trade has now to depend for the greater part of its requirements upon imported crude.

On the other hand, the yield of natural

gas is increasing yearly. From the counties of Welland, Haldimand, Norfolk, Essex and Kent on the north shore of Lake Erie, a supply is obtained which is piped to the cities and towns of the southwestern peninsula. The output in 1909 was estimated to have a value at the wells of \$1,188,179, and that for 1910 will probably shown an increase. The gas-bearing territory was proved to extend under Lake Erie, and wells drilled in shallow water off the shore in certain localities have yielded freely.

MINOR PRODUCTS

Arsenic may be classed among the non-metals, since it comes into the arts chiefly in the form of arsenious acid or

white arsenic. Ontario is rich in arsenical ores, and from the mines of Cobalt a large quantity of white arsenic is yearly obtained by the smelteries during the process of recovering the silver. The output in 1909 was 1085 tons valued at \$61,039 and for 1910 the quantity was not less. In addition, a considerable quantity was exported as ore and in the speiss produced by the refineries.

Iron pyrites, corundum, feldspar, graphite, mica, quartz, salt, talc, clay products, cement, building and crushed stone, lime, calcium carbide and fluorspar were all produced and testify to the variety of minerals Ontario contains. Some of these afford the basis for industries of more than local importance.

# Mining in British Columbia In 1910

By E. Jacobs \*

An estimate of the mineral production of British Columbia in 1910 gives a net increase in value of \$1,550,665, as shown in the accompanying table. It will be seen, though, that this was chiefly due to a substantial increase in coal, for with the exception of gold and a small addition to the 1909 total for silver, there was a decrease in the other minerals, these including lead, copper, zinc and coke. In the case of copper, though, the opinion may be expressed

cent. from the lead. Only 85 per cent. of the value of the spelter in the zinc concentrate was allowed. The prices used were: For placer gold, \$20 per oz.; lode gold, \$20.67 per oz.; silver, 51.3 per oz.; lead, 4 cents per lb.; copper, 12.75 cents per lb.; zinc, 4.6 cents per lb. Coal is taken at \$3.50 per long ton and coke at \$6, these being regarded as fair average prices for British Columbia. Taking the several minerals in order, the following comment is submitted:

Similkameen, and the remainder came in large part from mines in Sheep Creek camp, Nelson mining division; and in smaller degree from Rossland mines. The British Columbia Copper Company's Wellington group—a new producer—also made an appreciably large addition to the 1910 lode-gold production. There were not any decreases worth mentioning, the various mining divisions well maintaining their gold output. The outlook is favorable for a further increase in 1911.

ESTIMATED MINERAL PRODUCTION OF BRITISH COLUMBIA FOR 1910.

Gold placer .....	24,100 oz.	\$482,000	I.	\$5,000
Gold, lode .....	257,000 oz.	5,312,190	I.	388,100
<b>Total gold .....</b>	<b>281,100 oz.</b>	<b>\$5,794,190</b>	<b>I.</b>	<b>\$393,100</b>
Silver .....	2,500,000 oz.	1,282,500	I.	43,230
Lead .....	37,000 000 lb.	1,480,000	D.	229,259
Copper .....	39,003,000 lb.	4,972,500	D.	946,022
Zinc .....	4,000,000 lb.	184,000	D.	216,000
<b>Total metalliferous .....</b>		<b>\$13,713,190</b>	<b>D.</b>	<b>\$954,951</b>
Coal, tons, 2240 lb. ....	2,799,000	9,796,500	I.	2,773,834
Coke, tons, 2240 lb. ....	214,000	1,284,000	D.	268,218
Building materials, etc. ....		1,200,000		
<b>Total mineral production .....</b>		<b>\$25,993,690</b>	<b>I.</b>	<b>\$1,550,665</b>

that the decrease was more apparent than real, for there appears to be ground for concluding that the 1909 copper returns supplied to the department of mines in one or two important instances gave the assay value of the ore rather than the quantity of copper actually recovered at the smeltery. For 1910, it is believed the figures used in the estimate presented herewith show the copper recovered.

In calculating values in the table, the JOURNAL'S average prices of metals for eleven months, to December 1, were taken, but following the official custom in the province, deductions were made of 5 per cent. from the silver and 10 per

SLIGHT GAIN IN GOLD PRODUCTION

Placer-gold mining in 1910 showed a small net increase. The season was not favorable for hydraulicking operations in Cariboo district, as a shortage of water prevented cleaning up at several of the larger mines; consequently only 10,000 oz. was recovered, as against 12,350 in 1909. Several small losses brought the total decrease up to 2750 oz. Against this, however, Atlin, in Cassiar district, made a gain of 3000 oz., so that there was a net increase of 250 oz., or \$5000, in the whole province.

In lode gold, the gain was 18,776 oz. Approximately one-half of this was made by the Hedley Gold Mining Company, operating the Nickel Plate mines, in the

SILVER

The quantity of silver produced in 1910 was practically the same as in 1909. There were decreases in East and west Kootenay, chiefly in Ainsworth mining division, of the latter district, but these were compensated for by corresponding increases in the Slocan and Coast districts. Between 500,000 and 600,000 oz. of silver was recovered from copper-gold ores by smelteries; the greater part of the remainder came from galena ores. The recovery of silver at the Consolidated Mining and Smelting Company's lead and copper reduction works at Trail was about 2,000,000 oz., or four-fifths of the total of the province. For the first time, a Portland Canal mine contributed to the year's production.

COPPER

Compared with the 1909 official figures, production in 1910 was less by about 6,600,000 lb. A reason for much of this seeming loss has already been given. The proportions of production by districts were: Boundary, 31,500,000 lb.; Rossland, 3,600,000 lb.; Coast, 3,200,000 lb.; and the remainder from other parts. The Granby company's output was re-

\*Victoria, B. C.

duced, following a destructive fire at the mines which interfered with ore shipping and necessitated blowing out several furnaces at the smeltery until fresh arrangements could be made for resuming the normal output. The British Columbia Copper Company made a gain of about a million pounds. Both the Consolidated company, at Trail, and the Tye Copper Company, on Vancouver island, also made increases in production of this metal<sup>1</sup>.

#### LEAD AND ZINC PRODUCTION DECLINED

The decrease in lead output was about 7,000,000 lb. The St. Eugene mine, East Kootenay, was 8,500,000 lb. short of its 1909 production; but against this loss the Sullivan, in the same district, formerly idle, produced approximately that quantity. In Ainsworth division two of the larger mines were together 7,500,000 lb. short, in one case owing to the destruction of a concentrating mill by fire and the consequent loss of the greater part of the season's production. There were several gains in the Slocan, at the Richmond-Eureka, Van Roi and Standard, notably at the last with an in-

<sup>1</sup>Our own statistics of copper production in British Columbia, based upon reports from all of the smelters, fall short of what Mr. Jacobs estimates.—EDITOR.

crease over 1909 of about 1,500,000 lb. Summer fires cut down the production of silver, lead and zinc at several important Slocan and Ainsworth division mines, destroying surface works at the mines and bridges and trestles along six or seven miles of railway, thereby practically stopping production for six months.

The production of zinc was seriously checked by the forest fires already mentioned. The Whitewater mill, up to last July, produced much zinc concentrate, and in 1909 the Lucky Jim mine shipped 5000 tons of crude ore averaging about 45 per cent. spelter. The latter mine was within a week of being ready to ship on a larger scale than formerly, when the destruction of the railway took away its transportation facilities. Shipments will be resumed next year. The Ruth mill, Sandon, Slocan, produced 450 tons of zinc concentrates. The Van Roi produced until Aug. 1, 1910, when its lease of a concentrating mill expired; it is now building its own mill.

#### GENERAL PROGRESS

In Cariboo, the producing capacity of John Hopp's hydraulic mines was considerably increased, and the Quesnelle Hydraulic Gold Mining Company made

much progress with construction of its 17-mile ditch and flue. In Atlin, a small but rich gold-quartz mine was opened. In East Kootenay, the Consolidated Company put in an ore-testing plant at the St. Eugene and reopened the Sullivan lead mine while the provincial government established a mine-rescue station at Hosmer. In Slocan, the Van Roi Mining Company made progress with building a concentrator, and at the Standard a big shoot of galena ore was developed. At Rossland, another valuable shoot of gold ore was found in the War Eagle, and the Le Roi No. 2 Company opened an orebody on the 1300-ft. level. In the Boundary, the British Columbia Copper Company commenced shipping gold ore from its Wellington group mine, and increased the blast-furnace capacity of its smeltery 50 per cent. In Similkameen, the Hedley Gold Mining Company put in larger power plant and added fine-grinding and more gold-saving appliances at its 40-stamp mill. On Vancouver island, the Tye Copper Company increased its custom-ore smelting business, while the Canadian Collieries (Dunsmuir), Ltd., made important additions to its plant. The Portland Canal Mining Company built and equipped a concentrator and commenced production at its mine.

# Mining in The Transvaal in 1910

By Hugh F. Marriott \*

The estimated results from the gold mines of the Witwatersrand for the year 1910 show an increase over those of 1909 of roughly 1,000,000 in the tonnage milled and £875,000 in yield, while, for the outside districts of the Transvaal the increase amounts to £275,000 in yield, equal to 27 per cent. of the 1909 output. The grade of ore milled corresponds closely with that of 1909 at 28.5s per ton.

The only new producer for the year was the Bantjes, which recommenced crushing operations in August after a lapse of over 20 years. One remarkable feature of the official returns issued by the Transvaal Chamber of Mines was that on the Witwatersrand the number of companies operating in September was 59 as compared with 68 during 1909. This reduction in number was the result of the policy of amalgamation so freely adopted during the last few years. Among the mines which, for this reason, no longer make separate returns are Crown Reef, Langlaagte Deep and Robinson Central Deep, all of which went into the Crown Mines; the Geldenhuis

Estate and Jumpers Deep amalgamated with the Geldenhuis Deep; and the North Randfontein, Robinson Randfontein, South Randfontein and Porges Randfontein were absorbed by the Randfontein South company.

#### STAMP DUTY INCREASED

The number of stamps running during September, 1910, was 9150 as compared with 9158 in 1909, but the duty per stamp per 24 hours increased from 6.79 tons, which was the average for 1909,

TABLE I. TRANSVAAL GOLD PRODUCTION.

Year.	WITWATERSRAND DISTRICT.			OUTSIDE MINES. Value.	Total Value for Transvaal.
	Tons Milled.	Value.	Value per Ton Milled, Shillings.		
1884-09	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	18,196,589	28,810,393	31.6	1,147,217	29,957,610
1909	20,543,759	29,900,359	29.1	1,025,429	30,925,788
1910*	21,500,000	30,775,000	28.5	1,300,000	32,075,000

\*Mining engineer, London Wall building, London, E. C., England.

\*Estimated.



to 7.40 tons, in September, 1910. This increase in duty was largely brought about by the greater use of tube mills, there being now 181 at work as compared with 134 in 1909. Various discussions and tests were conducted during the year with the object of determining what is the proper economic ratio of tube mills to stamps. On the first introduction of tube mills it was generally accepted that the proper ratio was in the neighborhood of one tube mill for every 50 or 60 stamps, while with new installations at present one tube mill is generally installed for every 20 stamps or so; for instance, the City Deep plant consists of 200 stamps and nine tube mills. On the East Rand Proprietary Mines two batteries of 40 stamps were for some time operated as an experiment in conjunction with eight tube mills, or one tube mill for every 10 stamps, and a duty of 23 tons per stamp per day was obtained, with screens of large mesh. Another factor in the improvement in stamp duty is the fact that the weight of stamps used in new plants is much greater than formerly. Only a

agitator for cyanide treatment. In addition, great attention was paid to such matters as screening, mortar-box classifiers, and amalgam traps. In fact, it can be said that the management and direction staffs on the Rand are constantly endeavoring to improve their methods

TABLE III. STAMP DUTY IN TONS PER DAY AT RAND MINES.

1902	4.85	1907	5.60
1903	4.91	1908	6.27
1904	4.90	1909	6.79
1905	5.05	1910	7.11*
1906	5.34		

\*Average for nine months ended 30th September, 1910.

and are always willing to give any new process or device a fair trial.

STOPE DRILLS

During the year the award was made in connection with the competition for small stope drills, promoted by the Transvaal Government, in conjunction with the Chamber of Mines; they offered prizes amounting to £5000 for the best

of hand-drilling, which is about 1s. 1d. per foot. It was decided by the judges to divide the two prizes equally between the Holman 2 1/8-in. drill and the Siskol, the former of which drilled 12,779 ft. in the 215 shifts and the latter 14,083 ft.; the Siskol cost slightly more than the Holman per foot drilled. The official statement read by Mr. Francke representing the Chamber of Mines, expressed the view that probably a machine weighing about 130 lb. would be more economical than one of 100 lb. weight. There is no doubt that this competition gave a great impetus to the use of small machine drills, and large numbers of them are now employed on the mines of the Rand.

APPROACHING ADDITIONS TO PRODUCTION

During 1910, several large companies rapidly approached the crushing stage, the most notable being the following:

TABLE IV. LABOR EMPLOYED IN TRANSVAAL GOLD MINES.

(MINES DEPARTMENT STATISTICS.)

Year	Month	Total Colored and Chinese.		
		White.	Colored.	ese.
1902	July	8,162	32,616	32,616
	Dec	10,292	45,698	45,698
1903	June	11,825	66,221	66,221
	Dec	12,695	73,558	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
	Dec	19,605	164,826	12,275
1909	June	21,620	175,895	7,317
	Dec	23,077	168,665	2,038
1910	June	24,794	201,770	201,770
	Dec			

TABLE II. YIELD, COSTS, PROFITS AND DIVIDENDS OF WITWATERSRAND MINES.

Year.	Tons Milled.	YIELD.		COSTS.		PROFITS.		Dividends, £
		£	P.T. s. d.	£	P.T. s. d.	£	P.T. s. d.	
1902	3,416,813	7,179,074	42 -	4,371,000	25 7	2,805,000	16 5	2,148,715
1903	6,105,016	12,146,307	39 9	7,555,000	24 9	4,579,000	15 -	3,345,499
1904	8,058,298	15,520,329	38 7	9,790,000	24 4	5,740,000	14 3	3,877,623
1905	11,160,422	19,991,658	35 10	13,019,000	23 4	6,972,000	12 6	4,853,117
1906	13,571,554	23,615,400	34 11	15,100,000	22 4	8,515,000	12 7	5,565,972
1907	15,523,229	26,421,837	34 -	16,440,000	21 2	9,980,000	12 10	6,962,416
1908	18,196,589	28,810,393	31 8	16,799,166	18 6	12,011,227	13 2	8,570,103
1909	20,543,759	29,900,359	29 1	18,105,983	17 7	11,794,376	11 6	9,305,899
1910†	21,500,000	30,775,000	28 7	19,575,000	18 2	11,200,000	10 5	4,351,471*

\* For six months ended 30th June, 1910. † Estimated.

few years ago the erection of a mill with stamps of 1000 lb. weight was considered to mark a great era of progress; of new mills the Randfontein Central stamps weigh 1650 lb., the West Rand Central Deep 1760 lb., and the City Deep 2000 lb. Table III shows the average duty per stamp per diem from 1902 to 1910.

METALLURGICAL PRACTICE

Much thought was devoted during 1910 to the improvement of metallurgical practice on the Rand, and numerous experiments were made. Among other new devices and processes the following may be mentioned: The Caldecott system of continuous collection and separation of sand, in operation at the East Rand Proprietary Mines and the Simmer & Jack; the Arbutle process for treating slimes and sands, a feature of which is a large cone for thickening the pulp before treatment; the Ridgway filter; the Butters filter, which has been eminently successful at the Crown Mines and elsewhere; the Merrill patent zinc-dust precipitation press, which is receiving a trial at the Village Deep; and Brown's air

drills and £600 for their operators. The prizes for the drills were two in number, £4000 and £1000. The weight of the machines was limited to 100 lb., and there were 19 competitors. The tests lasted nearly a year, and a great deal of experience was gained as a result. Machines of the reciprocating type gained both the first and second prizes, the hammer type of machine not showing up so well. Several of the machines which entered the competition had minor defects which were capable of correction, but no alteration was allowed during the competition.

Preliminary trials were held on the surface, and nine out of the 19 machines were eliminated, leaving 10 to compete underground. The prizes were awarded on the work done in five stopes on three mines, 43 shifts being worked by each drill in each stope, or 215 shifts in all for each machine. Accurate statistics were compiled as to the cost of compressed air, stores, spares, and the depreciation of the machines. The cost per foot drilled for the winning machines was slightly under 10d., this compares very favorably with the cost

The City Deep, which commenced crushing about the middle of December, 1910, with a milling capacity of 65,000 tons per month; the Randfontein Central, with a capacity of 160,000 tons per month; Brakpan with 60,000 tons per month; and Modder B, with 26,000 tons per month; the last three of these are expected to commence crushing operations during 1911.

These additions amount to a total of 3,700,000 tons per annum, and, besides these, at least eight mines have considerable increases in plant in contemplation or in course of erection, while other properties in the earlier stages of development will have to be reckoned with in the course of the next few years. It is apparent, therefore, that the output of gold from the Transvaal may be expected to continue increasing for some time to come.

The question of native labor is intimately associated with that of expansion, and unremitting efforts have been made to increase the supply and to make it more efficient. It is a matter for regret that, owing to the increasing demand for native labor, the various groups con-

trolling the mines on the Rand have been to a great extent recruiting with competing organizations during the year under review. The tendency of this competition is to increase unduly the cost of recruiting and the scale of wages; within the last month or two, however, an arrangement has been made fixing a maximum allowance to recruiters per native, and it is hoped that this arrangement will have a beneficial effect. The following table shows the labor employed in Transvaal gold mines at corresponding periods for every year since 1902.

It will be seen that, notwithstanding the complete withdrawal of the Chinese, the total unskilled labor force was

respect favorably with those of any other part of the world, yet it is believed that conditions can be improved, and that improvement in this respect will lead to higher efficiency. On the Village Deep a large Sirocco fan was erected, 2000 ft. below the surface, with great benefit to the air in the mine, while at the Cinderella Deep a Capell fan is employed at a depth of about 4000 ft. On other mines thorough investigations were made by expert advisers, and schemes adopted for complete systems of ventilation through the whole of the workings.

It is a matter for some congratulation that the grade of ore milled, which has decreased year by year since 1901, re-

which had for its objectives the adoption of profits as the criterion of good mining, and elimination of arbitrary comparisons between the working costs of one mine with those of another whose conditions were in all probability very different.

The scheme, in essence, is to replace the cubical unit of the ton milled by a superficial unit of the amount of ground worked out. For convenience, to suit the local custom in keeping mine records, the unit of one square fathom was adhered to. By the adoption of this standard the incentive to increase stopping width no longer has the same strength as under the ton-milled method, seeing that, if the width is unduly in-

TABLE V.—PROPOSED SYSTEM OF REPORTING RETURNS FOR RAND MINES.

Name of Company.....—QUARTERLY RETURNS FOR 1910.

(1.) Average percentage of profitable to total ore based on the working results obtained during 1909. .... (to be utilized in comparing columns 1 and 2). As a general average for the whole mine the limit of payability is governed by column 11 (eleven).

(2.) Estimated value of the gold contents per square fathom of the profitable ore reserves standing developed in the mine at 12/31/09 = £..... (for comparison with column 5).

Quarter Ending.	1			2			3				4		5
	Areas Developed On Plane of Reef in Square Feet.*			Areas Stopped Out On Plane of Reef in Square Feet.†			Resultant Average Stopping Widths by Actual Measurement.				Value of Total Gold Contents of Areas Stopped as Disclosed by Block Assay Plan of Ore Reserves <i>in Situ</i> . £	Average Gold Contents per Square Fathom Stopped. (4 ÷ 2a). £	
	S.R.	M.R.L.	M.R.	1a Total Area in Square Fathoms.			2a Total Area in Square Fathoms.						Total.
March 31.....													
June 30.....													
September 30...													
December 31....													
Totals and averages...													

\* Quarterly note to be added, giving: Distance exposed in feet. Average width of reef in inches. Value per square fathom over average reef width. † Two reefs stopped together are to be considered as one.

Quarter Ending.	6	7	8	9	10	11	12		13
	Value of Total Gold Won. £	Average Amount of Gold Won per Square Fathom. (6 ÷ 2a). £	Percentage of Recovery. (100 × col. 6 ÷ col. 4).	Mine Working Costs per Square Fathom Over Areas Stopped on All Reefs. £	Proportion of Accessory Costs Chargeable Against Annual Profits per Square Fathom.* £	Average Working Costs per Square Fathom. (9 + 10). £	11a		Distributable Profit per Square Fathom Stopped. (12 ÷ 2a). £
							Total Working Costs. (11 × 2a). £	Total Distributable Profit Obtained. (6 — 11a). £	
March 31.....									
June 30.....									
September 30...									
December 31....									
Totals and averages									

\* To include maintenance, profits tax, head office and everything except increase of capacity of plant.

greater in June, 1910, than in any previous year. Efforts are being made by mine managers to improve the conditions of housing and the general welfare of the natives, and in this manner it is hoped to make service on the Rand increasingly popular, and to attract more and more labor to the mines.

VENTILATION

In this connection it is important to mention the steps that have been taken on some of the mines to improve the condition of the air in which the natives have to work, by the installation of proper systems of ventilation. Although it is believed that, generally speaking, the Witwatersrand mines compare in this

mained steady during 1910. During the year mining practice on the Rand was subjected to investigation and criticism both external and internal. It had for some time been growing more and more apparent that the effort to obtain low working costs was in many instances accompanied by too great a reduction in yield, the margin of profit, instead of becoming larger through the diminution of costs, actually becoming smaller. The fact was that low working costs were beginning to be looked upon as the end of all good mining rather than simply a means to the end which good mining should have in view—to secure profits. When I was in Johannesburg in the early part of 1910 I brought forward a scheme

creased, the cost per fathom will rise more than the corresponding improvement in the yield per fathom. I also proposed that returns should be published by the mines quarterly instead of monthly, as it is undeniable that the publication of monthly returns and the necessity for equalizing results month by month act as a drag on economic mining. Subjoined is the form which it was proposed the return should take.

There is not space in the limits of this article to deal fully with the arguments to be adduced to support the adoption of this method. The scheme, which was propounded to a representative meeting of mine directors and managers in Johannesburg, has been widely discussed



and criticized. It has been adopted by the Eckstein and Rand Mines groups for internal use; but it is thought that, for the present at least, it would not be politic to substitute this quarterly statement of results for the monthly returns to which shareholders and the public are accustomed.

GOVERNMENT LEASES

At the beginning of 1910, a departure in mining was inaugurated by the flotation of the Government Gold Mining Areas (Modderfontein) Consolidated, Ltd. This company was formed to work certain ground equivalent to 2633 claims on a partnership arrangement with the Transvaal Government. The mining rights under this ground belonged to the Government, which split up the ground into two areas and invited tenders for the right to work the property. The conditions stipulated that the tenderer for each area should undertake to guarantee £700,000 working capital on the formation of the company to work the area, and a condition of the form of lease from the Government was that the latter should receive a share in the profits made by the company, such share to be calculated on a sliding scale based on the relation of profits to yield.

As a minimum, it was laid down that the Government should receive the proportion of net profits that net profits bore to yield, such proportion to be not less than 10 per cent. of profits and not more than 50 per cent. That is, if the yield were 25s. per ton milled and working costs were 15s. the profit would be 10s. or two-fifths of the yield; the Government would then receive a minimum of two-fifths of 10s. per ton milled. Net profit is taken to be the value of the production after deduction therefrom of the cost of production, and of such sums as may be allowed in respect of the exhaustion of capital. For the purposes of the lease, cost of production and capital have the same meaning as is assigned to them in the Profits Tax Ordinance. In addition, the tenderers were invited to add to their tender a further share of the profit, in the form of a percentage of the amount payable under the sliding scale proportion. The tenders which were accepted were put in by a nominee of Barnato Brothers, who agreed to add to the sliding scale a percentage varying from 7½ to 22½ per cent., the maximum share of profits going to the Government being 61¼ per cent. Other stipulations of the Government were that there should be no vendors' shares in the company to be formed, and that the Transvaal public should be allowed to subscribe for 12½ per cent. of the original capital provided. Messrs. Barnato obtained permission to put the two areas together into one company, which was floated with £1,400,000 capital.

A peculiarity of this sliding-scale basis is to be noted, which is that the better the mining that is done the greater is the proportion of profits which the Government receives, and consequently the less the proportion which accrues to the company. The accompanying table, based on the minimum scale, illustrates this peculiarity.

TABLE VI. SLIDING SCALE BASIS OF OPERATING GOVERNMENT MINING AREAS.

Yield per Ton.	Cost per Ton.	Profit.	Government's Share.	Company's Share.
25s.	20s.	5s.	1s.	4s.
25s.	17s. 6d.	7s. 6d.	2s. 3d.	5s. 3d.
25s.	15s.	10s.	4s.	6s.
25s.	12s. 6d.	12s. 6d.	6s. 3d.	6s. 3d.

With the same yield—25s.—on a reduction in working costs from 20s. to 17s. 6d. the company and the Government share equally in the increase of 2s.6d. in the profit. If the costs are reduced by a further 2s.6d. the Government gets 1s.9d. of the benefit and the company 9d. If the costs are brought down yet another 2s.6d. the Government obtains 2s.3d. while the company gets only the odd 3d. This is on the minimum basis only, and when it is remembered that, in the case of the areas mentioned above, it has been agreed that the Government is to get a further percentage of the profits, it is apparent that beyond a certain point there can be little incentive for the management of the company to strive for any reduction in costs or higher ratio of profits to yield. The Government has other ground to dispose of in the same way, and already tenders have been invited on similar lines for another large area.

SAND FILLING

A notable event during 1910 was the inauguration of the filling of worked-out stopes with sands from dumps and current reduction operations. Some active steps became vitally necessary, as, on several mines, falls of rock and damage to shafts occurred through the insufficient support afforded by pillars. The system of filling up stopes with sand has long been practised in Silesia, and men were brought from the mines there with a thorough knowledge of the system to advise in its adoption on the Rand. Sand filling is now being carried on in a large number of mines with successful results.

REINFORCED CONCRETE

Reinforced concrete for construction works was largely used during the last 12 or 18 months. The work which has been done includes ore bins at the Rand Central and Nourse mines; excavator supports about 35 ft. high and 200 ft. long at the Crown mines, and similar supports at the Nourse mines; tube-mill platforms;

pile blocks; and various buildings at a number of mines, including compounds, transformer houses, stores, change houses, and smelting houses.

NEW GEOLOGICAL MAP

A new geological map of portions of the southern Transvaal and northern Free State was published by Mr. Bleloch, with a treatise which explains Mr. Bleloch's theories of Rand geology and his deductions in regard to the possibility of finding extensions of the Rand series in the neighborhood of the reef series between the Transvaal and the Free State.

PREMIER DIAMOND MINE

The great diamond mine worked by the Premier (Transvaal) Diamond Mining Company, Ltd., has taken its place as one of the foremost of the mining undertakings of the Transvaal. With the exception of the year ended Oct. 31, 1909, work has, year by year, been conducted on an ever-increasing scale, but the yield in carats per load, the value per carat, and the yield in shillings per load have all decreased just as steadily. As a set-off the cost per load has decreased from 4s. 7d. in 1903 to 1s. 11.4d. in 1909. It is not yet possible to give cost figures for 1910. At the annual meeting held in February, 1910, it was stated that it was expected to reach a washing record of 1,000,000 loads per month.

Rhodesia

BY HUGH F. MARRIOTT\*

Gold mining in Rhodesia is practically confined to southern Rhodesia, the returns for which are compiled by the Rhodesia Chamber of Mines; there is only one small gold mine in northern Rhodesia which is productive at the present time.

At the time of writing actual returns are available for only the first nine months of the year 1910, and the figures given for this year in the accompanying table are arrived at by adding to the nine months' yield a corresponding average for the remaining three months. It is more than probable that this estimate will be found to be in excess of results, as the yield for September was rather less than the average for the nine months.

There were about 145 individual producers, of which over two-thirds worked with not more than 5 stamps each, or their equivalent. The output of gold for 1910 will in all probability be rather less than that for 1909, although the yield per ton is 1s. 8d. per ton higher.

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A few years ago the mining industry of southern Rhodesia was in an unsatisfactory state, properties generally speaking being over-capitalized and in some cases over-equipped. The result was that the companies working the mines frequently

table, giving their September production. The largest producer in 1909 was the Globe & Phoenix, which made a working profit of £177,281 from 74,492 tons treated, yielding £280,732. During 1910 a general reorganization of plant was undertaken, which necessitated a curtailment of milling during the first six months of the year and a total cessation during July, August and part of September. The results for the first half of 1910, notwithstanding the lower tonnage and high costs, were remarkable, and the following comparison shows the improvement in value in the last 18 months:

the big amalgamation scheme carried into effect by the Rhodesian Exploration and Development Company, Ltd. This company increased its capital from £450,000 to £2,000,000 and acquired the undertakings of the Rhodesian Banket Company, the Etna Development Company, the Rhodesian-Abercorn-Shamva Trust Company, and the Gold Schists of Rhodesia, Ltd. The enlarged company now has an issued capital of £1,450,000 and its property includes cash and loans against security amounting to roughly £1,600,000; stocks and shares in various companies which had on Sept. 1, 1910, a market value

GOLD PRODUCTION OF SOUTHERN RHODESIA.

	Tons Milled.	Value of Gold Won, £	Value per Ton, s.
Prior to Sept. 1, 1898.....	*	23,456	.....
Sept. 1, 1898 to June 30, 1899..	81,841	177,072	43. 26
July 1, 1899 to June 30, 1900..	104,746	208,877	39. 88
July 1, 1900 to March 31, 1901	140,716	320,457	45. 54
Year ended Mar. 31, 1902.....	249,667	640,661	51. 32
Year ended Mar. 31, 1903.....	338,156	709,461	41. 96
Year ended Mar. 31, 1904.....	516,747	845,359	32. 71
Year ended Mar. 31, 1905.....	787,936	1,113,068	28. 25
Year ended Mar. 31, 1906.....	1,100,609	1,556,741	28. 28
April 1, 1906 to Dec. 31, 1906..	1,051,908	1,531,481	29. 10
Year 1907.....	1,610,875	2,178,886	27. 05
Year 1908.....	1,819,230	2,526,006	27. 77
Year 1909.....	1,807,771	2,623,785	29. 00
Year 1910 (last 3 mos. estimated)	1,700,664	2,524,262	29. 66

\*No details available.

	Tons Crushed.	Yield £	Per Ton.	Costs,		Profit,	
				£	P.T.	£	P.T.
Year 1908.....	75,413	154,555	41s.	98,220	26s.	56,335	15s.
Year 1909.....	74,492	280,733	75s. 4d.	105,028	28s. 2d.	177,281	47s. 2d.
6 months to June 30, 1910.....	23,535	183,058	155s. 7d.	45,980	39s. 1d.	137,078	116s. 6d.

It will be observed that, notwithstanding the high grade of the ore extracted during the six months ended June 30, 1910, the ore reserves at that date were calculated to have a value of 1 dwt. more than those of Dec. 31, 1909.

Next in importance to the Globe &

of £1,400,000; various unquoted shares and interests; about 325,000 acres of land in a good situation and a total of over 3500 mining claims. It is to be observed that a Rhodesian mining claim extends indefinitely on the dip of the reef, so that these 3500 claims are at least equivalent to 35,000 claims in the Transvaal. The directors state their intention to adopt a bold policy of development, and with its great resources this company will no doubt become an enormous factor in the development of mining in Rhodesia.

Reference was made in last year's statistical number to the discovery in the Abercorn district of an auriferous conglomerate. This orebody is of low grade, but of great width. A company called the Shamva Mines, Ltd., has been formed under the control of the Consolidated Goldfields of South Africa and others, with an issued capital of £500,000, to acquire 243 claims in this district. H. A. Piper, consulting engineer to the Consolidated Goldfields, estimated the ore in sight at 527,340 tons assaying 4.85 dwt. He also estimated that a profit of 7s. 6d. per ton would be made when treating 20,000 tons monthly.

The Tanganyika Concessions, Ltd., states that during the year ended June 30, 1910, smelting operations continued on its Kansanshi mine and that there were at June 30, 1500 tons of smelted copper at the mine awaiting shipment.

The Rhodesia Broken Hill Development Company, Ltd., owns large tin- and lead-ore deposits in Northern Rhodesia. The company's engineers estimate that it has 140,000 tons of ore in sight assaying 26.08 per cent. lead and 22.27 per cent. zinc, also 300,000 tons of ore assaying 32 per cent. zinc. The great obstacle to this company's success was the difficulty experienced in finding a satisfactory process for the treatment of the ores. It is now believed that these difficulties have been overcome by the Bradley-Williams process.

SEPTEMBER PRODUCTION OF NINE IMPORTANT RHODESIAN MINES.

	Tons Crushed.	Reduction Plant.	YIELD, SEPT. 1910.	
			Total.	Per Ton.
<i>Bulawayo District:</i> Bucks Reef.....	878	5 stamps.	£6,026	137s. 6d.
<i>Gwelo District:</i> Globe & Phoenix.....	3,454	40 stamps.	9,385	54s. 4d.
Selukwe Columbia.....	2,469	1 Chilean, 2 pans.	5,132	41s. 7d.
Wanderer.....	15,438	4 Gates rolls.	8,532	11s.
<i>Hartley District:</i> Giant Mines.....	8,731	30 stamps and 2 tube mills.	14,362	32s. 11d.
<i>Lomagundi District:</i> Eldorado.....	6,427	20 stamps and 2 Chileans.	15,802	49s. 2d.
<i>Umtali District:</i> Penhalonga.....	6,500	60 stamps.	5,014	15s. 5d.
Rezende.....	3,600	30 stamps.	5,300	29s. 5d.
<i>Mazoe District:</i> Jumbo.....	3,420	30 stamps.	6,295	36s. 10d.

found they were unable to pay their way and ceased working. A large number of the properties were then let on tribute for a period of years, and the tributors have, as a rule, been successful in getting profits. During the last year or two many of the tributing leases expired and the proprietary companies were unwilling to extend the leases. The tributors, knowing that their leases would not be renewed, ceased to do any development and worked out all their best ore, so that when the companies took over the properties they had little in the way of ore reserves and naturally the output fell off considerably. This probably accounts for the diminished output for 1910.

There are nine mines which produced gold at the rate of £5000 per month or over, as shown in the accompanying

Phoenix as a producer is the Eldorado Banket Gold Mining Company. During the year ended March 31, 1910, this company crushed 80,566 tons of ore and won gold of the value of £194,689, equal to £2 8s. 4d. per ton; costs amounted to £1 2s. 6d. per ton, leaving a working profit of £103,863, or £1 5s. 10d. per ton. Profits since March 31 have been maintained at about £8800 per month. This mine has a development of 200,000 tons, valued at 17.95 dwt. per ton.

The Wanderer mine is of particular interest by reason of the fact that it reduces its ore by dry crushing and direct cyaniding.

IMPORTANT AMALGAMATION

One of the prominent events of the year in Rhodesian mining matters was



# Quicksilver in the United States

The production of quicksilver in 1910 showed a small increase, as appears in the following statistics.

State.	1909.	1910.
California .....	16,217	17,000
Texas .....	3,925	3,600
Other States.....	810	900
Totals .....	20,952	21,500

The above figures are for the number of flasks, which now are of 75 lb. each.

## Quicksilver in California in 1910

BY LEWIS H. EDDY\*

The production of quicksilver in California in 1910 exceeded that of 1909, and probably reached 17,000 flasks. San Benito county produced about 10,000 flasks; Santa Clara county about 4000. In Napa and Lake counties the furnaces

new territory and developing the old as would have been expected, but this is due largely to the situation of the numerous serpentine formations in respect to transportation. The cinnabar deposits in California, like the chrome iron, are in most localities situated so far from transportation and fuel that small capital is not readily attracted, and large capital awaits the opportunity of a considerable advantage. The production of 1910 came from the same counties that produced quicksilver in 1909, namely, Colusa, Lake, Napa, San Benito, San Luis Obispo, Santa Clara, Sonoma, and Trinity. In the last named county the Altoona Quicksilver Mining Company leased its property to a number of workmen who operated it for five or six months in the year, and sent out about 200 flasks. Sonoma county probably produced the same as in 1910 or

duction of quicksilver of this country up to the normal, even with the working-out of the older mines.

## The Quicksilver Industry in Texas

BY WILLIAM B. PHILLIPS\*

During 1910 the Chisos Mining Company continued in active operation. This is now the only producing company in Texas. Operations at the mines of the Marfa & Mariposa Mining Company were practically suspended, and nothing has been done by the Texas Almaden, the Big Bend or the Colquitt-Tigner companies for several years.

The production of the Chisos Mining Company for 1910 may be taken at 300 flasks per month, or 3600 flasks for the year. This property is on section 295, block G. 4, and the property comprises the entire section of 640 acres. It is in the bituminous-shale area and the main shaft has by this time penetrated the underlying Buda limestone, the present depth being about 650 ft. The company has an excellent 20-ton Scott furnace, a large and commodious store and a good camp. The bright, highly colored cinnabar that characterized the upper levels has given place to a black, bituminous ore that carries high mercury contents. The reports of trouble from Mexican marauders that were sent out late in the year were entirely baseless. There was no interruption of work from any cause.

The Big Bend company, in section 216, block G. 4, Brewster county, about six miles east of the property of the Chisos company, is putting down some deep bore holes with a view to determining the underground conditions. This company built a 50-ton Scott furnace several years ago to use an ore that carried less than 1 per cent. of metal, but the operations were not successful. The Texas Almaden, adjoining the Big Bend, put down a number of bore holes three years ago and found good ore in depth, but no operations were in progress there during 1910. No further prospecting was carried on in the Terlingua district. Last year the holders of property on and near Christmas mountain made an examination, but nothing was done.

The land commissioner of the State of Texas recently made a trip into that country with a view to formulating some definite policy with respect to the public lands. He is said to be in favor of the

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AVERAGE MONTHLY PRICE OF QUICKSILVER.  
(PER FLASK OF 75 LB.)

	1909.			1910.		
	New York.	San Francisco.		New York.	San Francisco.	
		Domestic.	Export.		Domestic.	Export.
January .....	\$45.50	\$45.30	\$43.30	\$52.20	\$50.90	\$48.90
February .....	45.50	45.50	43.50	50.00	49.50	47.50
March .....	45.50	44.75	42.75	49.25	48.75	46.75
April .....	45.00	44.25	42.25	48.00	47.56	45.56
May .....	44.50	44.00	42.00	47.60	47.15	45.15
June .....	44.50	44.00	42.00	47.00	46.25	44.25
July .....	43.75	43.44	41.44	47.00	46.25	44.25
August .....	43.75	42.95	40.95	46.00	45.88	43.88
September .....	45.00	43.50	41.50	46.00	45.50	43.50
October .....	47.00	45.90	43.90	45.80	45.40	43.40
November .....	52.50	50.75	48.75	43.88	43.50	41.50
December .....	52.50	51.00	49.00	42.00	41.50	39.50
Year .....	\$46.30	\$45.45	\$43.45	\$47.06	\$46.51	\$44.51

were closed down for lack of ore, but in all of the districts of the State producing quicksilver there was in 1910 a considerable endeavor to find new deposits, and old workings were prospected in the hope of finding undeveloped orebodies, for the reason that the demand for quicksilver exceeded the output. The prices for 1910 averaged about \$4 per flask in advance of 1909. This advance in price, resulting from the small output compared to the requirements, stimulated not only the production but the prospecting all over the State. The Nevada mines did not add largely to the output of coast States. The purchases in 1910 of quicksilver from all other producing sections amounted only to about 550 flasks. Nearly the whole production was sold in the domestic market, but little being exported. The stock of quicksilver in the United States is now low. Although that fact is generally known, there was not so great an effort put forth in prospecting

more. San Luis Obispo probably increased its output over the year 1909. While the New Almaden in Santa Clara county, the oldest producer of quicksilver in the State, has not kept up its production in the last few years, and the Guadalupe in adjoining territory has not greatly increased its output, there is a strong probability that new bodies of cinnabar ore will be found in that neighborhood. On the Mackenzie ranch, across the gulch opposite to the New Almaden and the Guadalupe, considerable prospecting was done in 1910. This property presents the same contour and, so far as developed, a formation similar to that of the neighboring quicksilver mines. The cinnabar deposits in California are not confined to the Coast range district, as might be inferred by the names of the counties which are the chief producers, but extend into the western slope of the Sierra Nevada. Careful inspection of these various localities leads to the belief that there are many deposits of cinnabar ore which if properly developed would keep the pro-

\*6 Ferry building, San Francisco, Cal.

sale of the lands there with reservation of the mineral rights. Considering the fact that the country lacks but little of being a wilderness and that the lands are worth very little, if the mineral rights are reserved, it would appear that prospective purchasers would prefer to buy outright at a reasonable price than to take the land at any price without the minerals.

It would be a case of "he sold me the box without the socks."

All possible inducements should be given those interested in quicksilver mining to secure their attention to this district. It is now and is likely to be remote from rail; the conditions of living are onerous and the entire region is almost a desert. And yet the deposits there are

of high grade, easily and cheaply mined, especially in the bituminous-shale area west of Terlingua creek, and the district is today probably the best undeveloped quicksilver area in the United States. This I know, as I spent 18 months there and opened the Chisos property. In spite of its many drawbacks it is the most promising quicksilver district in the country today.

## The Tungsten Industry in 1910

A firm dealing in tungsten ore quotes the following commercial rates for 1910: for a good grade of ore about \$7 per unit per ton, of 2000 lb., with a lower price for lower-grade ores containing deleterious substances and a premium for exceptionally high-grade ore. Tungsten metal price averaged about 85c. per lb. Ferrotungsten is quoted at about 83c. per lb., depending upon the size of the order.

### Tungsten in California in 1910

BY SAMUEL H. DOLBEAR\*

As formerly, the chief operations for tungsten in California in 1910 were confined to the Atolia mines in the Rand mining district in San Bernardino county. The Atolia Mining Company (Atkins, Kroll & Co., managers) owns the principal producing properties in the district. During 1910 this company increased its holdings by the purchase of the Weatherbee and Cora Dee mines, for which about \$15,000 was paid. The latter properties are situated in the tungsten belt, and are different exposures of the same vein, which is about 3 ft. in width and was partially developed at the time of their purchase.

The industry enjoyed a more prosperous year than in 1909. During the early part of 1910 a local schedule of \$7 per unit of  $WO_3$  in 60 per cent. ores prevailed, increased in the latter part of April to \$7.50 with strong interest manifested by purchasers. This price (\$7.50) was maintained until September, when the price offered dropped to \$7.25 with a disposition among the small producers to hold their ores for a better schedule. An average price of \$7.275 prevailed during the 12 months. These figures are for scheelite ores carrying 60 per cent. of  $WO_3$  or over.

The production of the Atolia Mining Company was constant at about 40 tons of concentrates per month, an increase of about 10 tons per month over the figures for 1909. It is probable that these

concentrates averaged about 67 per cent.  $WO_3$ . At the average price of \$7.275 per unit, or \$484.43 per ton, the value of the 1910 production would be \$232,526. The mill of the Atolia Mining Company, consisting of Blake crushers, a 6-ft. Huntington mill and Frue vanners, was kept in full operation during 1910; about 60 men were on the payroll of the company. Two hundred and nine acres of tungsten lands were patented in 1910 by this company, and about 40 acres by others.

Small mining operations in the Stringer section of the Rand district produced a few tons of concentrates during 1910. Among these were the Baltic, Winnie and Sunshine mines. Placer operations for tungsten also attracted attention, and yielded a small amount of placer scheelite. The Wickard tungsten mine north of Atolia was operated intermittently and a few tons of ore were milled. At St. Elmo, south of Atolia, W. E. Deacon and associates commenced development operations.

At Johannesburg the Stanford Mining and Reduction Company equipped its custom mill with a concentrating plant, and has treated most of the ores mined by the small producers. At Ivanpah, in San Bernardino county, five shipments of scheelite-wolframite ore were reported. The United States Tungsten Mining Company increased its holdings by the purchase of five claims of the Williams property. At Amelie, Vontrigger and Barnwell, only small development was recorded, the properties at those points having been idle most of the year.

### Tungsten Mining in Colorado

BY R. D. GEORGE\*

The activity in the Boulder county, Colo., tungsten field was greater in 1910 than at any other time since the panic of 1907, and the production exceeded that of any previous year in the history of Boulder County mining, though the average price per unit was somewhat lower than that of 1907.

The total shipments of concentrates and high-grade ore for 1910 amounted to 1540 tons. Of this total tonnage probably 35 per cent., or 540 tons were of high-grade ore of an average tenor of 35 per cent. tungstic acid, and about 1000 tons were concentrates of an average tenor of 60 per cent. tungstic acid. The monthly market quotations taken in connection with the monthly production throughout the year were such as to give an average price of \$7.75 per unit of tungstic acid. At this figure the value of the Boulder county production for 1910 was \$612,000. The best previous year in the history of Boulder County tungsten mining was 1907, in which 1146 tons of ore and concentrates were produced and sold at an average price of \$8.33 per unit of tungstic acid, yielding \$573,643.

There was no important extension of the field and few mines were opened, but deeper development work showed that, on the average, the orebodies at least held their own, if indeed, they did not increase with depth. A number of operators state that their best orebodies have been found in their deepest workings.

#### TUNGSTEN MILLING

Until recently the tungsten ores have been handled by mills primarily designed for gold and silver ores, but in the last year or two there was much remodeling of old and building of new mills with a special view to the handling of tungsten ores. The new Primos mill at Lakewood has a capacity of 50 tons per day and is equipped with stamps, dropping 90 times per minute, Wilfley tables, hydraulic classifiers, and Frue vanners. The tailings are reground and the fines are carried to an extensive canvas plant. The capacity of the Wolf Tongue mill at Nederland was increased and the equipment modified. The crushing is done by a jaw crusher, rolls and stamps; the concentration by a Harz jig, Wilfley tables and Monell slimers and a small canvas plant. A part of the tailings from the Wilfley is reground in a Huntington mill.

The Ardourell & Smith mill on Beaver creek is equipped with rolls, Wilfley tables and Monell slimers, and is now profitably working over the material of the old Wolf Tongue settling basin, but will also

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handle the ores of the Fayette Leasing Company operating on the Tungsten Mining, Milling and Exploration Company's claims. The Tungsten Mines Company's new mill on Beaver creek, is equipped with rolls, Monell tables and slimers, and is handling ore from the Mammoth, and others of the company's mines. The Eureka mill, at Boulder, was active a part of 1910 on ores from the Rogers tract east of Nederland. This mill is also equipped with Monell tables and slimers. The Zophar mill, at Wall street, is equipped with Wilfley and Monell tables and slimers and is handling ores from the Barker tract.

A large part of the production must be credited to leasers working on the various properties. The parent claim-holding companies themselves produced comparatively little ore, though development work was prosecuted with considerable vigor. There were comparatively few important changes in the holding of property during 1910. The Rogers tract is still under lease to Eugene Stevens, who has a number of sub-leasing companies at work. It is reported that Thomas L. Wood, of the Zophar Mining Company has leased the Barker tract.

### Tungsten in Washington

Satisfactory developments of the new tungsten area in Stevens county, Wash., were carried on during 1910. Three properties were under development; the Germania in Cedar cañon, 35 miles north of Springdale; Tungsten King, eight miles north of Deer Park; and Blue Grouse, a mile south of the Tungsten King. The district shipped several tons of concentrate during the year, and extensive prospecting was carried on with the result of greatly extending the tungsten-bearing area.

### Tungsten in Montana

In Montana a small production of tungsten continued to be made during 1910, chiefly from the Jardine district, two miles north of Yellowstone Park. The ore is scheelite. Occasionally small bodies of tungsten ore are found in the veins of the Butte district, but no regular production is made.

### Tungsten in Nova Scotia

The tungsten deposit in Nova Scotia, in the Moose River district, Halifax county, discovered in 1908, was in operation in a small way during 1910. The work was confined chiefly to developments. The ore is scheelite and is found in interbedded veins remote from the vicinity of any igneous rock.

## Ammonia Production in 1910

By W. N. McILRAVY

The principal features of the ammonia production of the United States in the year 1910 were a fair increase in volume and an accompanying increase in price. The total recovery of ammonia of all forms reckoned as sulphate of ammonia amounted to about 106,500 tons in the year 1909, and in 1910 an increase in production of 10,000 tons may be fairly estimated; therefore the total recovery may be placed at 116,000 tons for the year. As little increase took place in the coal-gas industry, in so far as the production of ammonia would be affected, and as the small production from other sources was about stationary, the increase must be attributed to the by-product coke ovens. This view is further supported by the condition of the by-product coke-oven industry, though this, in common with the iron business on which it mainly depends, has been by no means pushed to the limit. While few of the plants were idle, many of them were operated at only 60 to 75 per cent. of their total capacity for a part of the year; but, on the other hand, others, and among them those of large capacity, operated at full capacity without interruption. The only new ovens that went into operation during 1910 were the 40-oven addition to the South Chicago plant, although the 50-oven plant at Indianapolis and the 50-oven addition to the Hamilton plant, both of which came in late in 1909, can hardly be considered as effective in ammonia production till 1910.

The prospects for 1911 include a plant of 560 ovens at Gary, Indiana, 110 ovens at Sault Ste. Marie, 280 ovens at Ensley, Ala., and 60 ovens at Woodward, Ala. The two first-mentioned plants are scheduled to come in during this winter.

The United States imports of sulphate of ammonia for the fiscal year ended June 30, 1910, totaled 62,610 net tons, the figure for the preceding year being 40,192 net tons and for 1908 34,274 net tons. The last fiscal year therefore brought an increase of 55 per cent. in imports. The consumption in the country of ammonia in all forms may therefore be reckoned as over 178,000 tons of sulphate and sulphate equivalent.

The principal feature of the market for sulphate of ammonia during 1910 was a steady rise, interrupted at times with small recessions, but always recovering and seeking still higher levels. The price of domestic at the beginning of 1910 was \$2.70 per 100 lb. but rising constantly. By March it reached \$2.85, then receded to \$2.80 or a little less. The price was stationary until the end of August, when an upward tendency was

again manifest, the end of September bringing \$2.89 and of October \$2.97. For the rest of the year the market was almost bare of spot domestic, but the imported article ruled at \$2.83 to \$2.90. It is therefore clear that the market returned to practically the same level as prevailed before the removal of the duty, the only difference being in the larger amounts produced, imported and consumed. The outlook for future business arising from the recovery plants building and projected in the country is unquestionably good. The products of the several processes for recovering the nitrogen of the air appeared in some quantity in European markets and to a smaller extent here, but neither the price nor the demand for the better known article seemed to have been affected thereby.

## Vanadium in 1910

There was an active demand for vanadium deposits during 1910, especially from French sources, but there is no record of any important new investments in the business in the United States or Mexico. The New Mexico deposits were developed successfully, according to report, but plans to erect mills did not materialize. The Cave Creek deposits in Arizona are being investigated and several Mexican deposits were slightly developed. The Colorado occurrences still seem to be the most promising source of supply in the United States. The Peruvian deposits of exceptional richness are closely controlled, and conflicting reports of their possibilities are extant.

Concerning the general vanadium situation a company actively interested in the business writes:

"Of course the statement that there is a production of vanadium to the extent of from \$300,000 to \$400,000 a month at Newmire is entirely wrong, and these statements are usually gotten up by people who have ore claims for sale. The production of vanadium ore at Newmire does not average \$20,000 worth per month in the whole district; this includes the prepared vanadic acid as well as crude ore running about 1½ per cent. shipped as it comes out of the ground. In a general way the vanadium market is over supplied, and the one or two large vanadium producers can easily take care of any demand that there may be. There are a lot of companies on paper issuing fine prospectuses which make it look as if there were a shortage or a larger demand than there really is. The consumption, of course, is growing with the extent of increased knowledge and different fields of consumption. Prices for ferro-vanadium are about \$5 per lb. of vanadium contained in the alloy. Prices for vanadic acid are about \$2.50 per lb., according to purity."

# AVERAGE MONTHLY PRICES OF CHEMICALS, EARTHS, MINERALS, ETC., IN 1910

(IN CARLOAD LOTS AT NEW YORK)

Material.	Unit.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Average, 1910.	Average, 1909.
<b>Abrasives:</b>															
Corundum.....	C. per lb.	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50
Emery, Turkish flour in kegs.....	C. per lb.	1.875	1.875	1.875	1.875	1.875	1.875	1.875	1.875	1.875	1.875	1.875	1.875	1.875	1.875
Emery, Naxos flour.....	C. per lb.	1.875	1.875	1.875	1.875	1.875	1.875	1.875	1.875	1.875	1.875	1.875	1.875	1.875	1.875
Emery, Chester flour.....	C. per lb.	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
Emery, Peekskill flour, f.o.b. Easton, Penn.	C. per lb.	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Garnet.....	\$ per Sh. T.	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Boric acid.....	C. per lb.	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Borax sacks.....	C. per lb.	4.375	4.375	4.375	4.375	4.375	4.375	4.375	4.375	4.375	4.375	4.375	4.375	4.375	4.375
Alum, lump.....	C. per 100 lb.	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
Aluminum sulphate, com'l.....	\$ per 100 lb.	1.625	1.625	1.625	1.625	1.625	1.625	1.625	1.625	1.625	1.625	1.625	1.625	1.625	1.625
Arsenic, white, spot.....	C. per lb.	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70
Barytes, American ground.....	C. per lb.	2.625	2.625	2.625	2.625	2.625	2.625	2.625	2.625	2.625	2.625	2.625	2.625	2.625	2.625
Chrome ore, New Caledonia, 50 per cent. ex. ship. N. Y.	\$ per Sh. T.	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50
Cobalt oxide.....	C. per lb.	82.50	82.50	82.50	82.50	82.50	82.50	82.50	82.50	82.50	82.50	82.50	82.50	82.50	82.50
Copperas, bulk.....	C. per 100 lb.	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00
Copper sulphate, carload lots.....	C. per lb.	4.225	4.225	4.225	4.225	4.225	4.225	4.225	4.225	4.225	4.225	4.225	4.225	4.225	4.225
Fluorspar, lump.....	\$ per Lg. T.	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
Fuller's earth, lump.....	\$ per 100 lb.	82.50	82.50	82.50	82.50	82.50	82.50	82.50	82.50	82.50	82.50	82.50	82.50	82.50	82.50
Magnesite, Greece, crude 85 per cent.....	\$ per Lg. T.	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Magnesite, calcined, powdered.....	\$ per Sh. T.	31.50	31.50	31.50	31.50	31.50	31.50	31.50	31.50	31.50	31.50	31.50	31.50	31.50	31.50
Gilsonite, Utah ordinary.....	\$ per Lg. T.	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00
Litharge, Am. powdered.....	C. per lb.	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
Red lead, American.....	C. per lb.	6.875	6.875	6.875	6.875	6.875	6.875	6.875	6.875	6.875	6.875	6.875	6.875	6.875	6.875
White lead, Am. dry.....	C. per lb.	5.875	5.875	5.875	5.875	5.875	5.875	5.875	5.875	5.875	5.875	5.875	5.875	5.875	5.875
Nitrate of soda, 95 per cent. spot.....	\$ per 100 lb.	2.087	2.087	2.112	2.112	2.112	2.087	2.087	2.10	2.125	2.125	2.125	2.125	2.139	2.139
Zinc white, Am. extra dry.....	C. per lb.	5.437	5.437	5.437	5.812	5.812	5.75	5.75	5.75	5.75	5.75	5.75	5.937	5.781	5.38
<b>Phosphate rock:</b>															
*Florida hard, 77 per cent.....	\$ per Lg. T.	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25
Florida hard, pebble, 68 per cent.....	\$ per Lg. T.	3.875	3.875	3.875	3.875	3.875	3.875	3.875	3.875	3.875	3.875	3.875	3.875	3.875	3.875
†Tennessee, 78 to 80 per cent.....	\$ per Lg. T.	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25
Tennessee, 75 per cent.....	\$ per Lg. T.	4.875	4.875	4.875	4.875	4.875	4.875	4.875	4.875	4.875	4.875	4.875	4.875	4.875	4.875
Tennessee, 68 to 72 per cent.....	\$ per Lg. T.	4.375	4.375	4.375	4.375	4.375	4.375	4.375	4.375	4.375	4.375	4.375	4.375	4.375	4.375
†South Carolina land rock, 60 per cent.....	\$ per Lg. T.	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
Potassium cyanide, 98 and 99 per cent., 5-ton lots.....	C. per lb.	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50
Kaimit, bulk.....	\$ per Lg. T.	8.50	8.50	8.50	9.25	9.25	9.25	9.25	9.25	9.25	9.25	9.25	9.25	9.25	9.25
<b>Pyrites:</b>															
Dorn, non-arsenical furnace, f.o.b. mines.....	\$ per 100 lb.	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25
Dorn, non-arsenical fines, f.o.b. mines.....	\$ per 100 lb.	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25
Imp, non-arsenical furnace.....	\$ per Unit	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50
Imp, arsenical furnace.....	\$ per L. T.	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75
Imp, arsenical fines.....	\$ per lb.	9.00	9.00	9.00	9.25	9.25	9.25	9.25	9.25	9.25	9.25	9.25	9.25	9.25	9.25
Imp, non-arsenical fines.....	\$ per 100 lb.	10.75	10.75	10.75	10.75	10.75	10.75	10.75	10.75	10.75	10.75	10.75	10.75	10.75	10.75
Soda, caustic, 33.....	\$ per 100 lb.	1.787	1.787	1.787	1.787	1.787	1.787	1.787	1.787	1.787	1.787	1.787	1.787	1.787	1.787
Salt cake, bulk.....	C. per 100 lb.	41.00	41.00	41.00	41.00	41.00	41.00	41.00	41.00	41.00	41.00	41.00	41.00	41.00	41.00
Sodium bromide.....	C. per lb.	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Sodium cyanide, 120 to 130 per cent. KCN per 100 per cent., 5-ton lots.....	C. per lb.	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50
Sodium sulphate, com'l calcined.....	C. per 100 lb.	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
<b>Sulphur:</b>															
Louisiana, prime to New York.....	\$ per Lg. T.	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
Talc, domestic.....	\$ per Sh. T.	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
Zinc chloride, gran.....	C. per lb.	4.50	4.50	4.50	4.125	4.125	4.125	4.125	4.125	4.125	4.125	4.125	4.125	4.125	4.125
Zinc dust.....	C. per lb.	6.75	6.75	6.75	6.625	6.625	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.625	6.625
Zinc sulphate.....	C. per lb.	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25

\*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel, Ashley river, S. C.

Note—These quotations were for ordinary wholesale lots at New York unless otherwise specified and were generally subject to the usual trade discounts. In the case of some of the important minerals such as pyrites, sulphur, etc., in which there are well established markets the quotations fully represent the latter. But in the cases of some of the minor mineral products, the quotations represent what dealers asked of consumers and not what producers realized in selling their outputs as matter of private contract. The monthly figures are the averages of the quotations published in the JOURNAL.



# Petroleum in the United States

The accompanying table shows the revised figures of production for crude petroleum in the United States in 1909, and the preliminary estimate of the yield for 1910. These figures show an increase of about 28,000,000 bbl., or about 15 per cent. over 1909. The increased production of California is about 17,000,000 bbl., or 27 per cent. In the California field the Midway and Sunset districts show the largest increase, with Coalinga as third. Kern River's yield fell off slightly. The price obtained for California oil was slightly lower than that received in 1909, but the yield is so large that its value will surpass the gold production of the State. The Illinois field showed an increase of over 4,000,000 bbl.; the Mid-continental field 7,000,000 bbl. and the Appalachian field 1,000,000

PRODUCTION OF CRUDE PETROLEUM IN THE UNITED STATES. (IN BARRELS OF 42 GAL.)

Field.	1909.	1910.
California.....	58,192,723	74,327,150
Colorado.....	(a) 500,000	(a) 500,000
Gulf { Texas.....	9,256,972	14,866,525
{ Louisiana.....	3,324,363	
Illinois.....	30,898,339	35,000,000
Lima { Indiana.....	6,192,000	5,171,000
{ Ohio.....		
Mid-continental (b).....	46,826,196	53,613,030
Kentucky-Tennessee (a).....	1,250,000	1,050,000
Appalachian (c).....	25,394,200	26,089,900
Wyoming.....	(a) 15,000	(a) 15,000
Others.....	(a) 5,000	(a) 5,000
Total.....	182,058,458	210,636,505

(a) Estimated.  
 (b) Kansas and Oklahoma.  
 (c) Pennsylvania, New York, West Virginia and eastern Ohio.

bbl. The Kentucky-Tennessee field showed a slight decrease, while the Lima field fell off 1,000,000 barrels. The Gulf field increased 2,285,190 barrels.

In the Appalachian field no new wells of importance were reported for the year, and the increase is due largely to the big wells drilled in the latter part of 1909. The average price of oil in this field for 1910 was \$1.38 per barrel, as compared with \$1.62 in 1909.

Among the foreign developments during 1910 are the Maikop fields of Russia, the deposits discovered on Sakhalin island, Siberia, and the work of the Burma Oil Company in Persia. These new sources of supply, while tending to lower prices of oil, will eventually result in increased profit in other industries, due largely to cheaper fuel.

## Petroleum in California in 1901

By M. L. Requa \*

The production of oil in California for 1910 will approximate 75,000,000 bbl. Compared with the production of 58,000,000 in 1909, it shows an increase of 17,000,000 bbl. for the year. The cause for the rapid increase was two-fold: (1), the incentive to more active drilling because of the high price of oil during 1909 and part of 1910 (the price of 62½c. paid by the Associated to the independent producers stimulated extreme activity throughout the San Joaquin valley and coast fields); (2), the bringing in of the flush production in Midway, notably the Lake View gusher and the wells of the American Oil Fields. Comparison of the principal fields is given in the accompanying table.

### OVERPRODUCTION AND LOWER PRICES

Because of the tremendous overproduction, largely due to the Lake View well in Midway, the price of oil during 1910 tended downward until late in November and December. Some oil was sold as low as 30c. at the well and one large contract was taken by a Midway company at 35c. The close of the year, however, saw a stiffening of prices, and while production is still 40,000 bbl. daily beyond consumption, the asking price in the field was fairly steady at 50c. at the well. The last three months of the year showed a material decrease in production, due in part to decrease in flow of the Lake View and other flush Midway producers and in part to cessation of drilling and a

relaxation of efforts to produce from pumping wells already drilled. Total storage in the State at present approximates 27,000,000 barrels.

### INDEPENDENT PRODUCERS' AGENCY ALLIED WITH UNION OIL COMPANY

Negotiations in 1909 between the Union Oil Company and the Independent Producers' Agency resulted in an agreement

#### CALIFORNIA OIL PRODUCTION.

	1909. Bbl.	1910. a Bbl.
Coalinga.....	15,406,600	18,038,464
Kern River.....	14,508,292	14,121,892
Santa Maria, Lompoc and Arroya Grande..	8,080,488	7,631,171
McKittrick.....	5,807,212	5,100,683
Fullerton-Brea Cañon.	4,271,000	5,073,773
Salt Lake District.....	3,821,233	3,223,192
Midway.....	2,234,456	9,970,949
Sunset.....	1,999,800	9,481,090
Whittier.....	848,800	893,972
Los Angeles.....	529,965	477,515
Newhall and Santa Paula.....	516,778	142,449
Summerland.....	66,300	67,000
Watsonville and Sar- gents.....	63,799	65,000
Puente.....	38,000	40,000
Total.....	58,192,723	74,327,150

a Estimated.

whereby the Union Oil Company became the selling agent for all independent oil. This agreement became effective on the expiration of the agreement with the Associated Oil Company in Jan., 1910.

Because of this agreement a new 8-in. pipe line was constructed by the Union Oil Company from Coalinga south to Junction, where it meets a similar line coming north from McKittrick, Midway and Kern river. From Junction to Port Harford on tide water there is as yet only a single line, but it is expected this line

will be doubled in the near future, giving two complete lines, one from Coalinga, the other from McKittrick, Midway and Kern river. Recent negotiations resulted in an agreement whereby the Associated Oil Company sells all of the unsold Independent production and turns over to the Union-Independents certain large railway contracts and other business controlled by them. It is believed this agreement will make for greater economies, as oil will now be supplied from the field nearest to the point of consumption.

### OIL SUPPLANTS COAL IN CERTAIN DISTRICTS

In 1910 there was a notable invasion of territory long dominated by coal. The Northern Pacific, Great Northern and Canadian Pacific have all contracted for oil for their locomotives on the divisions reaching tidewater. The Canadian Pacific steamers on Puget sound have also been converted to oil burners. Practically all of the railways on the Pacific coast are now consuming oil for locomotive fuel. The Pacific Mail Steamship Company and the Pacific Coast Steamship Company are now about the only companies operating on coastwise trade that still cling to coal.

The Panama canal work has consumed an increasing quantity of oil and the market in Chile and other South and Central American ports continue to expand. Alaska is consuming more oil than at any time heretofore, and recent figures seem to indicate that the mining of Alaska coal must be deferred until the exhaus-

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tion of California oil, because of the inability of the coal to compete in price.

**ONLY ONE NEW PROMISING FIELD DISCOVERED**

The only new development made in 1910 that gives promise of a new field was in the Lost hills, situated about 45 miles south of Coalinga and about 25 miles north of McKittrick. This territory is as yet entirely too new to hazard any opinion as to its future. One well has been brought in by Martin & Dudley at 500 ft., and pumps a production variously reported from 200 to 500 bbl. Owing to the fact that there is no means of disposing of the oil, the well is only pumped occasionally and its true production is unknown. The oil is coming from a shale and not from an oil sand. This territory has been mapped by the U. S. Geological Survey as oil land, but the depth to the top of oil sand was placed at 3000 ft. Striking oil at 500 ft. caused considerable surprise and opened up several interesting geological possibilities.

**GAS DEVELOPMENTS**

The development of a gasfield lying to the east of the Midway field in the Elk and Buena Vista hills caused the rumors that natural gas was to be piped to Los Angeles and throughout the San Joaquin valley to San Francisco, and possibly north through the Sacramento valley as far as Red Bluff. There seems no reason to doubt the existence of a tremendous gasfield in the locality mentioned and the utilization of the gas now going to waste seems to be a matter of but a short time. In the Lake View well the State claims the largest oil gusher ever struck in the United States. Brought in during March, 1910, its production is estimated at approximately 8,000,000 bbl. to date. In the

Standard and Honolulu gassers, in Midway, claim is also made for gas wells among the largest ever struck.

**AGITATION AGAINST THE SOUTHERN PACIFIC RAILROAD**

Agitation concerning the oil lands owned by the Southern Pacific company, reached an acute stage. Briefly it is claimed that the patents from the United States do not cover oil land and that such land must revert to the Government. The agitation, according to the views of leading attorneys, is without merit and it is unlikely the railroad will be disturbed in its ownership of lands that seem to have been honestly acquired and possession of which still rests in the railroad, notwithstanding efforts in past years to sell at \$2.50 per acre.

**WITHDRAWAL OF OIL LANDS**

The action of the Government in withdrawing certain lands for entry and the more recent passage by Congress of the so called Pickett bill has brought to a crisis the entire question of acquisition of Government lands for the purpose of oil exploitation. Heretofore existing laws have been entirely inadequate and unsatisfactory and there is no question but that new and rational laws that recognize conditions as they exist are not only desirable, but necessary. Locators, however, who have no legal title and who have in no way complied with the laws are making most strenuous objection to the enforcement of the present law. Operators who were upon the land and drilling in good faith at the time the withdrawal order went into effect will probably be unmolested, but those who were not actually drilling seem to be confronted with the possibility of being dispossessed.

The regulations under which land so withdrawn may be acquired or leased demand careful consideration. If some of the suggestions made are finally adopted, there will be no possibility of these lands ever being worked. The most the Government can reasonably ask is a royalty on oil produced and possibly some limitation of production. Methods of drilling and details of operation should not be interfered with, nor attempts made at supervision beyond assuring honesty as to production statistics. Proposals on the part of the Government to regulate size and weight of casing and other similar details, are not only absurd but entirely impractical. The entire success of the Government's action is now dependent on two contingencies: (1) The recognition of certain good faith claimants and the rejection of certain others who have not acted in good faith; (2) wise and sane regulations whereby withdrawn land may be acquired and operated with the least possible governmental supervision compatible with the success of the proposed policy.

**DECLINE IN PRODUCTION LOOKED FOR**

There is at present no indication of any great expansion of territory in 1911 except in the Lost hills, and it is quite possible that production may materially decline. Midway is thought by some authorities to have reached its maximum and it is not probable that any of the older fields will afford any great surprises. The territory between Coalinga and Maricopa continues to be the most attractive and it is reasonable to expect that in 1911 material additions to the known oil area of the State will be made in the district lying between these two towns.

# The Appalachian Oilfield in 1910

By H. C. George\*

The Appalachian oilfield comprises the oil pools of New York, southeast Ohio, Pennsylvania and West Virginia. The petroleum secured from these pools is a high-grade product with a paraffin base. Most of the oil pools in this field have shown a steady decrease in production during the last five years, but there has been a slight increase in total production during the last two years, owing to the discovery of some large wells in West Virginia in 1909.

Although the new production secured during 1910 was less than the new production secured in 1909, the total production was greater because of the great increase in old production furnished by the

big wells drilled in West Virginia in 1909, which have been rather persistent.

The total production of the Appalachian oilfield in 1910 was 26,089,900 bbl., as compared with 25,394,200 bbl. in 1909;

24,240,000 bbl. in 1908; 25,500,000 bbl. in 1907, and 27,345,000 bbl. in 1906. The decline in the price of crude petroleum of the Pennsylvania grade, which began in March 1909, when the price paid was

**PRODUCTION OF WELLS DRILLED IN THE APPALACHIAN OILFIELD IN 1908, 1909 AND 1910.**

	Number of Wells Drilled.			Daily Production in Barrels.			Daily Production in Barrels per Well Drilled.			Per Cent. of Dry Holes		
	1908	1909	1910	1908.	1909.	1910.	1908.	1909.	1910.	1908.	1909.	1910.
Allegany county, N. Y.	493	468	303	880	838	446	1.8	1.8	1.4	13.4	7.5	16.2
Pennsylvania	3,748	3,958	2,056	9,532	10,361	5,936	2.5	2.6	2.8	19.0	15.6	23.7
West Virginia	1,329	1,810	1,735	27,304	35,872	35,347	20.6	19.1	20.4	32.5	36.9	40.6
Southeast Ohio	1,344	2,285	1,682	13,798	25,239	19,321	10.3	11.0	11.5	39.3	36.2	36.6
Kentucky	205	179	119	2,519	2,108	997	12.3	11.7	8.4	33.6	44.7	62.2
<b>Total</b>	<b>7,119</b>	<b>8,700</b>	<b>5,895</b>	<b>54,033</b>	<b>81,918</b>	<b>62,047</b>	<b>7.6</b>	<b>9.4</b>	<b>10.5</b>	<b>25.0</b>	<b>25.6</b>	<b>32.8</b>

\*Director, Wisconsin State Mining Trade School, Platteville, Wis.



\$1.78 per barrel, continued until May 1910, when the price paid was \$1.30 per bbl. This latter price continued until the end of the year. The average price in 1910 was \$1.33 per bbl. as compared with \$1.62 in 1909, \$1.78 in 1908 and \$1.74 in 1907.

The New York and Pennsylvania pools showed a marked decline in the number

of wells drilled and in the new production, and also a corresponding increase in the per cent. of dry holes. Nothing worthy of notice took place in these fields during 1910. There was less activity than at any time during the last five years.

The operations in the West Virginia and southeastern Ohio pools in 1910 were only slightly less in the number of

wells drilled and in the new production than in 1909, owing to the stimulus produced by the discoveries made in 1909.

The Kentucky-Tennessee pool showed a marked decline in new production and wells drilled during 1910, and a higher percentage of dry holes. The production of the pool in 1910 was 1,050,000 bbl., as compared with 1,250,000 bbl. in 1909.

# Oil and Gas in Mid-Continental Field

By Erasmus Haworth\*

The production of oil in 1910 by the Mid-continental field was the greatest since its development began, the total aggregating 53,613,030 bbl., as shown by the accompanying table. As usual, the Prairie Oil and Gas Company was the greatest consumer of oil, it having purchased about three-fifths of the total production. The Texas company and the Gulf Pipe Line Company were about equal consumers, each taking between seven and eight million barrels. The independent refineries increased their purchase largely with a total consumption of more than 6,000,000 bbl. The decrease in storage amounted to 378,842 barrels.

ductive sands lying down near the Mississippian limestone. As the distance westward increases the depth likewise increases, so that south of Wann the wells are from 900 to 1000 ft. deep, and likewise obtain their main supply from the Cherokee shales. Further west, around Dewey, oil has been obtained at about the same depth or else from sands which lie higher up geologically, so that the term "shallow sand," while correct by tape-line measurement, may be misleading to the geologist.

Outside of the Nowata-Lenapah field no new development of note has been made, but many wells have been brought in around the borders of the old fields,

There is a general feeling throughout the field that prices will rule higher and many think that as soon as rains supply the necessary water for development purposes, there will be a great revival in drilling. Early in December the Prairie

## OIL PRODUCTION, MID-CONTINENTAL FIELD, DURING 1910.

	Barrels.
Prairie Oil and Gas Company . . . . .	31,444,104
Texas Oil Company . . . . .	7,587,272
Gulf Oil and Pipe Line Company . . . . .	7,956,654
Independent refineries . . . . .	6,375,000
Fuel oil, crude . . . . .	250,000
Total . . . . .	53,613,030

Oil Company, for the first time in years, removed the bar on low-gravity oil, and is now paying the same for oil regardless of its quality, 42c. a barrel. Other companies, particularly the independent refineries, are manifesting quite a disposition to advance the price, some paying 2c. above the market, and a number of them are asking producers for bids on a yearly contract.

## PIPE-LINE DEVELOPMENTS

During the first half of 1910 the Oklahoma Pipe Line Company completed an 8-in. pipe line from the oilfields to Baton Rouge, a distance of about 500 miles. It has built to date a total of 28 storage tanks along the line, each with a capacity of 35,000 bbl. which, with 175,000 bbl. necessary to fill the line, gives an added storage of a little over 1,000,000 bbl. This pipe line belongs to the Prairie Oil and Gas Company. The Gulf Oil and Pipe Line Company extended its line from the Glen pool northward into the Osage territory within about 31 miles of the Kansas line. It bought the Mattson Oil Company property in order to increase its production. The Texas Oil Company completed a line to Tulsa, where it has a 5000-bbl. refinery and is now building northward into the Osage and Bartlesville districts to gather oil from the wells of the old Central Fuel Company, which property the Texas Oil Company has obtained.

The Prairie Oil and Gas Company has greatly extended its gathering pipe lines, so that it covers practically the entire oilfield.

## CRUDE OIL BOUGHT BY THE PRAIRIE OIL AND GAS COMPANY DURING 1910.

Month.	Total Runs, Barrels.	Daily Average, Barrels.	Deliveries, Barrels.
January . . . . .	2,529,475	81,596	2,700,362
February . . . . .	2,106,895	75,246	2,293,697
March . . . . .	2,646,312	85,365	2,609,582
April . . . . .	3,256,164	108,538	2,633,425
May . . . . .	2,756,856	88,931	2,649,538
June . . . . .	2,703,612	90,120	2,791,573
July . . . . .	2,704,768	87,251	2,844,336
August . . . . .	2,600,718	83,894	2,445,627
September . . . . .	2,606,583	86,886	2,257,954
October . . . . .	2,643,217	85,265	2,868,330
November . . . . .	2,487,645	82,921	2,875,479
December . . . . .	2,381,859	76,834	2,853,043
Total . . . . .	31,444,104		31,822,946

## DEVELOPMENT

Development during 1910 was not active, although a number of interesting new areas were discovered, the most important of which was the large area trending nearly east and west lying north of Nowata, different parts of which are known by different names, such as the Nowata field, the Lenapah field, the Wann field, etc. This new development virtually connected the shallow sand area of Alluwe and Coody's Bluff, east of Nowata, with the oilfields lying to the east of Dewey, and is the only prominent pool thus far developed in the entire area which has substantially an east and west trend over anything like so great a distance. On the east the wells are from 600 to 700 ft. deep, and obtain their oil from the Cherokee shales, the most pro-

so that in the aggregate a large number of new producers has been obtained. Dry weather seriously interfered with development during the latter part of the year.

## DEMAND AND PRICES

During January and February the demand was greater than the supply, so that the Prairie company reduced its stocks slightly. During March, April and May, the production outran the consumption. June witnessed a slight reduction of stocks, while during August and September, particularly September, the production gained on the consumption. By October the production was falling short, and a considerable reduction of stocks resulted, which condition was intensified in November and December. This extra demand also resulted in an increase of price, the market having advanced 4c. by the first of December.

\*State geologist, Lawrence, Kan.

Likewise, the independent refineries at Caney, Independence and Coffeyville, five in number, all have their own pipe lines from the northern portion of the Oklahoma oilfields to their several refineries. The extra rush of consumers to secure production has resulted in a marked decrease in the number of holdings, and a marked increase in the aggregate holdings of the few larger companies. Should such activities continue there another year production will be confined almost entirely to the strong companies.

#### REFINERIES

The independent refineries seem to have flourished during 1910, as indicated by their increased consumption, as shown in the accompanying tables of production. Of these there are a total of 25, sixteen of which are in Kansas and nine in Oklahoma. The majority of them now are working up the byproducts in quite a satisfactory way, producing in addition to naphtha, gasolene and kerosene, the usual grades of lubricating oils, vaseline and paraffin, and also a large amount of fuel oil. The Standard Asphalt and Rubber Company, of Independence, Kansas, buys a large quantity of the heavy oils and also has bought much residuum from other refineries. It makes a variety of asphalt which is used extensively in street paving and another product called

rubber, used principally for insulation purposes by manufacturers of electrical supplies.

#### GAS

Should future drilling operations fail to develop new gas fields, the time is not far distant when gas throughout the Mid-continental field will be more valuable than oil. The consumption by the large pipe-line companies and the many manufacturing interests has been unusually great and gas pressure has decreased rapidly throughout the entire area. In the face of this readily observed condition, new pipe lines have been built. One 16-in. line has been completed from the Hogshooter district, south of Bartlesville, to Joplin. The Portland Gas and Pipe Line company has just completed a pipe line, from the same area in Oklahoma, to Iola, for the purpose of supplying gas to the various cement plants controlled by the Iola and the United Kansas Portland Cement Companies.

No new remarkable discoveries of gas were made throughout the year. In many places, particularly in Kansas, drilling was moderately active around the borders of the old gas fields, and an amount of new gas was developed which, were the demand not so great, would have been quite satisfactory. But, with the demand as great as it is, the in-

creased production did not equal the decrease in capacity of old wells. As a result, almost every large manufacturing establishment in the entire area has begun using oil for fuel, in part, and there is a general sentiment that the price of gas will advance until factories will be driven to oil entirely. Should the demand for oil become sufficiently great to force prices to a level with that paid for like grades of oil elsewhere, it would seem that the price of fuel oil likewise would advance, compelling factories virtually to go to a coal basis within the next few years.

The Kansas Natural Gas Company remains by far the largest consumer of gas. All through last winter, and thus far this winter, complaints have been made, particularly at Kansas City, that the supply of gas is inadequate, and the city authorities of Kansas City are now threatening radical measures should the gas company not deliver more gas to the consumers. The best engineering authorities, however, are of the opinion that no matter what the supply may be in the fields, the pipe lines connecting with the consumers on the north are inadequate to carry more gas than they are now delivering, and that no marked relief can be obtained without increasing the pipe-line capacity in this field.

## Petroleum in Illinois in 1910

By Raymond S. Blatchley \*

Illinois again resumed continuous growth in oil production in 1910, after the relapse of 1909. The estimated production for the year is 35,000,000 bbl., as against 30,898,339 in 1909, and 33,685,106 in 1908. The increase was due indirectly to general market conditions and the ability of various pipe lines to cope with the supply. The introduction of new pipe lines into the field late in 1909 materially aided in the increased activity. The basis of estimating the production, since only 11 months' returns are available, was to assume the December runs of the Ohio Oil Company equivalent to those of November—the tank-car shipments being about 2,000,000 bbl., and miscellaneous pipe-line runs outside of the Ohio Oil Company being 4,680,000 bbl. The latter runs were based upon a daily average of 12,000 bbl. for the first six months, 16,000 bbl. for the next three months, and 12,000 bbl. for the last three months of the year. The total estimation, therefore, reaches 35,000,000 bbl. The ac-

\*Geologist in charge of oil studies, State Geological Survey, Urbana, Ill.

companied table gives the pipe-line runs of the Ohio Oil Company by months, according to the *Oil City Derrick*.

The pipe line runs are those of the Ohio Oil Company, the Tidewater Pipe Line Company, and the Indian Refining Company. The tank-car shipments are those of the Sun Oil Company, Complanter Refining Company, the Indian

#### RECEIPTS OF THE OHIO OIL COMPANY, 1910.

January.....	2,226,108
February.....	1,980,408
March.....	2,382,806
April.....	2,314,789
May.....	2,389,994
*June.....	2,399,606
July.....	2,638,253
August.....	2,572,859
September.....	2,447,106
October.....	2,373,325
November.....	2,245,676

\*Includes oil in iron tankage purchased.

Refining Company, the Missouri-Illinois Oil Company, Central Refining Company, W. F. Watson, Bridgeport, Ill., and railroad shipments from Sparta, Ill.

The prices of the two general grades of oil remained steady during the year. Oil of gravity over 30 deg. B. commanded 60c. per bbl., and under 30 deg. B., 52c.

per bbl. But little oil under 30 deg. B. is marketed in Illinois.

#### THE SOUTHEASTERN ILLINOIS OILFIELDS

The Clark county and adjoining shallow oil areas are almost inactive. But little drilling was done during 1910. One profitable deep test was drilled by the Ohio Oil Company on the K. and N. E. Young farm, near Casey, Ill., to a depth of 2969 ft. Oil and gas of considerable sulphur content were found at 2750 ft. in what is seemingly the Trenton limestone. The combined daily output of the Clark, Cumberland and Edgar county wells was about 9000 barrels.

Considerable drilling in Crawford county failed to prevent the decline of new production over 1909. The drilling was chiefly scattered over the entire pool during the greater part of the year. In the later months a concentration of development took place in the Bellair-Licking area, where new productive sands between 1000 and 1100 ft. were found. Many good wells were completed. The average well in the county is far below the previous initial yield, indicating the inevitable decline. The yield reached



about 30,000 bbl. daily in 1910, as against 100,000 in 1907.

Highly profitable but expensive drilling took place in Lawrence county, where seven distinct sands produce oil in varying quantity and grade. They lie between 750 and 1900 ft. and in order are, the Bridgeport No. 1 and No. 2 sands, from 750 to 900 ft. deep; the Buchanan

and Wabash counties but without any showing of oil except in Gallatin county, where the amounts were small and insignificant. The area in Richland, Wayne and Clay counties lie on or near the axis of the Eastern Interior coal basin.

SOUTHERN-CENTRAL AND WESTERN ILLINOIS

The best recent results from wildcatting took place in Marion county during 1909-1910. The new Sandoval field of four wells in 1909 increased to 35 producing wells yielding over 3000 bbl. daily, 16 dry holes and 22 drilling wells on Dec. 1, 1910. The oil comes from a sand in the Chester formations of the Mississippian series of rocks, known as the Benoist sand, and which has been determined equivalent to the Kirkwood sand of Lawrence county. Its average depth is about 1550 ft. A second pool was opened up during 1910 near Centralia, several miles south of the Sandoval area. Four light producing wells and several dry holes have been drilled. The productive sand is the same that is found near Sandoval. The two fields seem to lie along an irregular terrace upon the broad and gentle western flank of the Illinois basin. The general trend is to Duquoin, Illinois, on the south, and Brownstown and Pana to the north. Much drilling is contemplated along this area.

oil and gas along the Sandoval-Duquoin terrace, especially in Washington and Perry counties. The accompanying tables compiled from the *Oil City Derrick* show the development in Illinois during 1910.

On Jan. 1, 1910, it was estimated that 16,497 wells had been drilled in Illinois. Of these 2379 were barren. In the first 11 months of 1910, 1937 wells were drilled, with 430 of them barren, bringing the total up to 18,434 drilled and 2809 barren. The resulting dry wells amounted to 15.2 per cent.

WELLS DRILLED IN ILLINOIS DURING 1910.

Month.	Wells Completed.	New Production, Bbl.	Dry Holes.	Average Initial Production, Bbl.
January.....	111	5,331	17	56½
February.....	158	6,840	43	58½
March.....	128	5,593	29	56½
April.....	157	7,260	41	62½
May.....	192	8,091	43	54½
June.....	211	9,267	50	57½
July.....	172	6,386	43	49½
August.....	235	10,042	47	53½
September.....	234	8,419	48	45½
October.....	198	10,133	30	60½
November.....	177	8,832	39	64
Total.....	1,973	86,194	430	...

sand, 1275 to 1400 ft.; the Kirkwood sand, 1550 to 1650 ft.; the Tracy sand, 1700 to 1750 ft.; the McClosky sand, 1825 to 1860 ft., and the Green, Henry and Pepple sands from 1850 to 1910 ft. deep, possessing a few wells each within narrow limits. The McClosky and Tracy sands are the richest developed in Illinois. The former is found in the southern part of the deep field and the latter in the northern portion, in what is known as the King-Applegate pool. The chief activities of the year were in the two above mentioned sands. Most all of the wells from these sands produced, initially, between 500 and 2000 bbl. A short-lived impetus was given to the Lawrence county area early in the year, when a new pool was tapped on the outskirts of Lawrenceville, two miles or more from the active fields. Two wells of 100-bbl. yield were drilled, but several sur-

The Lima Oilfield

By H. C. GEORGE\*

The production of the oil pools of northwestern Ohio and eastern Indiana, known as the Lima oilfield, has declined steadily for several years. The total production in 1910 was 5,171,000 bbl. as compared with 6,192,000 bbl. in 1909; 7,287,000 bbl. in 1908 and 8,030,000 bbl. in 1907. During 1910 there was a considerable increase in new production from Indiana, but the old wells have been abandoned in such numbers that the total production has shown a decline. The year 1910 also showed a marked decrease in

PRODUCTION OF WELLS DRILLED IN THE LIMA FIELD IN 1908, 1909 AND 1910.

	Number of Wells Drilled.			Daily Production in Barrels.			Daily Production in Barrels per Well Drilled.			Per Cent. of Dry Holes.		
	1908.	1909.	1910.	1908.	1909.	1910.	1908.	1909.	1910.	1908.	1909.	1910.
Northwest Ohio..	837	917	573	9,252	7,771	6,344	11.0	8.4	11.1	9	9.6	13.4
Northwest Indiana.....	413	304	363	3,405	3,852	8,010	8.2	12.6	22.1	19	27.3	19.0
Total.....	1,250	1,221	936	12,657	11,623	14,354	10.1	9.5	15.3	13.5	14.0	15.7

A new gas area was tapped early in 1910 near Greenville, Bond county. The sand was found between 950 and 1000 ft. and was correlated with the Benoist sand of Sandoval, and the Kirkwood sand of Lawrence county. The wells yielded from 1,250,000 to 2,000,000 cu.ft. of gas daily. A recent test was put down on the Brown farm, near Pocahontas, Bond county, that secured an initial production of about 25 bbl. at a depth of 1975 ft. The oil is, apparently, in the Niagara limestone. Much drilling is being done at present in an effort to develop both the gas area and the lower oil measures.

WILDCAT WORK IN WESTERN ILLINOIS

Several light-pressure gas wells were drilled near Jacksonville, Morgan county, during the year. The yield came from a depth of about 300 ft., was odorless and colorless, but burned with a hot, blue flame. Several barren wells were drilled in Jefferson, Washington, Perry, Monroe and Clinton counties. Much new drilling was started late in the year in search of

the number of wells drilled and an increase in the percentage of dry holes.

The average price paid for North Lima oil in 1910 was 83c. per bbl. as compared with 91c. per bbl. in 1909; \$1.03 per bbl. in 1908 and 93½c. per bbl. in 1907. South Lima oil has brought 5c. per bbl. less in each of these years. The accompanying table gives the new production in detail.

Gold in Germany

The Berlin correspondent of the *London Economist* reported the discovery of gold ore in the Eifel region, near the Belgian frontier. The deposit appears to be extensive, although exploration work is as yet too little advanced to speak in definite terms of the quality or amount of the ore. It is mentioned that one boring struck the reef at 8 ft. from the surface. The ore is described as of good paying quality, though exact analyses are as yet lacking.

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WELLS DRILLED DURING 1910 IN DIFFERENT COUNTIES, ILLINOIS.

County.	Wells Completed.	New Production.	Dry Holes.
Lawrence.....	606	55,435	88
Crawford.....	1,133	25,222	238
Clark.....	107	1,700	30
Cumberland.....	15	162	2
Edgar and Coles.....	6	65	2
Marion.....	53	3,540	23
Miscellaneous.....	53	70	47
Total.....	1,973	86,194	430

rounding dry wells discredited the area. The average daily yield of the Lawrence county area was between 45,000 and 55,000 bbl. Both "sour" and "sweet" oils were produced, but each was handled separately.

Considerable wildcatting was done several miles west and south of the present fields in Richland, Clay, Wayne, Gallatin

# The Coal and Coke Industry in 1910

By Floyd W. Parsons

The last three months of 1910 were the best months of the year for coal operators. November and December brought continued cold weather and stimulated the domestic trade. In spite of the business lethargy, which was more pronounced at the close of the year, the demand for steam coals was quite brisk. There was a marked difference in the conditions governing the coke industry at the close of 1910, when compared with the last months of 1909; in the former period, the steel business was good and coke prices had advanced to \$3 a ton at the ovens. Coke prices at the end of 1910 were in the neighborhood of \$2 at the ovens, with the demand slack.

In the latter part of 1909, the coking industry was greatly hampered by a lack of labor and a scarcity of water. Shipments were also handicapped by a shortage of railroad cars. In 1910, the year closed with labor conditions reversed; in November and December, there was a considerable exodus of laborers from the Pennsylvania coke regions, many of these people returning to European countries. Nothing whatever was heard, during the year, of any extended plans for a consolidation of coke manufacturers, such as was contemplated in 1909. Coke manufacturers are tending more and more to the better practice of saving by-products, which plan means the gradual abolishment of beehive ovens.

## THE YEAR A BANNER ONE

Taking a broad view of the coal industry throughout the United States in 1910, the year must be regarded as the best in history. More coal was mined and more companies made money in 1910, than in any previous year. This was true notwithstanding the fact that the year was a decided disappointment in a business way. It is also true that a considerable part of the general prosperity in coal mining that occurred in many districts, was due to the protracted strike in Illinois and the central western States. It is evident, therefore, that the gain of some was accomplished through a loss by others.

The States showing good gains in 1910, were West Virginia, Indiana, Ohio, Alabama, Colorado, New Mexico and Utah. West Virginia came close to the 60,000,000 ton mark, and ranked second as a producer. For the first time in their history, Alabama produced 15,000,000 tons; Indiana 15,000,000 tons, and Colorado 12,000,000 tons. It also appears that Pennsylvania showed a material increase in output over that reported for 1909.

## THE ILLINOIS PRODUCTION

It appears now that the output of coal in Illinois for 1910, will show a smaller falling off, if any, than generally anticipated. The strike in Illinois, lasting five months, affected all districts except the fifth and ninth, which districts withdrew from the operators' association. As the Illinois Operators Association now stands, it controls only 63 per cent. of the State's production, while in 1904, it controlled the entire output. Assuming a normal production in Illinois to be 52,000,000 tons annually, the association controls an output of less than 33,000,000 tons. Since the mines in Illinois resumed, after losing in their controversy with the miners, the operators have been generally handicapped by a shortage of cars and labor.

Labor troubles occurred in many districts in 1910, but were of short duration except in Illinois, and the southwestern States, (Kansas, Arkansas, Missouri and Oklahoma). The Iowa miners were on strike for six weeks, but the demand for coal during the remainder of the year was so good that the year's production will show a material increase. In practically all of the coal-producing States, the miners received a wage increase of about 5.55 per cent. Colorado was an exception, the rate of wages remaining the same. Only two counties in Colorado are organized, and the miners in these two counties (the northern lignite field) have been on strike the greater part of the year; the lignite mines are being operated now with nonunion labor.

## THE ANTHRACITE PRODUCTION

The anthracite production in 1910, showed an increase of about 3,000,000 tons over 1909, and was slightly greater than the production reported for 1908. The anthracite industry is now established on such a substantial basis that the markets and general trade are no longer subject to the violent fluctuations that occur in other lines of business. A slackening in the steel business is immediately reflected in coke demand and prices, while any depression in general manufacturing is soon attended by a slowing-up in the steam-coal trade.

If the bituminous-coal business throughout the entire United States could be placed on a basis such as governs the hard-coal trade, the greatest step toward the conservation of our fuel resources would be accomplished. Unsatisfactory and inefficient methods of mining bituminous coal have been due more to the killing competition that has existed, than to any other single cause. When an oper-

ator has difficulty in breaking even, financially, on his year's work, he is not going to exert himself, and add additional expense in the installation of precautionary measures about his mines. Therefore he gambles with fate, and offers a daily prayer that the next disaster will not strike at his door. Most operators have in their minds what they would like to do to increase efficiency and safety, but they lack the price. It is not ignorance, but necessity. If all our miners were as anxious to work in safe mines as most operators are to have safe mines, many practices, including solid-shooting, would be abolished, and general conditions bettered.

## THE REGULATION OF PRICES

At several recent conventions of coal men, discussions have ensued relative to the control of coal prices. There were those who advocated amending the Federal anti-trust laws, so as to permit selling arrangements, claiming that the result would be beneficial because of fewer accidents and better fuel conservation. One other matter of legislation that must come eventually, is an employer's liability act. Various plans have been suggested, those based on the creation of a liability fund through the collection of a definite and proportionate tax from each coal operator, having greatest merit. There is also an important move under way, looking to the appointment of each State mine inspector, rather than the general election of such an official.

Practically all of the important coal States are engaged in the revision and enactment of new mine laws. State commissions were appointed in Alabama, Illinois, Colorado and Oklahoma, and these bodies have carefully examined existing conditions and laws, and have suggested many changes that will certainly make our mines safer. Notwithstanding the added expenses brought about, the operators have aided in the revision of existing laws, and in all districts there appears a marked willingness to comply with new rules in every particular.

## THE PREVENTION OF MINE ACCIDENTS

The principal topic of discussion at the different gatherings of coal-mining men in 1910, was the cause and prevention of mine accidents. There were those who advocated high-velocity air currents as a cure for gas explosions, while an equal number favored slow currents, claiming that large volumes of air passing through a mine raised the dust and increased the likelihood of dust explosions. There is no doubt but that some mines are over-



doing their ventilation in sending more air underground than is necessary; however, it is wrong to believe that a great volume of air going down a shaft, or into an entry, always reaches the men at the face. The ideal solution is brought about by having sound brattices, good over-casts, properly regulated doors and a system carefully planned with numerous splits. When a mine provides 100 cu.ft. of air per minute for each man employed at every remote face, the ventilation is sufficient in nine out of ten cases. Less air than the law requires is dangerous, and more air than is specified by law is unnecessary and perhaps also adds to the dangers from dust. It is quality of ventilation that counts more than quantity.

There are those who are opposed to sprinkling underground, claiming that it causes fatalities through falls of roof. This subject has been well investigated by experienced engineers in America and Europe; the results show sprinkling to be beneficial whether applied as a spray through a nozzle, or when exhaust steam is introduced into the intake air. Mr. Haas, of the Consolidated Coal Company, has investigated the subject of dampening dust at 40 of his mines, and states his belief that the effect on the

roof is not nearly as great as the opponents of sprinkling claim. Mr. Haas further adds that by introducing moisture underground in the form of exhaust steam, he has effected an annual saving of many thousands of dollars, as compared with what sprinkling the same mines with sprays or hose would cost. After a careful reading of the results obtained in European countries, it does appear that stone dust or powdered shale is the agent to use to prevent dust explosions. Coal dust with only 30 per cent. of shale mixed in, is difficult to explode, and with 50 per cent. stone dust, the coal is rendered harmless. Stone dust will not exaporate and is an inexpensive agent. It should not only be sprinkled on the roadway, but should be thrown on the sides and roof to dislodge any coal dust accumulated there.

GREAT ADVANCES IN KNOWLEDGE

There has been a greater advance in the solution of coal-mine problems the past few years than ever before. Explosions still occur, it is true, but the beneficial effects of remedial measures are sure to be felt eventually. The adoption of permitted explosives in most mines was a step forward, and the next move must be the use of safety lights under-

ground. In a decade, it is certain that many, if not all States will have abolished the naked light entirely. Compressed-air motors and mining machines are being placed in some of our newer operations, and hydraulic mining cartridges have successfully supplanted powder in a number of mines. With no flame of any description underground, with a well protected roof, and properly regulated haulage, some of our mining companies will have eliminated the greatest dangers now extant.

THE FEDERAL BUREAU OF MINES

The year 1911 should bring greater advancement in coal production and in the solution of mining problems than any previous 12 months. The Federal Bureau of Mines is now well organized, and the work is being carried forward by competent men according to an intelligent and popular plan. The rescue cars have proved a valuable adjunct to the work of the Mines Bureau, and the engineers and men in charge have demonstrated their worth at all of the recent mine disasters. Those employed in the new Bureau of Mines have the confidence of the coal-mining industry, and the maximum efficiency of the department is thereby insured.

# The Bituminous Coal Trade in 1910

By John H. Jones\*

The year 1910, notwithstanding the uncertainty of mining conditions and the apparent unrest throughout the country, will show a production of coal greater than any year in the history of the country, unless it be 1907. When we stop to consider that 60 years ago this country produced but 7,000,000 tons, and that in 1910 it produced between 450,000,000 and 500,000,000 tons, we cannot help wonder at the great growth shown. In spite of the fact that many of our manufacturing industries did not operate as fully as in 1909, the consumption of coal in other lines—such as manufacturing gas, producing electricity, coal used by the railroads and in the homes of the people, etc.—showed a remarkable increase, so that the production of 1910 was large.

The business prospects for 1911 are such that I feel confident that the production will pass the half-billion mark. During January and February (pending the settlement of the freight rate controversy by the Interstate Commerce Commission) conditions will be rather quiet, but immediately upon the announcement of a favorable decision, I am confident the

railroads will go into the market and purchase their requirements and will not hesitate to arrange for extensions and betterments which are absolutely necessary, and which, in many cases, have been held back for years on account of the antagonistic attitude of the people toward the transportation lines.

It will be noted that the 1910 lake tonnage is the largest in the history of the country. The wonderful prosperity in the Northwest, brought about by good crops, and its great industrial activity, should cause another increase in 1911.

The majority of the operators in this country are sparing no efforts to provide

LAKE TONNAGE FROM ALL DISTRICTS.

Year.	Pittsburg District.	Ohio District.	West Virginia 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
1909	8,687,395	3,002,815	3,874,570	15,564,690
1910	11,911,900	4,297,300	6,629,500	22,838,700

PITTSBURG DISTRICT PRODUCED ABOUT 50,000,000 TONS

The production in the Pittsburg district in 1910 was about 50,000,000 tons, and 1911 should surpass this. General mining conditions are favorable toward a good production in 1911, inasmuch as the miners' scale has been settled and does not terminate until April 1, 1912.

Accompanying table shows lake tonnage from all districts for the last 10 years:

every known safeguard for the health and safety of their employees. The best thoughts of the world's greatest mining experts are bearing on the problems confronting the mining industry. The Government Testing Station, in Pittsburg, has done great good, and I believe that with the progress that has been made, the United States will continue to lead the countries of the world in the low mortality rate per million tons of coal mined.

\*President, Pittsburg - Buffalo Company, Pittsburg, Penn.

The following table will show that we now head the list (with great room for improvement):

LIVES LOST PER MILLION TONS OF COAL PRODUCED.

United States.....	3.84
Great Britain.....	4.15
Germany.....	6.35
France.....	6.56
Belgium.....	5.71
Austria.....	8.16

Conditions in coal mining as yet unrecognized and unknown, are rapidly being discovered and overcome. For instance, modern sanitary requirements demand sufficient air to give every man in the mine enough to breathe and to carry off the foul air and gases, but an overabundance, in case of a slight explosion at any point, is liable to render such explosion serious on account of the dust it carries in suspension.

A TAX ON EMPLOYERS OF LABOR

On a number of occasions I have recommended that a tax be placed on the pay rolls of employers of labor, to be deposited in a special fund to be administered by the Government upon a certain basis, so that in case of an accident causing the loss of the head of a family, enough money would be paid to the widow, children and other dependents to take care of them and educate and rear the children properly.

Great strides have been made in mining knowledge, but the personnel of the men in charge and the men employed is the great factor in the safe working of the mines. The fact that a man has been careless a hundred times and escaped injury breeds within him a contempt for the ever-present danger, and sometimes

causes a reckless disregard not only for his own safety but for the safety of others. This is a factor most difficult to overcome.

It is manifestly impossible to prevent all accidents, but we must figure out the best methods of reducing them to a minimum. Eighty-five per cent. of all accidents in the mines result from causes other than gas or dust explosions, or blown-out shots, and when it is taken into consideration that more than 50 per cent. of these could be prevented by ordinary care on the part of the injured person, it can readily be seen what effect a more rigid police regulation will have in the future coal production of this country.

Our State mine inspectors are clothed with police power and have all risen by their ability from the ranks of the miners, and they have, by the careful study of mining conditions, fitted themselves for their present positions. They are constantly studying to improve conditions and methods, and if we will all cooperate (mine inspectors, miners and operators) it will only be a short time until this country will be able to show a much lower proportion of accidents to the number of men employed.

THE RESULT OF IMPROPER MINING

In this country, a great deal of coal is lost on account of improper mining. In some districts from 30 per cent. to 50 per cent. of the coal is lost, and no pretense whatever is made to recover it. The cheapest methods of mining are employed so that the coal can be placed on the market at competitive prices. In many cases, the amount saved by such methods will more than overcome the

coal lost in mining. A law for the conservation of coal lands should be enacted, and some method of mining adopted which will compel the companies to mine their coal in a systematic manner; but in doing this it would be absolutely necessary to enact laws which would enable the operators to pay the miners living wages, and at the same time secure the prices for their coal necessary to enable them to mine it in such a way that the coal now unmined would be conserved to posterity.

In Germany, and many other countries, the producing and selling of coal is handled in such a way that the operator is always assured of a certain margin of profit, and in this way it is possible to conserve the coal for future generations, by the consumer paying a price (under the supervision of the Government) high enough to enable the operators to take out (as near as practicable) every pound of coal. This method might not be popular in this country, but it certainly would be practicable.

When the new mining laws are enacted, the mine foremen and fire bosses (better known as State officials) should be given more rigid police power, so that in case a miner or other employee inside the mine should fail to carry out the instructions of the mine foreman so that his own or other lives may be jeopardized by his failure so to do, the mine foreman or other State official should have power to arrest such employee, and his decision in the matter should be final, subject only to reversal by the courts. It is just possible this may be arbitrary, but such a law would help to minimize the number of accidents in our mines.

## The Pittsburg District in 1910

By B. E. V. Luty \*

The year 1910 in the Pittsburg coal trade was better than 1909 and 1908 in tonnage and earnings, but fell short of 1907 in both respects. We estimate the total tonnage of the largest local shipper, the Pittsburg Coal Company, at 15,500,000 tons, this being based upon official returns for the first nine months, making the following comparison:

PRODUCTION OF PITTSBURG COAL COMPANY.

1905.....	14,499,931	1908.....	13,217,545
1906.....	18,175,280	1909.....	14,560,231
1907.....	18,005,382	1910.....	15,500,000

The Monongahela River Consolidated Coal and Coke Company, for the nine months ended Aug. 31, showed a production of 3,620,167 tons of river coal and 1,875,839 tons of rail coal, a total of 5,496,006 tons; this indicates a loss of 99,828 tons in river coal and a gain of

1,161,134 tons of rail coal or a gain of 1,061,306 tons in total coal, as compared with the same months a year earlier.

The production of the various independent companies increased largely in nearly all cases from 1909 to 1910, and the coal mines connected with steel interests showed large increases.

The biennial wage scale expired March 31, 1910, and after a suspension of about 30 days, an agreement was reached except as to the gassy mines, the details for which were left to subsequent experiment and settlement. The general mining rate was advanced from 90 to 95c. with an advance of 5.55 per cent. on day rates, the scale to expire March 31, 1912.

COAL PRICES MORE SATISFACTORY

Prices were on the whole considerably more satisfactory than in 1908 and 1909.

In 1909 the open-market prices averaged close to \$1.05 for mine-run during the first nine months of the year, jumping to an average of about \$1.15 in the closing three months. In 1910 the \$1.15 average was practically maintained during the first three months. After the wage advance prices jumped to \$1.20@ \$1.25, but in November, at the close of the lake shipping season dropped to about \$1.15, so that the spread between the wage rate and selling price was lower at the close of the year than at the opening, although the average spread was slightly higher in 1910 than in 1909. Many term contracts, like the large one between the United States Steel Corporation and the Pittsburg Coal Company, are on the basis of a differential above the prevailing mining rate. The coal companies made considerably more money in

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1910 than in 1908 or 1909, but the increased earnings were due in greater measure to an increased tonnage rather than to any betterment in the price obtained for the coal.

The Pittsburg Coal Company's earnings in nine months ended Sept. 30, were as follows: 1907, \$2,109,049; 1908, \$1,352,228; 1909, \$231,600; 1910, \$1,333,562.

The Mononogahela River Consolidated Coal and Coke Company, for nine months ended July 31 showed gross earnings, 1909, \$1,562,052; 1910, \$1,475,469; net earnings, 1909, \$260,820; 1910, \$112,598.

The event of 1910 in coal transportation was the closing, in January, of a 99-year traffic arrangement between the Western Maryland and the Pittsburg & Lake Erie (New York Central), pursuant to which work was started upon a 93-mile single-track connection between the Pittsburg, McKeesport & Youghiogheny, of the New York Central, at Connellsville, to the Western Maryland, at Cumberland, to afford an outlet to seaboard for coal originating on the Pittsburg, McKeesport & Youghiogheny Railroad.

RIVER SHIPPING CONDITIONS WERE POOR

In 1907 there was water for shipment to lower-river markets in every month; in 1908 there were no shipments in the second half; in 1909 there were shipments in October, and in 1910 there were no shipments in the second half, except that in November, the Government created an artificial rise by letting down dams in succession, whereby about 110,000 tons lying in the fifth and sixth pools were moved to lower river points. The

year closed with 5,000,000 bushels lying in the Pittsburg harbor waiting water and the river mines running slack.

CONNELLSVILLE COKE

The year 1910 was one of bitter disappointment to the Connellsville coke industry. The price of coke had been boomed in the closing months of 1909, in the belief that owing to constantly expanding blast-furnace operations there would not be enough coke to go around. Asking prices on standard grades of Connellsville furnace coke on contracts for 1910 were pushed up to \$3, and a small tonnage was sold in October and November at close to this figure. As a rule the furnaces refused to contract at such prices. Some compromises were made

PRICES OF CONNELLSVILLE COKE.

	Furnace.	Foundry.
January.....	\$2.60	\$3.05
February.....	2.25	2.75
March.....	2.00	2.60
April.....	1.80	2.40
May.....	1.70	2.25
June.....	1.65	2.20
July.....	1.65	2.15
August.....	1.65	2.15
September.....	1.60	2.15
October.....	1.55	2.10
November.....	1.45	2.00
December.....	1.50	2.00

through ratio contracts, the monthly settlement price being a fraction of the market price of pig iron, while some furnaces turned to other cokes. During the first few months of the year, the Connellsville operators waited for other furnaces to come into the market, finally realizing that furnace wants fully as large as the most optimistic expectations, had been satisfied without any pressure at all being put upon the productive capacity of the Connellsville region.

Prices of prompt furnace and foundry

coke, per short ton at the ovens, were substantially as shown above.

During the 10 years preceding 1910, prices averaged approximately \$2.25 for furnace and \$2.50 for foundry. In all cases the best grades of foundry coke commanded higher prices than those given as the average for fairly good brands.

Production in the Connellsville and Lower Connellsville regions, not including the "Upper Connellsville" (Latrobe) region, has been as follows, using the U. S. Geological Survey figures as far as available, with the Connellsville *Courier's* estimate for 1909 and our own estimate for 1910.

CONNELLSVILLE COKE PRODUCTION.

Year.	Short Tons.
1905.....	15,236,387
1906.....	17,245,975
1907.....	19,400,327
1908.....	11,133,173
1909.....	17,785,832
1910.....	20,000,000

The 1910 production was divided as follows: First quarter, 6,000,000; second quarter, 5,200,000; third quarter, 4,700,000; fourth quarter, 4,100,000; total for 1910, 20,000,000.

In the second half of 1910, many contracts were made on a ratio basis, for periods of from six months to three years, beginning Jan. 1, 1911, and it is safe to say that on that date there was at least twice as much coke under contract for the ensuing six months on a ratio basis as at a flat price. The Bessemer basis was gradually abandoned and almost all the ratio contracts were referred to basic pig iron at valley furnaces. The basis for ratio contracts with basic iron generally ranges from 7:1 to 8:1, and customarily there are upper and lower limits beyond which the price of coke cannot range.

# The Chicago Coal Market in 1910

By E. Morrison

The most important and significant feature of the year 1910 to Chicago's wholesale coal dealers was the strike that completely stopped the production of coal at the Illinois mines from April 1 until the first week in September. These mines, normally, provide the city and its wholesale territory with 75 per cent. or more of their fuel supply, and predictions were freely made, in the early stages of the strike, that the closing of the mines would cause a wide suspension of business. Yet nothing of the kind occurred; though manufacturers and other consumers of large quantities of coal were forced to pay higher prices, they got the coal they needed, and to all appearances could continue to get it, indefinitely, from mines outside the State. Most of the substitute supply came from

Indiana, where the mines were worked to their full capacity; the rest came from mines east of Indiana. After the middle of September, to the end of the year, normal conditions prevailed.

At the opening of the year coal moved slowly because of weather that made railroad operations difficult. In the northwest the switchmen's strike also delayed shipments. Lump sold at premiums of 25@50c. in the first half of the month. A strong demand for screenings was one of the peculiarities of the first half of the year's business. In previous years screenings were considered a summer fuel; it became evident in 1910 that they are to be the favorite size of Illinois and Indiana steam-coal users. Screenings sold at \$2@2.50 in the middle of January and until October they remained as high

as or higher than run-of-mine. The difference was in part due, no doubt, to conditions of production that made fine coals scarce, but they are coming more and more into use with the increase in the number of furnaces designed to burn them economically and smokelessly.

CONSUMERS ANTICIPATED A STRIKE

Throughout February and March sales for steam and domestic purposes were large and supplies abundant. In March the demand for all kinds of western bituminous was large, owing to anticipation by retailers and consumers of the strike that went into effect April 1. The laying in of supplies was so large that not until May were the Indiana mines drawn on generally for the Chicago market. In March and April little steam

coal moved to consumers, and the domestic demand naturally fell off heavily. Early estimates that consumers had enough in storage piles for 30 to 60 days fell short of the truth; in many cases the supply was ample for 90 days. The mines used up their surplus in April and in May a coal market hardly existed, so small was the supply.

The naturally light summer demand was chiefly for screenings and kept the price of this size high. Eastern coals were shipped into the Chicago market in large quantities and were bought largely, but were not popular enough to suit shippers and dealers who expected that a lack of supplies from Illinois would give them a large and profitable market. The eastern coals were too high priced to compete with Indiana coals. By the employment of many of the striking Illinois miners, the Indiana operators were enabled to send large shipments to the Chicago market that sold at high prices, yet much lower than the prices of smokeless or Hocking coal.

Because of the high prices of Indiana coal as compared with Illinois, consumers bought closely to their immediate needs and watched closely for signs of the end of the strike and the resumption of receipts from Illinois mines. Shortly before Sept. 1, it became evident that peace between operators and miners was in sight and buying fell off markedly. The Southern Illinois mines, opening first, sent their products in so as to lower prices gradually. By the middle of September sales of Indiana and Eastern coals fell off notably and the receipts from Illinois were abundant.

By the middle of October mild weather and large supplies made the market somewhat dull. Domestic coals began to strengthen early in November and there was much early buying for winter storage. In the latter half of November the coal-carrying roads established freight rates higher by 10c. a ton on Indiana and 7c. on Illinois coals, and these advances were shifted to wholesale and retail prices.

The accompanying table shows the range of car prices of Illinois and Indiana coals, by months, throughout the year.

#### PRICES FOR EASTERN COALS

Smokeless, the most important of eastern coals, varied in price considerably as a result of the scarcity of western bituminous. Early in the year it was at times high priced because of transportation delays, lump selling as high at \$4 and run-of-mine up to \$3.50, against normal prices of \$3.65 and \$3.30. In the late spring and early summer smokeless sold ordinarily at 10c. @ 15c. less and in the autumn it rose again, September prices being \$3.80 on lump and \$3.30 on run-of-mine, while after October 1 smokeless lump commonly brought \$3.95. Hocking sold at \$3.15 until September,

when it was advanced to \$3.25 and brought \$3.40 during the last three months of the year. Shipments of Eastern coals were more nearly in accordance with the demand during the last half of the year than during the first half, but at no time was there a recurrence of

PRICES OF ILLINOIS AND INDIANA COALS IN 1910.

Month.	Lump and Egg.	Run-of-Mine.	Screenings.
Jan...	\$2.75@3.50	\$1.75@2.50	\$1.50@2.50
Feb...	2.00@3.00	1.75@2.25	1.60@2.00
March...	2.20@2.50	2.00@2.25	2.00@2.25
April...	2.25@2.75	2.20@2.50	2.15@2.60
May...	2.25@2.50	2.20@2.50	2.15@2.60
June...	2.00@2.60	1.90@2.40	2.00@2.50
July...	1.90@2.10	1.90@2.10	2.00@2.20
Aug...	2.00@2.15	1.90@2.00	1.90@2.15
Sep...	2.50@3.25	2.25@2.50	2.20@2.40
Oct...	2.10@3.25	1.90@2.10	1.40@1.60
Nov...	2.10@3.25	1.90@2.20	1.40@1.75
Dec...	2.20@3.50	2.00@2.30	1.50@1.90

the wave of price demoralization that followed excessive shipments in some preceding years. Anthracite sold at the same prices as in former years, the distribution in the spring and summer months being light but uniformly distributed. The scarcity of chestnut caused advancement of the price 25c. in November, without checking noticeably the strong demand for this size, which was in short supply throughout the year.

## Alabama Coal Industry in 1910

BY L. W. FRIEDMAN

After the early part of the summer in 1910, there was an active production of coal not only in Alabama but other Southern States. The coal strike in the Middle West and Western States brought about a demand at Southern mining centers that gave the trade an impetus that has been constant ever since. As a consequence, there is every belief that the banner production for twelve months has been made. Another factor in the activity that has prevailed throughout the mining sections in the Southern territory during the past year was the upbuilding of the coal trade at New Orleans and other southern ports, until today thousands of tons of coal are being rushed daily by rail and otherwise to these ports to supply ships and other consumers of fuel, the Alabama, Tennessee and other Southern product having been thoroughly tested.

Heretofore Alabama's record output for a year was made in 1907, when 14,250,454 tons of coal were accounted for. The two following years saw a reduction in the production, the slump in general conditions which started in during the latter part of 1907 being felt in this part of the country as well as elsewhere. Estimates made, based on the production of 1907, by Chief State Mine

Inspector James Hillhouse and others in a position to know, place the output for the year 1910 at above 15,000,000 tons.

#### CAR SHORTAGE

During the last two months of the year and longer, some interference with the activity at collieries throughout Alabama and in other States was felt by the railroad-car shortage. Had this not been a fact, it is believed the production would have gone up another quarter of a million tons at least.

But few months of the year 1910 saw a curtailed production at mines in Alabama in the fullest sense of the word. The labor situation was fairly good throughout the year, though at some places there were efforts made to get in more labor. The coal production with convict labor was steady.

Not only was there a better demand with its consequences, a larger output, but the prices for the product were better during the closing months of the year. It is also a fact that the year finished up with stronger conditions in this regard than ever before.

The coke production during 1910 in Alabama and other Southern States will show an increase also when the official figures are made public a few weeks hence. The banner production of coke in Alabama was also in 1906 when 3,217,068 tons were produced. The two following years saw a reduction, 1909 being given credit for 3,047,510 tons. It is estimated that the production in 1910 went above 3,300,000. For several months during 1910 the coke ovens were in full operation and some coke was accumulated, but the accumulation was soon worked off.

## Coal Mining in Michigan in 1910

BY R. H. FLETCHER\*

It appears from the data already at hand, that the coal industry in Michigan in 1910, showed no increased activity, in development or production, over 1909.

#### SUMMARY OF COAL MINING IN MICHIGAN FOR THE YEAR ENDED DEC. 1, 1910.

Average number of mines in operation in 1910.....	19
Average number of employees.....	1974
Average number of hours worked per day.....	7.5
Average number of days worked per month.....	19.5
Average daily earnings of each employee.....	\$3.25
Aggregate sum paid in wages.....	\$1,502,891
Total number gallons of oil used.....	23,993
Total number kegs of powder used.....	42,427
Aggregate tons of piked coal mined.....	678,459
Aggregate tons of machine coal mined.....	457,761
Aggregate cost of output.....	\$2,082,135
Average cost per ton.....	\$1.82

The accompanying summary shows in detail the state of the industry during the year.

\*Commissioner of Labor, Lansing, Mich.



# Coal Mining in Indiana in 1910

## Special Correspondence

The mining conditions and the coal situation in Indiana in general during the year 1910 were the most favorable and satisfactory for a number of years.

The market demands for the products of the Indiana mines were exceptionally good and the selling price for the entire year was satisfactory. During the contract year beginning March 1, the mines have been more nearly operated full time than during any previous year for a decade. These conditions were largely due to the suspension of mining in the Illinois districts because of a failure to agree on a wage scale and other demands. During the suspension in Illinois, several thousand Illinois miners found employment in the Indiana mines, a most acceptable acquisition to the mining force of the State. The average number of miners employed in the mines for the year was about 20,000, an increase of 1200 over the previous year.

The aggregate of wages paid to miners

and employees, with December report estimated, was approximately \$12,830,163, an increase of \$1,430,112 over the amount paid in 1909. The yearly earnings of the men employed in the mines will average approximately \$760, an increase of \$159 over the average for 1909.

### PRODUCTION FOR 1910.

Indiana has become the fifth largest coal-producing State in the Union. The total production for the year with December report estimated was 15,692,089 tons, an increase in round numbers of 2,000,000 tons. Of this, it is estimated that 14,400,100 tons was bituminous, and 1,291,989 tons was block coal. The block coals in Indiana are regarded with much favor and have done much to make the State famous as a coal producer. There are 18 coal-producing counties in the State, Sullivan and Greene counties leading in the order named and Orange county the smallest producer.

The fatalities for the year thus far reported were 19, as against 50 for 1909. The permanent, the serious and the minor injuries will reach nearly 900, a decrease of 229 as compared with the previous year. There were but four strikes during the year, and these were of small consequence and of short duration.

There were 12 new mines opened, and these are being operated successfully. Three mines were worked out and abandoned, leaving a total of 126 operating mines in the State.

The number of accidents to mine property was 8, two of which were fires in the interior of the mines.

During the last year, the State mine inspector and his four deputies enforced impartially the laws relating to the mining industry and guarded the interests of both miner and operator in such a way that the year closes with the coal mines in the State in better condition than ever before.

# Colorado Coal Industry in 1910

By James Dalrymple \*

Despite the fact that the coal industry of Colorado in 1910 was confronted by several serious obstacles, the production exceeded that of any preceding year, reaching the 12,000,000-ton mark, an increase of over a million tons over 1909. The lignite output showed a material decrease on account of the strike which was declared March 31, 1910, by the union miners in Boulder and Weld counties, and which is still pending with no immediate prospect of a settlement. While many of the mines in the strike-affected field worked with nonunion men, yet none worked full capacity; therefore, these two counties, the heaviest producers of the lignite variety, lost over 500,000 tons.

In Fremont, Huerfano and Las Animas counties, a car shortage handicapped the output in September and October, many mines working only half time, although there was a market waiting for all their product. In Las Animas county several hundred thousand tons of coal were further lost on account of the gas and dust explosions in the three largest producing mines in the State, viz.: Primero, Starkville and Delagua; the commercial loss to these three properties was great, as well as the loss of life, 205 men being killed.

\*State coal-mine Inspector, Denver, Colo.

Routt county, which two years ago produced only 5000 tons, in 1910 had an output of over 250,000 tons. The Moffat railroad, having reached Steamboat Springs, made it possible to develop some of the great coal resources of that country and a number of mines were opened

### SUMMARY OF COAL PRODUCTION OF COLORADO IN 1910.

Number of mines in operation.....	177
Number of new mines opened up....	10
Total tons of lignite coal produced...	1,639,455
Total tons of semi-bituminous coal produced.....	975,047
Total tons of bituminous coal produced.....	9,334,359
Total tons of anthracite coal produced.....	70,586
Tons of unclassified coal produced, estimated.....	70,000
Total tonnage.....	12,089,447
Total tonnage in 1909.....	10,736,459
Total tons of coke produced.....	1,190,901
Total tons of coke produced in 1909.....	1,091,882
Number of employees in and about the mines.....	14,768
Number of employees at the coke ovens.....	1,090
Total number of coke ovens.....	3,164

up on a large scale. There, too, a local strike prevailed, but was adjusted in the forepart of December. The product of this field is of a good bituminous quality. Another serious drawback to the operators was the shortage of miners in all the coal camps of Colorado, especially in the southern field where none of the mines were able to work full capacity because of the lack of men. The mine disasters drove hundreds of men from

these coal camps. The men employed in the coal mines of this section are natives from Italy, Austria, Japan and Korea, and are not practical miners; most of them have never been in a coal mine before. Outside of Boulder and Weld counties the mines are operated with nonunion men.

### PRICE OF COAL WAS SATISFACTORY

The price of coal went up, the bituminous and semi-bituminous was raised from \$6.00 per ton to \$6.25 and the lignite from \$5.00 to \$5.25; there was a market for every ton mined. There was no increase in the scale of wages and that is the cause of contention of the strike. The union men demanded an increase of 5.55c. for day work and dead work; 3c. per ton for machine-mined coal and 4c. per ton for pick-mined coal.

The recent mine catastrophes called attention to the inadequacy of the present coal-mining law, which was enacted in 1883 and amended in 1887 when coal mining in this State was in its infancy. These three mine explosions in less than a year aroused a great deal of public sentiment and a general demand for a better mining law prompted the governor of Colorado, John F. Shafroth, to appoint a mining commission consisting of Victor

C. Alderson, president of the School of Mines at Golden; Doctor Elkely, Professor of chemistry at the State University, Boulder; Professor George, State geologist, and the State inspector of coal mines as a fourth member. This commission made a thorough investigation into the causes of these explosions, examined mines in all sections of the State, and drafted a law which, if enacted by the incoming General Assembly, will cope with all the requirements of coal mining in this State.

When considering all the adverse conditions that the coal operators had to contend with, the increased production indicates that the commercial prosperity of Colorado in 1910 was great. Furthermore, the promptness and readiness with which the operators aided the Mining Commission in its labor of investigating the conditions of the coal mines for the purpose of drafting a law which is sure to increase the cost of mining, showed that new legislation would have no depressing effect on their activity. The accompanying table shows in detail the results of the year's activity in coal mining:

## Coal Mining in Utah in 1910

By J. E. PETTIT\*

The statistics relating to the Utah coal industry in 1910, are approximately as follows: Coal production for 1910, 2,526,093 short tons, or an increase over 1909 of 204,384 tons; coke, 1910, 146,064 tons; decrease since 1909, 34,065 tons; explosives used, 672,605 lb.; men employed, 3422, or an increase over 1909 of 439; average days worked, 284; average amount of coal produced per man, 738 tons; hydrocarbons (Gilsonite), 27,547 tons, or increase of 6640 tons.

### ACCIDENTS

The accidents in connection with Utah coal mines were: Fatal, 15; serious, 22; nonserious, 32. Three fatal and four serious occurred outside of mines; result, four widows and 13 fatherless children: Cause of fatal accidents: Run over by cars, 5; falls of rock, 4; falls of coal, 4; falling on pump gears, 1; premature blast, 1; total, 15; amount of coal mined for each life lost, 168,406 tons; for each man injured, 36,610 tons.

During the months of August and September a shortage of cars was experienced, but on the whole we have had a successful year with but few complaints and no labor troubles, some of the coal-mining companies giving the miners a 5 per cent. advance in wages.

\*State coal mine inspector, Salt Lake City, Utah.

## Coal Mining in Montana During 1910

By J. B. McDERMOTT\*

The report on coal production for the State of Montana from Oct. 31, 1908, to Nov. 1, 1910, showed that the output in that time amounted to 5,511,925 tons of coal. For the calendar year from Jan. 1, 1910, to Jan. 1, 1911, Mr. McDermott, State mine inspector, estimates that the production is 3,000,000 tons, thus indicating a healthy increase this year as compared with its predecessor. For a biennial period, this is by far the greatest in the history of the State, the increase being 37 per cent. over the preceding two years.

The report stated that while the development and equipment in and around the coal properties have kept pace with the increased production, the accident list grows no less. During 1907-8, for every 160,356 tons produced, one life was lost and for each 38,547 tons produced there was a serious accident. In 1909-10, there was a life lost for every 190,066 tons produced and a serious accident occurred for each 52,990 tons of coal mined.

Continuing, the report stated that the last two years were fairly free from labor troubles and disputes, although there were some local differences in Lewistown, Roundup and Gear Creek, but no general strike or suspension.

### OPERATORS GRANTED WAGE ADVANCE

After referring to the meeting of the Coal Operators' association and the United Mine Workers in Billings in September last, wherein a working agreement embracing a substantial wage advance and a semi-monthly payday system for the ensuing two years was agreed upon, the report said that in anticipation of a suspension, there was a considerable storage of coal, and as a consequence work has not been so brisk since, although business on the whole is fairly good at the present time. The future looks more promising for the coal mines in Montana with the building of the two new trunk lines—the Milwaukee, and the Billings & Northern; the rapid increase in population and the general development of the State. New mines are being opened, older ones remodeled and approved machinery installed. In 1909, there were 3862 men employed in the coal mines of the State with a production of 2,541,679 tons and in 1910, 4117 men with a yield of 2,970,246 tons. This is a gradual annual increase from 1251 men and 517,477 tons in 1890.

The production by counties in 1910, was as follows: Custer, 3350; Valley, 4018; Chouteau, 22,986; Gallatin, 29,-

\*Chief State mine inspector, Helena, Mont.

862; Park, 101,268; Fergus, 303,649; Yellowstone, 378,087; Cascade, 929,595; Carbon, 1,197,430, and this represents the yield of 52 different properties. Seven properties were abandoned during the two years covered by the report, and eleven new ones opened up.

The report included the accompanying table, showing the causes of accidents in and around the mines for this year, together with the outcome. It follows:

### FATALITIES IN COAL MINES OF MONTANA IN 1910.

	Injured.	Killed.
Falling roof.....	13	6
Falling coal and timber.....	8	2
Moving cars and cable.....	15	2
Explosives.....	7	0
Electric shock.....	1	0
Objects falling down shaft...	1	0
Cage striking bottom too hard	1	0
Mine cars on surface.....	2	0
Machinery.....	2	0
Railway cars.....	1	0
Wagon reach breaking.....	1	0
Other causes.....	2	0
Total.....	54	10

The report gave the following summary of 1910 conditions: Total number of machine operators and helpers employed, 212; loaders employed, 447; pick miners employed, 1947; inside daymen, 755; outside daymen, 756; making the total number employed in and about mines, 4117, and their average tonnage a day, per man employed, 3.3. In 1909, there were 51,822 lb. of dynamite and 1,447,270 lb. of black blasting powder used, and in 1910, 53,359 lb. of dynamite and 1,954,637 lb. of powder.

## Coal in Tennessee

By R. A. SHIFLETT\*

Coal mining in Tennessee in 1910 was far from satisfactory. The development of the Southwestern Virginia field, its thick seams of coal and large production have materially effected the coal industry in Tennessee. We are paying 50c. for mining coal all over Tennessee, as the minimum, though in some mines we are paying \$1 per ton for mining, all on a run-of-mine basis. The average price in the Southwestern Virginia field for mining is 21½c. per ton. This enables the mines of southwestern Virginia to compete in the markets that the Tennessee mines should have by right and have had for years. The advantage in freight rate is offset by the reduction in the cost of mining.

However, the coal business in Tennessee picked up considerably in the last two months of 1910 and domestic coal sold for from \$3.50 to \$4 per ton in the yards. Steam coal sold on an average of \$1.10 in open markets. For domestic coal, the price at the mines varies from \$2 to \$2.50 per ton.

The car shortage became very noticeable during the last two months of 1910. We were fortunate in not having any ex-

\*Chief mine inspector, Nashville, Tenn.



plosions in the mines and my department is doing everything possible to reduce these troubles to a minimum.

### Coal and Coke Production in the United States

The following tables have 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.	1909, Short Tons.	1910, Short Tons.
<b>BITUMINOUS:</b>		
Alabama.....	12,872,619	15,080,000
Arkansas.....	1,940,000	1,200,000
California and Idaho.....	18,540	20,000
Colorado.....	10,736,459	12,089,447
Georgia.....	285,700	280,000
Illinois.....	(a) 49,163,710	50,000,000
Indiana.....	13,692,089	15,692,089
Iowa.....	7,166,253	7,660,000
Kansas.....	6,107,040	5,750,000
Kentucky.....	10,296,145	13,723,235
Maryland.....	4,524,112	4,800,000
Michigan.....	1,758,020	1,620,000
Missouri.....	3,787,431	3,000,000
Montana.....	2,541,679	3,050,000
New Mexico.....	3,010,000	3,616,665
North Dakota.....	354,305	390,000
Ohio.....	27,756,192	32,500,000
Oklahoma.....	4,192,400	3,400,000
Oregon.....	91,400	80,000
Pennsylvania.....	136,205,695	144,365,816
Tennessee.....	7,090,420	7,009,000
Utah.....	2,322,209	2,526,093
Texas.....	1,859,259	2,050,100
Virginia.....	4,310,360	4,980,000
Washington.....	3,261,227	3,510,207
West Virginia.....	46,697,017	59,690,300
Wyoming.....	5,020,740	5,460,200
Alaska and Nevada.....	16,000	10,000
<b>Total bituminous.....</b>	<b>367,000,321</b>	<b>403,533,152</b>
<b>ANTHRACITE:</b>		
Colorado.....	72,100	70,586
New Mexico.....	14,000	8,000
Pennsylvania.....	77,040,880	80,310,720
<b>Total anthracite.....</b>	<b>77,126,980</b>	<b>80,389,306</b>
<b>Grand total.....</b>	<b>444,203,801</b>	<b>483,922,458</b>

(a) For the fiscal year ending June 30.

PRODUCTION OF COKE IN THE UNITED STATES.

States.	1909.	1910.
Alabama.....	2,521,000	3,300,000
Colorado.....	1,091,882	1,190,901
Georgia and North Carolina.....	50,000	62,000
Illinois.....	425,970	390,000
Kansas.....	12,000	10,000
Kentucky.....	38,849	58,700
Missouri.....	5,000	5,000
Montana.....	42,960	58,200
New Mexico.....	430,000	510,000
Ohio.....	250,000	260,000
Oklahoma.....	38,620	30,000
Pennsylvania.....	23,098,483	22,875,000
Tennessee.....	255,900	240,000
Utah.....	346,510	146,064
Virginia.....	1,294,942	1,310,000
Washington.....	42,335	40,000
West Virginia.....	3,125,451	3,250,000
Other states (b).....	2,007,000	1,890,000
<b>Total.....</b>	<b>35,076,902</b>	<b>35,625,865</b>

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

### North Dakota Lignite Coals

By J. W. Bliss\*

During 1910 the coal industry of North Dakota made a steady growth. The coal production for 1909 was 372,570 tons, while for 1910 it was nearly 390,000. New mines were developed and some of the old mines added new and more efficient machinery. More than 100 mines were in operation, besides which there were numbers of small coal banks where those living adjacent mined coal for their personal use. About 1000 men were employed during the busy season, and 400 during the idle months. There was one death caused by a fall of roof and two serious injuries due to a delayed shot.

Most of the mines are developed on a double-entry system and in a few instances the stub-entry system is used. In one case a sort of longwall retreat was attempted but proved unsatisfactory. The rooms are driven from 12 to 24 ft. wide and the pillars vary from 8 to 16 ft., depending on the character of the floor and of the overburden.

Where a sufficient amount of coal is left for a roof, after the room has been worked out, it is shot down and is the cheapest coal produced. In case of the recovery of the roof coal no attempt is made to rob the pillars.

There are some North Dakota mines working in 3-ft. beds of coal, but due to the high prices that timbering materials command, unless the roof clay is firm it is not practical to undermine in beds that are not thick enough to leave a coal roof. There are several coal beds from 12 to 19 ft. thick in which a small amount of timbering is sufficient and most of the timbers can be drawn and used again.

The future economic use of lignite will to a great extent depend on improved processes of briquetting and on the further development of the producer-gas engine. Tests in the government testing stations have clearly demonstrated its high efficiency when briquetted and when used in the production of gas. The State legislature of 1909 made an appropriation for the purpose of establishing an experiment station at Hebron, which is now in working order.

### Coal and Coke in British Columbia in 1910

The comparatively large net increase in coal production in British Columbia in 1910 was the result of a general enlargement of operations at the 10 collieries that have passed the preliminary stages of production. This is evident from the following approximate figures:

\*Assistant State engineer, Bismarck, N. D.

Vancouver Island collieries (5) in 1910 produced 1,600,000 tons; in 1909, 1,373,000 tons; Nicola Valley colliery, in 1910, 141,000 tons; in 1909, 62,000 tons; Crow's Nest Pass collieries (4), in 1910, 1,026,000 tons; in 1909, 558,000 tons. One new colliery, in Similkameen district, commenced producing and added to the total. There was, however, less coal made into coke, which accounts in small part for the increase in coal sold as such. The gross production of coal during 1910 was 3,119,000 long tons, as compared with 2,400,000 tons in 1909.

The opening of several new fields, or extensions of fields already producing, is in progress. These are, respectively, the upper Elk river and the Flathead fields, about Princeton and Granite creek, in the Similkameen; in Nicola valley; in the Skeena district on Graham island, of the Queen Charlotte group, on Vancouver island, and prospecting for coal is being carried on along the new route of the Canadian Northern railway, and in northern Cariboo.

### The Holman Drill

The following communication has been received from Henry Hellman, manager of Holman Brothers of New York, who are introducing the Holman Drill in America:

"May I supplement a statement in the JOURNAL of Dec. 31, 1910? The Holman drill was not tied for the first place in the recent Transvaal stope-drill competition. In the announcements made by the Chamber of Mines, the contest was started to be decided on the basis of economy. The true economic unit in machine drilling is the cost per foot, including all factors, such as air, interest and depreciation on power plant, pipe lines, repairs, stores, drill steels, etc. The final figures showed the Holman 2 1/2-in. drill to have a cost of 9.77d. per ft. Its nearest competitor registered a footage cost in excess of this figure as will be found by reference to the statement issued by Max Francke, who officially represented the Chamber of Mines. For certain reasons, best known to the committee of the Chamber of Mines, it was decided to lump the first and second prizes and divide them equally between the drills winning the first and second places. Holman Brothers accepted, without protest, the \$12,000 prize; whereas, in accordance with the conditions surrounding the competition, they were actually entitled to the prize of \$19,000, winning the first place. These statements are matters of record and will be found in the official announcements of the Transvaal Chamber of Mines, relating to the contest.

"It will be of interest to you to know that the English drill securing second place was 20 per cent. larger than the Holman drill, which won first place."

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