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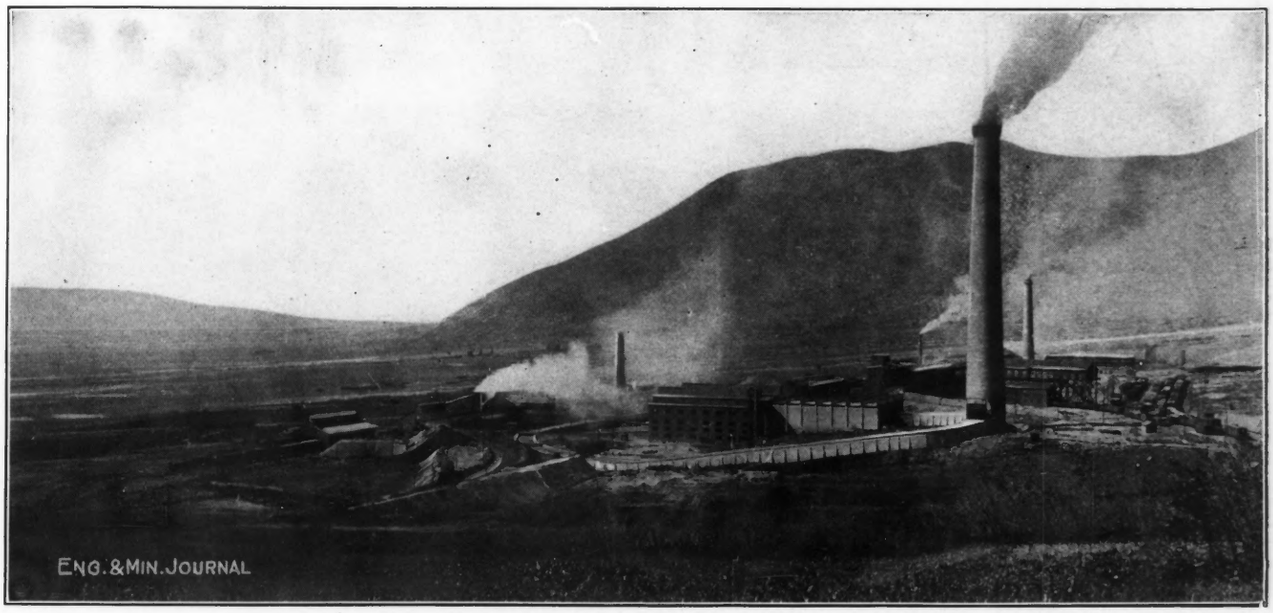
Metallurgical Plants Near Salt Lake City

SYNOPSIS—Salt Lake City was the first place in the United States at which an important general smelting business was established. It has maintained its pre-eminent position as a custom smelting center and draws its supplies from a wide area extending as far westward as California. The equipment of the leading smelting works is listed. The new chloridizing-leaching mills for the treatment of complex ores in the Park City and Tintic districts are an interesting metallurgical development.

The opening of rich lead mines in the vicinity of Salt Lake City in 1869 and 1870 resulted in great mining activity and a corresponding stimulus to metallurgical development. Silver-lead smelting at this period was in its infancy, having just been introduced in Nevada; nevertheless the Utah operators did not hesitate to erect furnaces for the reduction of their ores and by 1872 there were 21 lead furnaces in this region. Not all of these were successful and they were gradually supplanted by the plants in the environs of Salt Lake City, where fluxing ores and fuel could be more readily delivered. Salt Lake City thus became the first important general smelting center in the United States. The Germania plant, which perhaps represented the most advanced practice, was visited by many metallurgists of the older generation. It was on a site adjoining the present Murray plant of the American Smelting & Refining Co. The older plans, such as the Germania, the Hanauer, the Horn Silver, and the Mingo have completely disappeared; even the smelting works of a later generation have been succeeded by more efficient plants, or have been dismantled, such as the Bingham Consolidated, which was just north of the U. S. plant at Midvale, the Highland Boy near Murray, the Yampa at Bingham, the Utah at Hot Springs, near Ogden, and the Tintic at Silver City.



GENERAL VIEW OF INTERNATIONAL SMELTING CO.'S WORKS, TOOELE, UTAH

For many years the smelting plants were clustered close about Salt Lake City, but with increased railroad facilities and the growth of the metallurgical operations, there has been a tendency to place the newer plants at a greater distance from the city, thereby reducing the expense for the larger plant sites required and insuring greater freedom from "smoke farmers." The important smelting plants today are situated at Midvale, Murray, Garfield and International (Tooele, P. O.). At the last,

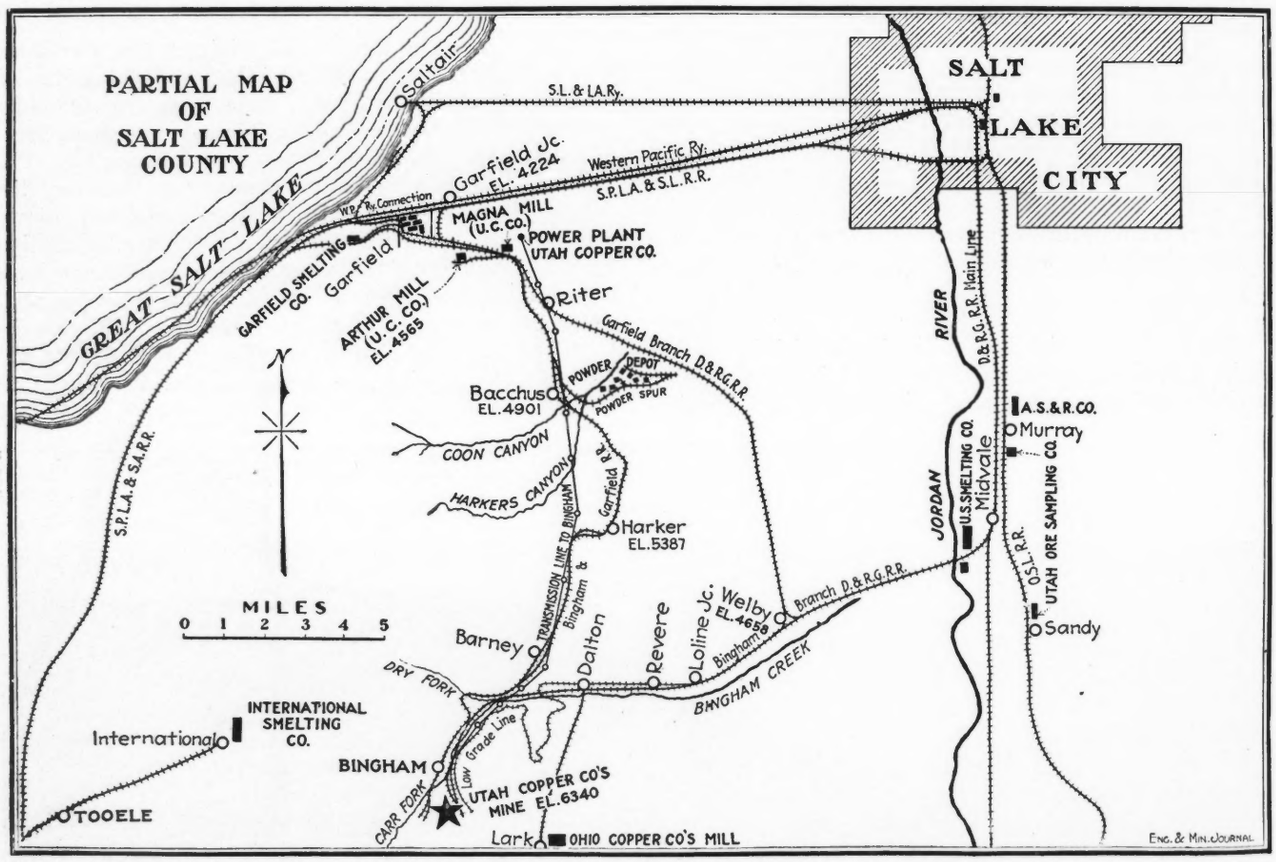
both lead and copper smelting is done; at Midvale and Murray, only lead furnaces are operated by the United States Smelting Co. and the American Smelting & Refining Co. respectively; Garfield does copper smelting only.

Three districts, Park City, Bingham and Tintic supply most of the Utah ores. Park City produces silver-lead and silver-lead-zinc ores; Bingham both lead and copper ores, but copper predominantly. The Tintic district in Juab County supplies a variety of ores, mainly oxidized ores high in silica; these usually carry gold and silver and small amounts of copper and lead; some ore is also produced, but in general the output of the Tintic district is too siliceous to be separately smelted. While these camps have for years formed the basis of the smelting operations near Salt Lake, their output is not equal to the present smelting capacity. Increased rail facilities have enabled the smelters to draw supplies from California and Montana, as well as from the neighboring states of Idaho, Nevada, Arizona and Colorado; the Cœur d'Alene district in Idaho is an important source of supply for lead ore; high-grade siliceous ores are shipped from many camps in Nevada and iron flux, containing small amounts of the more valuable metals, is now obtained from Eureka, Nev., itself the scene of important early operations in silver-lead smelting.

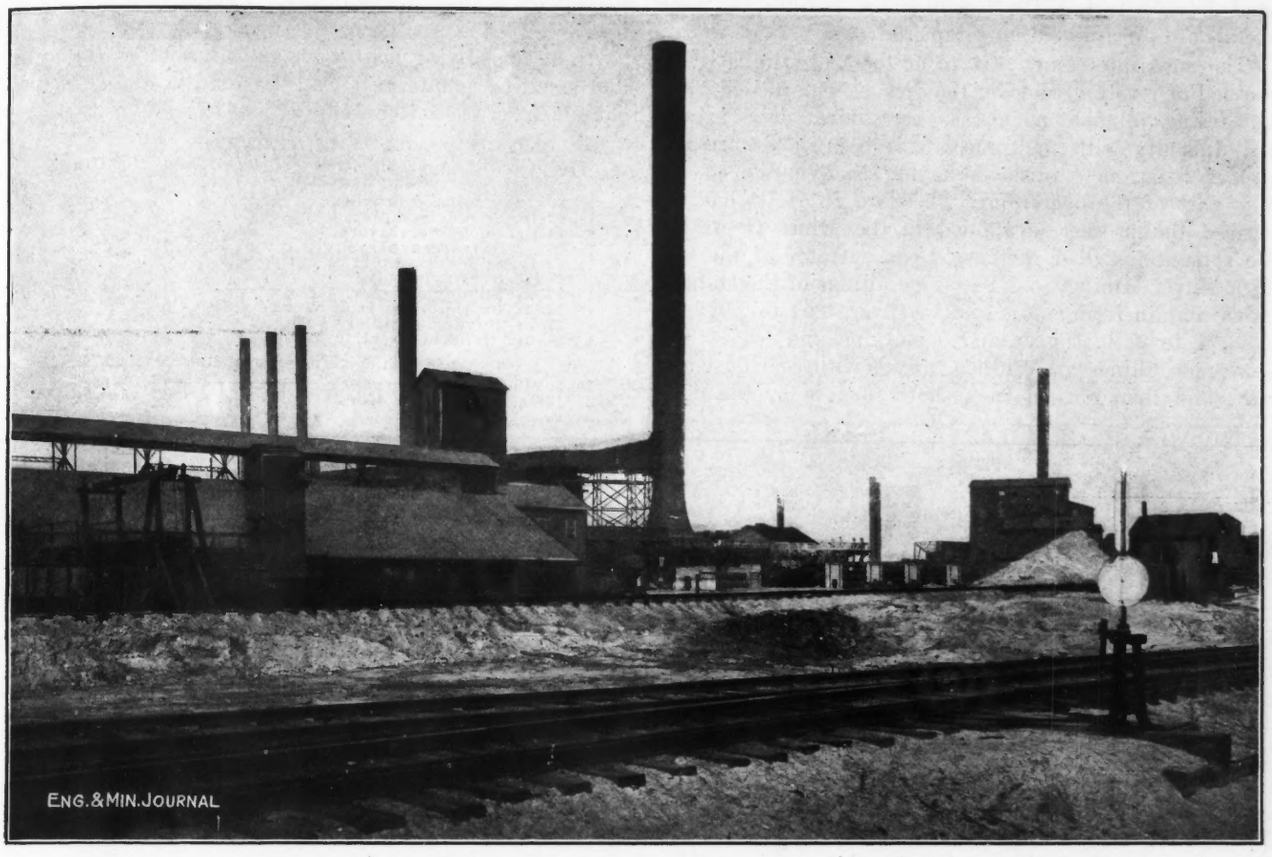
In the three important districts in Utah, the small producers are encouraged by custom sampling works and occasional shippers from Nevada and other states can avail themselves of the sampling mills near Salt Lake City. at Sandy and Murray; all of the smelting companies now maintain modern mechanical sampling mills to which most of their regular customers send their ores to be sampled under the supervision of their own representatives.

New Chloridizing-leaching Mills

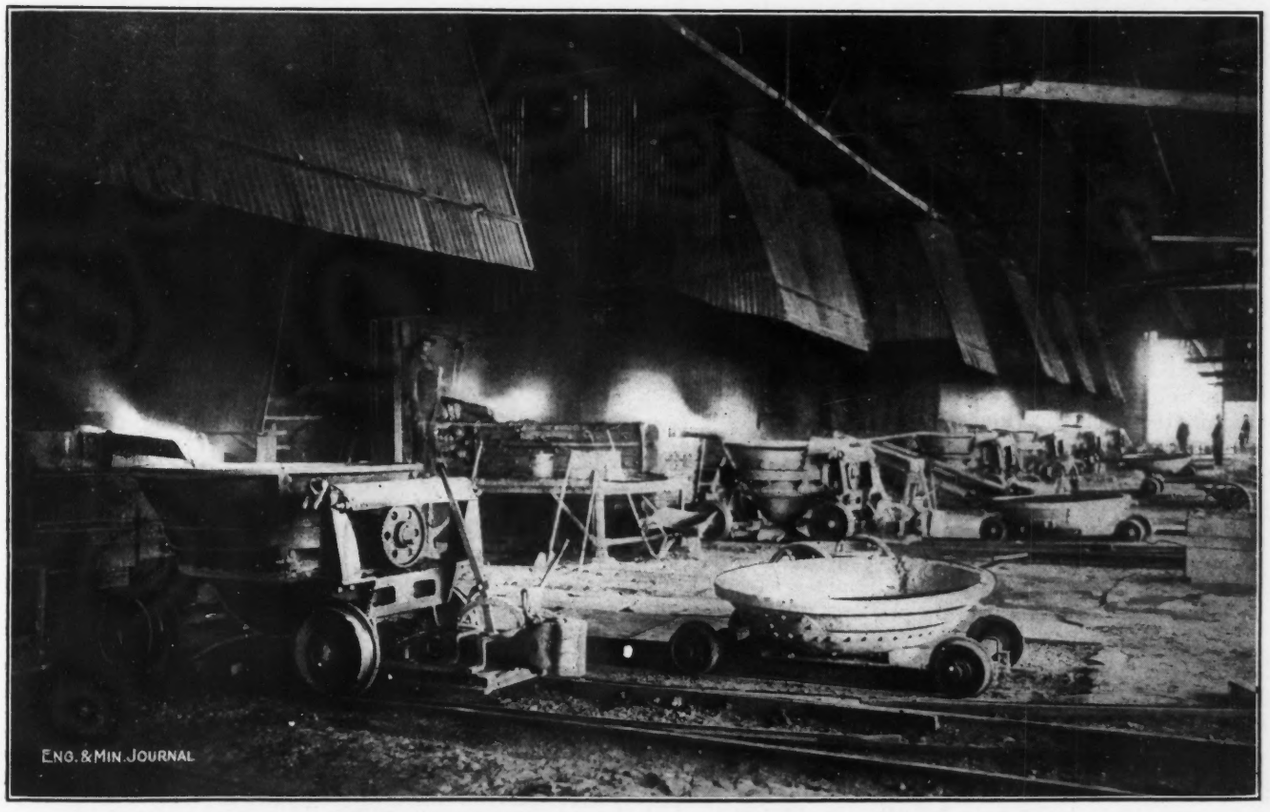
Some of the present smelting companies have built concentration mills to supplement the smelting works, as at Midvale where the United States Smelting Co. has a wet concentrating mill, and a Huff electrostatic plant for zinc separation. In a few instances the mining companies have built dressing plants near the smelting works. The most noteworthy mills at present are the two mills of the Utah Copper Co., the Magna and the Arthur, situated near the Garfield smelting works, the ore being transported from Bingham Cañon over the company's own railroad. The Ohio Copper Co. transports its Bingham ore through the Mascotte tunnel, concentrates it in a mill at Lark and ships the product to Garfield. There are other important mills in some of the outlying camps near Salt Lake City. In the Park City district, the silver-lead and silver-lead-zinc-copper ores are treated in simple concentrating mills and also in more complex works, such as those of the Mines Operating Co., and of the Park City Milling Co. In the Tintic district, another mill has been erected to treat the base ores; this plant at Silver City is backed by Jesse Knight and uses the process developed by N. C. Christensen. In this mill, as well as in the plant of the Mines Operating Co. at Park City, the ores are given a chloridizing roast and the gases are drawn into a condensing tower; the



Metallurgical Plants near Salt Lake City, Utah



MIDVALE WORKS, SHOWING MAIN STACK FREE FROM FUME AFTER FILTERING BLAST FURNACE AND ROASTER GASES



TAPPING FLOOR, LEAD BLAST-FURNACE DEPARTMENT, U. S. SMELTING CO.

acid formed is used in leaching the roasted ore; the metals are precipitated on scrap iron.

The most interesting feature of these new mills is the method of roasting whereby the ores are chloridized without losing valuable metals, as heretofore. The principal difficulty with the process has been in securing a proper roast, new furnaces having been developed for this part of the operation. Theodore P. Holt[1] has described the process as applied in the Mines Operating Co.'s plant installed in the old concentrator of the Ontario Silver Mining Co. The stope fillings of the Ontario mine contain from 6 to 14 oz. of silver, 0.01 to 0.015 oz. gold, 1 to 2 lb. copper and some zinc and lead. The low-grade fillings are crushed, mixed with coal dust and salt, and then roasted in a shaft furnace by the combustion of the contained fuel and an air blast. The gases pass to the condenser and at times supply all the acid required in the leaching; when there is little pyrite in the ore, sulphuric acid is added as required. The roasted charge is sluiced out of the furnaces with mill solution, raised to about 90 ft. by three Pohle air-lifts. The roasted ore is leached for about 24 hr.; in winter the solution is warmed by blowing in steam. Precipitation is accomplished by scrap iron with a consumption of about one pound per ton of product. The various metals are deposited in the order of their electromotive force but not sufficiently segregated to make commercial separations. The precipitate is brushed off the scrap iron, washed, filtered and dried. It is then sacked and shipped to a refinery, although experiments are being made with a view of separating the metals on the premises.

An accompanying map shows the situation of the mills and smelting plants near Salt Lake City; the principal equipment of the latter works is listed below:

UNITED STATES SMELTING CO.

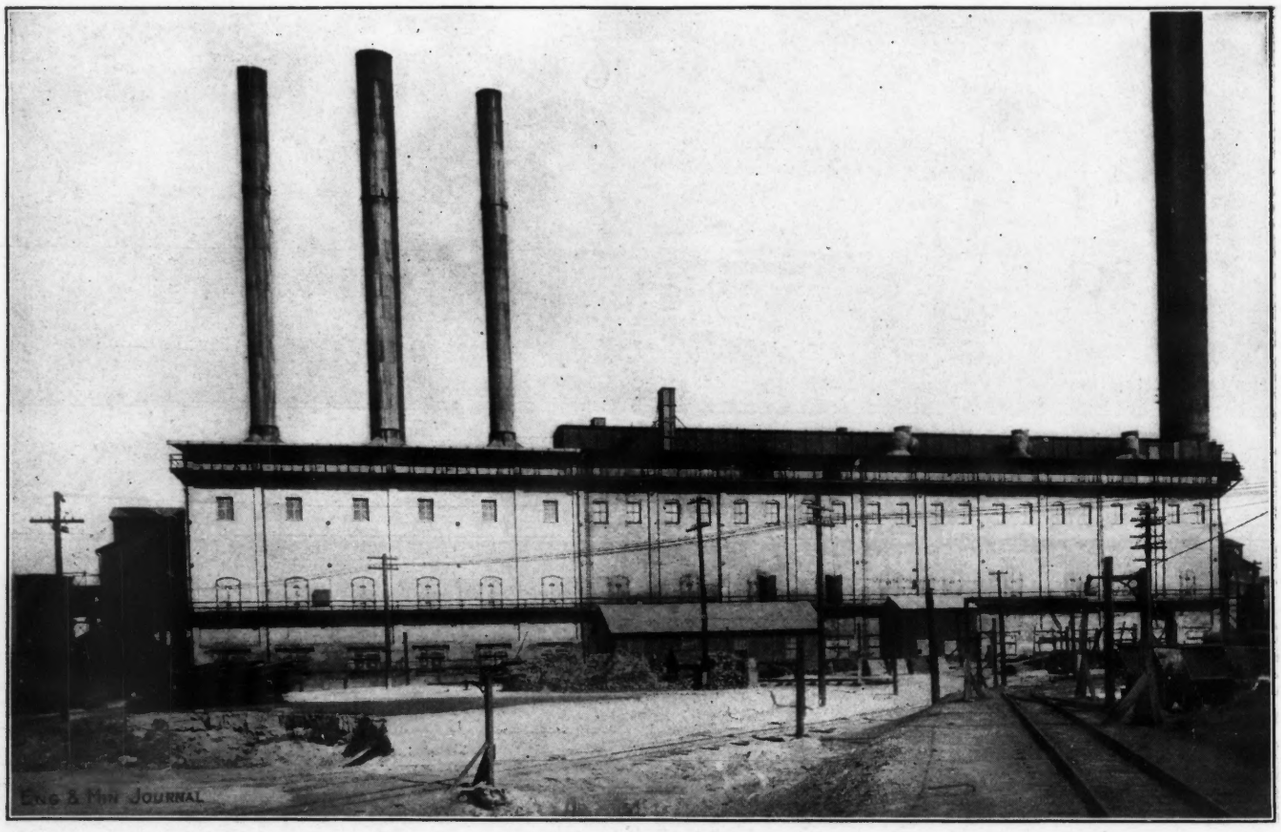
[Lead and Copper Smelting Works at Midvale, Utah]

Sampling Mill

1 20x10-in. Blake crusher
1 42-in. Snyder sampler, ⅛ cut
2 14-in. bucket elevators
1 No. 2 Gates crusher, Style D
1 42-in. Snyder sampler, ¼ cut
1 14x27-in. Davis rolls
1 27-in. Snyder sampler, ¼ cut
1 14x26-in. Colorado Iron Works rolls
1 27-in. Snyder sampler, ¼ cut
1 50-hp. General Electric motor

Sulphide Sampling Mills

1 20x10-in. Blake crusher
2 14-in. bucket elevators



THE ENLARGED BAGHOUSE AT MIDVALE, UTAH

2 16x36-in. Allis-Chalmers rolls
1 27-in. Snyder sampler, ⅛ cut
2 27-in. Snyder samplers, ¼ cut
1 50-hp. General Electric motor

Converter Roasting Department

1 18-cu.ft. Smith concrete mixer
1 14-in. bucket elevator
19 6x6x4-ft. box roasters
1 6x6x4-ft. box roaster (priming furnace)
1 24x36-in. Farrel crusher
1 76-cu.ft. skip hoist
1 20-ton Whiting crane
1 Ram car
1 American blower
1 100-hp. General Electric motor

Mechanical Roasting Department

2 21-ft. 6-in., seven-hearth Wedge furnaces
2 21-ft. 6-in. seven-hearth Wedge furnaces (under construction)
1 16-in. belt conveyor
2 16-in. belt feed conveyors
1 Link Belt pan conveyor
1 8-ft. 6-in. balloon flue

Dwight-Lloyd Sintering Plant

1 16-in. belt conveyor
4 42x264-in. straight-line sintering machines
1 5-ft. 6-in. balloon flue
1 three-hearth ZnO neutralizing furnace

[1]July, 1914, Bull. A. I. M. E. Cf. also pp. 253 and 254.

Lead Blast-Furnace Department

6 48x160-in. blast furnaces
3 140-cu.ft. charge cars, 6-ft. gage
3 130-cu.ft. charge-weighing larries, 6 tons capacity
4 10-ton electric locomotives
20 28-cu.ft. Stearns-Rogers slag pots
3 Remelting kettles
3 12- and 24x36-in. Nordberg Corliss tandem engines, each connected to
3 175-cu.ft. Connersville blower

Baghouse

1 122-in. American fan, Wedge furnace and Dwight-Lloyd flues
1 13-ft. 6-in. Sturtevant fan, roaster gases
1 15-ft. Sturtevant fan, blast-furnace gases
1 50-hp. motor, 122-in. fan
2 100-hp. motor, 13-ft. 6-in. and 15-ft. fans
1462 18-in. by 30-ft. woolen bags, blast-furnace gases
1878 18-in. by 30-ft. woolen bags, roaster gases
21 9-in. screw conveyors and dust hoppers

Arsenic Plant

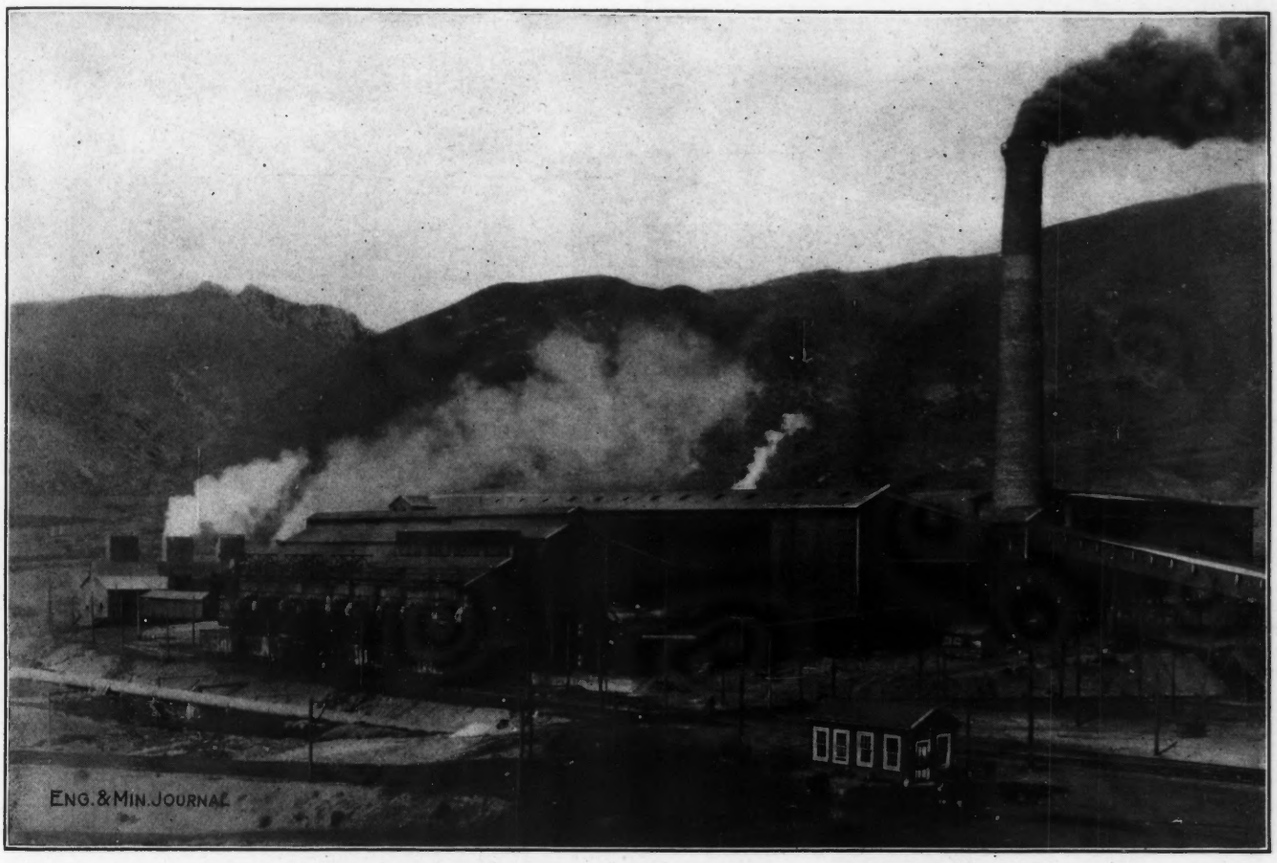
2 14½-ft. Brunton revolving-hearth furnaces
2 Crude-arsenic chambers, 16x200 ft., one section in operation

Wet Concentrator

1 9x15-in. Blake crusher
4 30x12-in. Allis-Chalmers rolls
7 Three-compartment single Harz jigs
10 Overstrom tables
17 Wilfley tables
3 Isbell vanners
1 Craven slime table
1 Sherman slime table
18 Slime-settling tanks
8 3x6-ft. trommels
3 3½x6-ft. trommels
1 5x14-ft. Denver Engine Works tube mill
2 75-hp. motors
1 50-hp. motor
1 30-hp. motor
1 25-hp. motor

Electrostatic Zinc Mill

1 5x30-ft. Ruggles-Cole dryer
2 6x6-ft. Newago screens
21 Huff electrostatic machines, Style D
1 Huff electrostatic machine, style E



LEAD SMELTING WORKS OF INTERNATIONAL SMELTING CO., TOOELE, UTAH

1 Steel-plate fan
36 18-in. by 25-ft. woolen bags, 18 on each chamber
1 10-hp. motor
1 10x20-ft. reverberatory refining furnace
1 refined arsenic chamber, 10x175 ft.
1 Steel-plate fan
18 18-in. by 25-ft. woolen bags
1 5-hp. motor

Copper Blast-Furnace Department
(Inoperative)

6 46x186-in. blast furnaces
1 17x58-ft. reverberatory furnace
5 84x126-in. copper converters
1 20-, 36- and 44x48-in. Allis-Chalmers converter blowing engines
1 20-, 42- and 44x48-in. Nordberg cross-compound condensing engine
3 15-, 30- and 63x42-in. Allis-Chalmers blowing engines, blast-furnace air
2 14- and 28x36-in. Nordberg cross-compound condensing engines each connected to
2 300-cu.ft. Roots blowers

Stacks

1 245x16½-ft. steel stack, brick lined, lead plant
3 100x6½-ft. steel stacks, baghouse
1 210x16½-ft. steel stack, brick lined, copper plant
1 150x7-ft. steel stack, reverberatory
1 200x8-ft. steel stack, converters

2 25-hp. motors
1 10-hp. motor
2 7½-hp. motors
1 Motor-generator set with rectifier equipment

INTERNATIONAL SMELTING CO

[Lead and Copper-Smelting Works at International (Tooele, P. O.) Utah]

Receiving bins, 30x300 ft.; capacity, 15,000 tons ore, 2000 tons coal
6 30-in. belt conveyors and two automatic feeders

Sampling Mill

8 20-in. belt conveyors, to copper-plant bins
2 20-in. belt conveyors, to lead-plant bins
2 24x12-in. Blake crushers
6 20x10-in. Blake crushers
8 Brunton oscillating time samplers, ¼ cut
4 18-in. bucket elevators
2 16-in. bucket elevators
2 54x24-in. crushing rolls
2 42x15-in. crushing rolls
2 48x12-in. crushing rolls
2 26x15-in. crushing rolls
2 4x14-ft. trommels
2 4x7-ft. trommels
1 12-in. belt man elevator
1 Platform elevator

Lead-Smelting Department

Sintering Department

Building, 42x160 ft.
10 42x264-in. Dwight-Lloyd sintering machines
5 Motor-driven fans, direct coupled
10 Variable-speed, d.c. motors, machine drives
20 Rotating sinter-charge apportioning tables and control apparatus
1 Rotating charge mixer
2 20-in. belt conveyors, sinter charge to mixer
3 18-in. belt conveyors, sinter charge to sinter-machine feed hoppers

Blast-Furnace Department

2 48x180-in. lead blast furnaces
8 60x180-in. lead blast furnaces

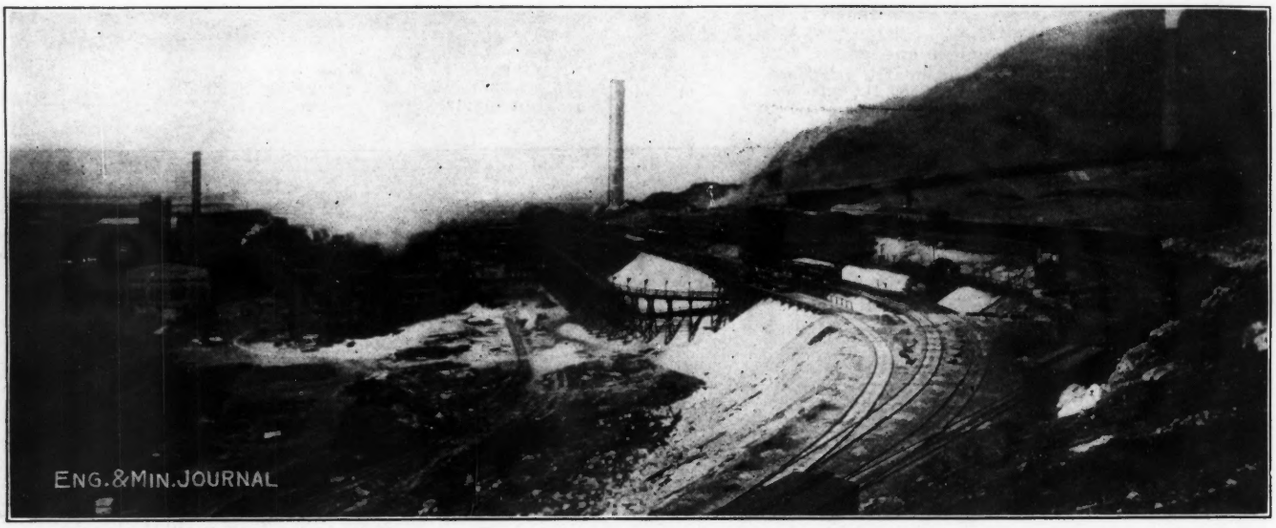
2 16-in. belt dust conveyors
5 200-cu.ft. electric-driven charge cars
1 12x38-ft. slag settling furnace
6 5-ton slag-pot cars
12 7-ton slag-pot cars
4 12-ton electric locomotives
4 30-ton drossing kettles
2 Bullion-weighing scales
1 Howard press, compressed-air operated
2 Motor-driven jacket-cooling-water pumps
1 Cooling tower, jacket-cooling water
Steel flue, balloon type to baghouse fan
Blast-furnace charge bins, 32 compartments arranged with suspended charge-weighing hoppers for all blast-furnace charge materials; railway tracks and belt conveyor to bins
1 Coke charge bin, 750-ton capacity, arranged with suspended charge-weighing hoppers
1 30-in. belt conveyor, coke supply to bin

Baghouse

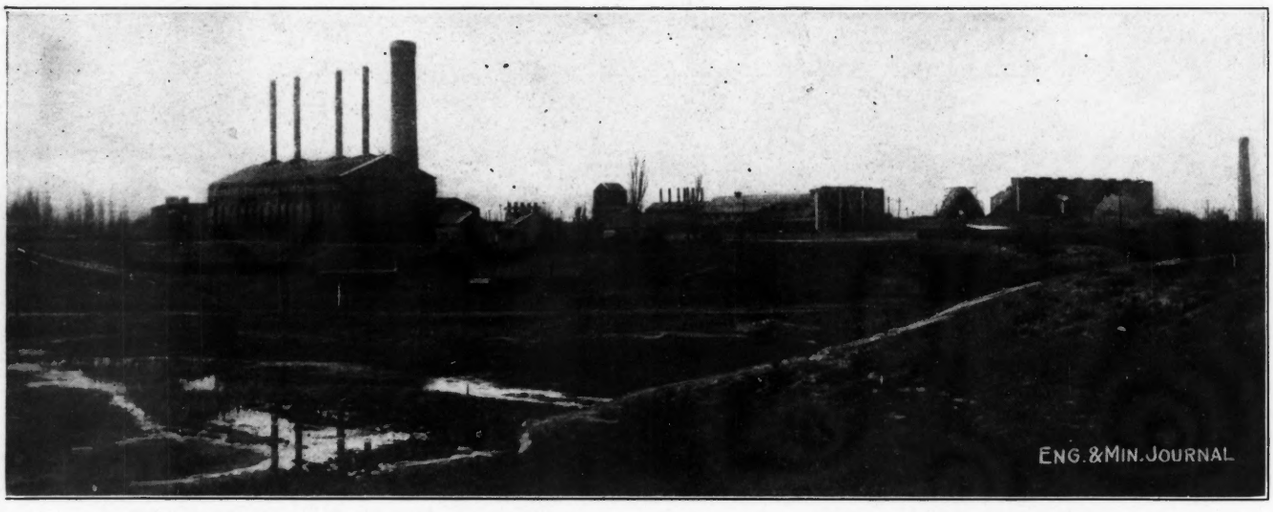
Building, 56x160 ft., 10 sections with burning chambers
1 No. 20 Sirocco centrifugal fan
1 100-hp. motor belted to fan
1440 18-in. by 31-ft. cotton and woolen bags
1 No. 4½ Sirocco reversed-current fan for shaking bags

Copper Smelting Department

Roaster crushed-ore bins, 5000 tons capacity
Miscellaneous crushed-ore bins, 3000 tons capacity
4 20-in. belt conveyors to roaster plant
5 20-in. belt conveyors and trippers
32 16-ft. six-hearth McDougal roasters
5 19x102-ft. reverberatory furnaces
4 750-hp. Stirling waste-heat boilers
1 750-hp. Stirling stoker-fired boiler
5 8x12½-ft. barrel-type converters



COPPER SMELTING WORKS AT GARFIELD, UTAH



MURRAY PLANT OF AMERICAN SMELTING & REFINING CO.—BAGHOUSE IN LEFT FOREGROUND

1 60-ton Morgan electric crane
2 25-ton Morgan electric crane, slag return to reverberatory furnaces
1 350x25-ft. brick stack
1 150x15-ft. brick converter stack
1 30-ton electric casting crane

Converter Baghouse

960 18-in. by 30-ft. woolen bags
1 No. 20 Sirocco fan, belt driven by
1 100-hp. motor
1 No. 4½ Sirocco reversed-current fan and motor
8 Spiral-screw conveyors for fume
2 16-in. belt conveyors for fume

Power Plant

2 350-hp. Corliss-valve engine direct connected to
2 250-kw. d.c. generators

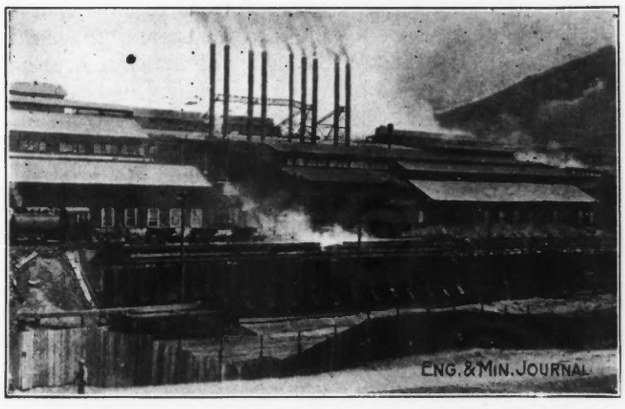
1 750-hp. 11-lb. converter blowing engine
1 600-hp. 11-lb. converter blowing engine
1 90-lb. 350-hp. steam driven air compressor
1 90-lb. 175-hp. electric-driven air compressor
2 No. 10 Roots blowers, direct coupled to corliss engines
3 350-hp. Stirling water-tube boilers
3 Le Blanc condensers
2 1000-kv.a. 2200-volt electric generators, direct coupled to triple-expansion engines
1 1000-kv.a. 2200-volt electric generator, steam-turbine driven

AMERICAN SMELTING & REFINING CO.
[Lead-Smelting Works at Murray, Utah]

4 Sampling mills
3 Seven-hearth Wedge roasting furnaces, 22 ft. 6 in. diam.
5 Godfrey roasting furnaces, 26-ft. diameter
2 42x264-in. Dwight-Lloyd sintering machines
4 7-ft. cast-iron mixing tables, 1½ r.p.m.
23 9-ft. Huntington-Heberlein pots
1 20-ton traveling crane
8 48x168-in. blast furnaces
4 35-ton drossing kettles
3 Sweater kettles
1 90x216-ft. baghouse
1 18x6-ft. fan
4032 18-in. by 30-ft. raw-wool bags
1 18-38x42-in. tandem-compound engine, driving
1 No. 10 Connersville blower
2 20-40 and 68x68-in. Dixon cross-compound blowing engines
2 18-36x36-in. cross-compound engines, driving
2 400-kv.a. generators
1 80-lb. single-stage air compressor
7 250-hp. marine boilers
3 94,000-gal. water-storage tanks

GARFIELD SMELTING CO.
(American Smelters Securities Co.)
[Copper Smelting Works at Garfield, Utah]

Lands, 30,000 acres
Plant site, several hundred acres
Standard-gage track, 16 miles
Belt-conveyor system, 8675 ft.
Concentrate bins, 25,000 tons
Daily consumption of materials: Concentrates, 1500 tons, representing about 25,000 tons of crude ore; ores, 1500 tons;



SLAG-CASTING EQUIPMENT AT GARFIELD

lime rock, 800 tons; coke, 200 tons; coal, 30 tons; oil for reverberatories, 1300 bbl.
Employees, 1200

Sampling Department

2 Buildings, 83x70x72 ft.
2 Oxide sampling mills
2 Sulphide sampling mills
Combined daily sampling capacity, 2400 tons

Roasting Department

16 Six-hearth McDougal roasters, 18 ft. diameter
14 Six-hearth McDougal roasters, 19½ ft. diameter
4 Seven-hearth Herreshoff roasters, 19½ ft. diameter
Total daily capacity, 2400 tons

Smelting Department

Main smelting building, 305½x840 ft.
4 42x240-in. blast furnaces
4 15x25-ft. oval settlers
(Dust chamber is 300 ft. long with cross-sectional area of 920 sq.ft., having wires suspended at intervals of 1⅝ in. and arranged with mechanical shakers)
4 19x112-ft. reverberatory furnaces
1 20½x112-ft. reverberatory furnace
1 20½x120-ft. reverberatory furnace
(Five of these furnaces are oil fired and one is at present being fired with pulverized coal as an experiment)
12 350-hp. Stirling waste-heat boilers
6 10x24-ft. Peirce-Smith converters
3 60-ton Shaw electric cranes
1 25-ton copper-pouring ladle
2 24-ft. Walker copper-casting wheels
170 17x60-in. converter-slag molds, 4 in. deep, mounted on rockers over receiving bins
24 5-ton charge cars
5 6-ton General Electric locomotives
36 10-ton slag cars
15 10-ton converter slag cars
4 General Electric locomotives
6 2-ton "basket" cars
3 3-ton General Electric locomotives
15 Atlas larry cars
1 15-ton Browning locomotive crane
2 15-ton Bay City locomotive cranes
2 26-ton American saddle-tank locomotives
1 45-ton American saddle-tank locomotive
10 50-ton Ingoldsby standard dump cars
1 Cottrell fume-condensing chamber, 105 ft. long, designed to handle 250,000 cu.ft. of gas per minute
2520 5-in. pipes, 10 ft. long, with a wire through the center charged at 20,000 volts.
1 22x350-ft. brick stack
1 30x300-ft. brick stack
2300 ft. of brick blast-furnace flue, area, 320 sq.ft.
620 ft. of steel blast-furnace flue, area, 215 sq.ft.
600 ft. of brick blast-furnace flue, area, 360 sq.ft.
1600 ft. of brick roaster flue, area, 320 sq.ft.
1200 ft. of brick reverberatory flue, area, 320 sq.ft.
775 ft. of brick reverberatory flue, area, 360 sq.ft.
900 ft. of steel converter flue, area, 227 sq.ft.

Power Department

2 17-34x36-in. Nordberg cross-compound engines
1 15-30x36-in. Nordberg tandem-compound engine
1 14-28x36-in. Nordberg tandem-compound engine
1 15-30x36-in. Allis tandem-compound engine
1 15-30x36-in. Allis cross-compound engine
3 23-50 and 54x48-in. Nordberg cross-compound blowing engines
2 400-kw. 250-volt General Electric generators
1 250-kw., 250-volt Westinghouse generator
1 500-kw. Curtis turbo-generator, four-stage, 4000-volt, 1800 r.p.m.
3 300-cu.ft. Connersville blowers
1 250-cu.ft. Roots blower
1 500-cu.ft. Leyner two-stage cross-compound air compressor
1 1400-cu.ft. Chicago Pneumatic two-stage cross-compound air compressor
1 20x20¼x24-in. Sergeant straight-line compressor
8 350-hp. Stirling boilers (power-house battery)

Organization of the Bureau of Mines

The following is the organization of the Bureau of Mines, as of July 24, 1914.

Director, Dr. J. A. Holmes.

Assistant director, Van. H. Manning.

Technical assistants reporting direct to the director: A. H. Fay; D. A. Lyon; W. E. Gibbs; A. G. White; J. T. Singewald; W. D. Ryan; H. D. Hibbard; C. A. Davis; Samuel Sanford; F. B. Laney.

Division of mineral technology: Chief, Charles L. Parsons.

Technical assistants: Oliver Bowles; Robert Back; H. W. Gillett; J. M. Lohr; K. L. Kithil; J. A. Davis; F. W. Horton.

Petroleum division: Chief, William A. Williams.

Technical assistants: J. H. G. Wolf; R. W. Andrews; A. G. Heggem; I. C. Allen; W. P. Rittman.

Mining division: Chief, George S. Rice.

Technical assistants: J. W. Paul; J. J. Rutledge; H. J. Smith; H. M. Wolflin; L. M. Jones; Charles Enzian; E. B. Sutton; J. C. Roberts; S. S. Smith; Edward Higgins.

Mechanical division: Chief, O. P. Hood.

Technical assistants: S. B. Flagg; Henry Kreisinger; H. H. Clark; C. E. Augustine; C. D. Smith; George S. Pope; W. F. Hausstein.

Chemical division: Chief, G. A. Hnlett.

Technical assistants: G. A. Burrell; H. C. Porter; S. P. Howell; W. A. Jacobs; A. C. Fieldner; R. Thiessen; F. K. Ovitz; E. J. Hoffman; C. G. Storm; J. D. Davis; J. K. Clement; D. J. Price.

Administration and special investigations: Chief, H. M. Wilson.

Technical assistants: J. H. White; J. R. Fleming; Lawson Stone.

Graphite Produced in the United States in 1913 amounted to 4775 tons of natural graphite, and 6817 tons of manufactured, according to the U. S. Geological Survey. Imports amounted to 28,879 tons.

Early Mining in Utah*

The first lead mined and smelted in large quantities in the great country to the west of the Rocky Mountains came from Nevada. The opening of the deposits in Utah followed soon afterward. The existence of argentiferous lead ore in those territories had been known for several years previous; to some extent since the Mormon occupation of Utah and the hegira overland to California soon after 1849; to a more extent since the movement to the Comstock lode in the years succeeding 1859, and to a still more extent since the march of Gen. Conner's California volunteers in 1863, the members of which were enterprising prospectors, and devoted much time to looking for mineral in the country they traversed, which, be it said, was to the subsequent trouble of legitimate miners. The lack of transportation facilities, however, practically precluded the development of the deposits until the completion of the Pacific railway. In studying the history of the lead industry of the West, we have fortunately a minute and authoritative contemporaneous record in the annual volumes of the series entitled "Mineral Resources of the States and Territories West of the Rocky Mountains."

In the first volume of the "Mineral Resources," treating of the year 1866, such references to the known existence of lead ore as the following are to be found:

Utah is known to abound in many of the useful and, it is believed, also in the precious metals. Both lead and iron have been produced for many years past by the Mormons living in the southern counties.

* * * * * *

A number of large lodes heavily charged with argentiferous galena have been opened at Rush Valley, a short distance southwest of Salt Lake City, and being tested by the smelting process proved rich in both lead and silver. A number of furnaces were erected there two years ago, since which they have been kept part of the time in operation, and with suitable appliances it is thought a considerable amount of silver bullion might be produced from these mines.

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At Minersville, in the western part of Utah, are mines of lead and copper, which contain some gold and silver. One of the mines has been worked to a depth of 90 ft. At this point copper predominated, and the working of the mine for lead was suspended. The lead was smelted to supply the territory. While lead prevailed working of the mine was remunerative. No effort was made to recover the silver, although in many countries this would have been profitable.

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The Rush Valley district, Utah, abounds in veins containing argentiferous galena and copper. In 1865 there was considerable excitement about these mines. Companies were organized by officers of the army at Salt Lake City, and some developments were made. Smelting works were erected at the mines, but the smelting failed to extract the metal in a satisfactory manner.

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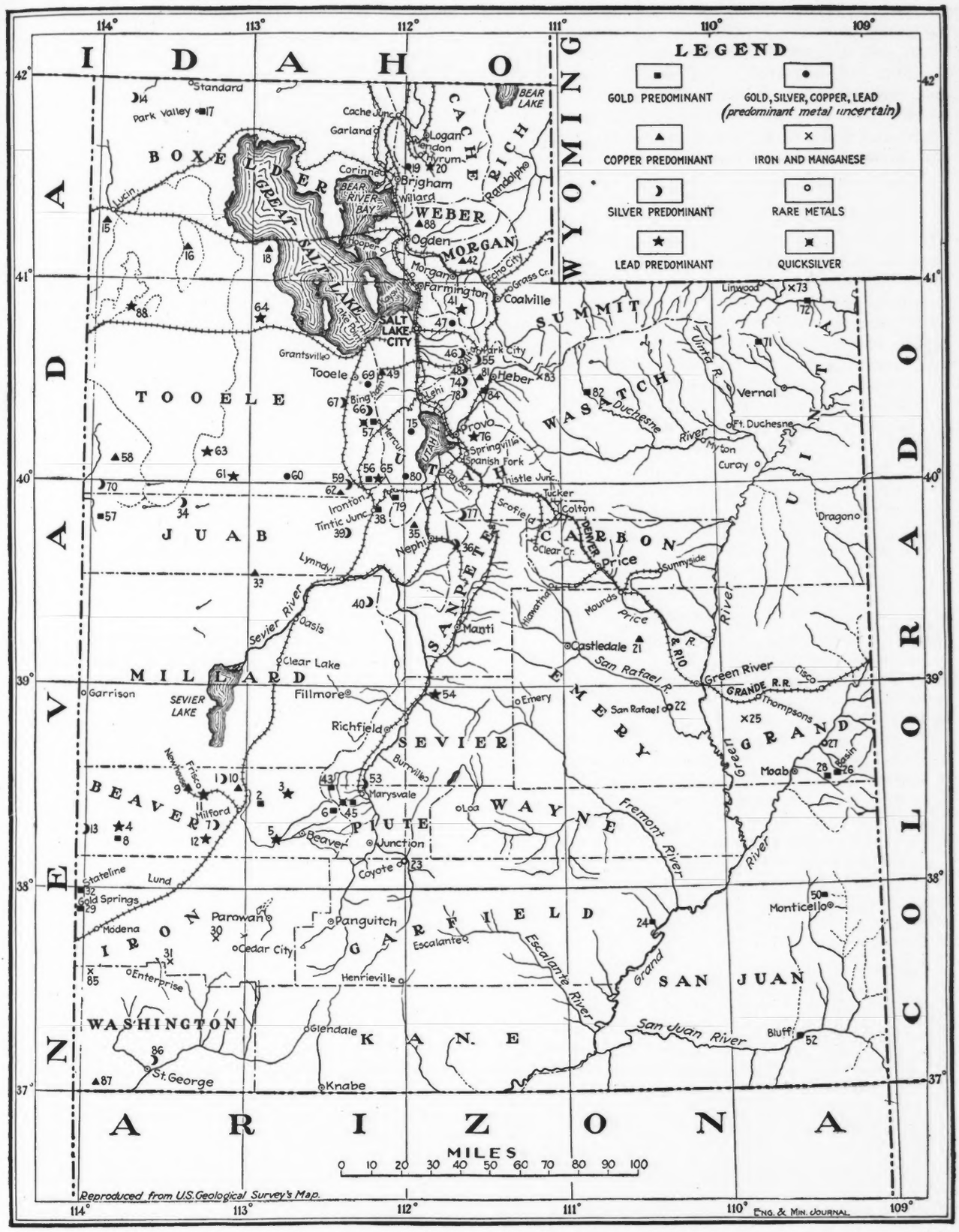
Cottonwood Cañon, about 27 miles southeast from Salt Lake City, contains several silver mines. A Mr. Hirst is running two furnaces there at present. They are not on an extensive scale, but the results are satisfactory. This is a valuable lead-mining district.

The above extracts indicate clearly the character of the knowledge as to the silver-lead deposits of Utah at the end of 1867 and outline the practice in exploitation of such of them as were worked. The prospectors of that time and the seven years immediately preceding were anxious to find lodes of gold and silver ore that could be beneficiated by the processes of plate or pan amalgamation. Lead-bearing ores were not wanted, being valuable only for their precious-metal contents, which could be only extracted at greatly increased cost as compared with those ores that were amenable to amalgamation. The occurrence of such ores at numerous localities was known, however, and their future value, when the Pacific railway should be completed, was appreciated. Rich argentiferous galenas were smelted at several places, the metals being reduced to a base silver-lead bullion, from which the gold and silver were refined by cupellation. The furnaces were doubtless small and crude affairs, similar to what the Mexicans used to employ, and still do. At Orcana, Nev., and Cottonwood Cañon, Utah, there were more important constructions. Of the lead-bearing localities mentioned in "Mineral Resources" at the end of 1867 the more part failed to prove of any great importance, but certain of them became the greatest lead producers in the United States during the next decade. Thus both Eureka, Nev., and Cottonwood Cañon, Utah, had been discovered previous to the end of 1867, and at the latter, smelting had already been begun. Bingham Cañon, Utah, also had been discovered.

The earliest knowledge of lead ore in Utah was possessed by the Mormons, who settled at Salt Lake City in 1846. They produced such lead as they required for their purposes for many years previous to 1866, but the leaders of this people discouraged the searching for mineral, it being contrary to the policy of the church to have its disciples engage in mining pursuits, wherefore but little was known of the mineral resources of Utah until the soldiers stationed at Salt Lake began to unearth them. It is doubtful if the Mormons had any knowledge of the silver content of the galenas which they smelted; if they did, they did not regard it as worth while to separate, a process involving the conversion of the lead to litharge and a resmelting of the latter to regain metallic lead which would have been profitable only with a bullion rich in silver. Certainly the ore at Minersville was smelted only for lead to supply the territory, with no attempt to separate silver. Dr. R. W. Raymond, then special commissioner of mineral statistics for the Treasury Department, had an interview with Brigham Young and several leading members of his church. They expressed a willingness to have all the natural resources of Utah developed and utilized, and disclaimed any hostility to mining, but admitted that they had discouraged their own people from engaging in it because they thought that agriculture would be far more profitable. Mr. Young expressed the opinion that the ores of Utah had never yet been skillfully treated. "What we used to call lead," said he, "and dig and melt up into bullets, these fellows call silver now! But if anybody is fool enough to come and mine for it, he may do so, and welcome."

The year 1869 is especially noteworthy in the history of silver-lead mining west of the Rocky Mountains. The great event was the connection of the Central Pacific and Union Pacific railways, making an uninterrupted transcontinental line. The silver-bearing lead ores, which formerly had been ill favored because of the greater cost and difficulty of extracting their precious-metal value, could then be worked to advantage, inasmuch as it was possible to send the base bullion east or west for refining and marketing. The occurrence of lead-bearing ores was therefore not so much deplored as only

*Slightly condensed from "Lead and Zinc in the United States," by W. R. Ingalls.



MAP OF UTAH, SHOWING MINING DISTRICTS

a year or two previous, the erection of furnaces was talked of more nonchalantly, and a considerable number of furnaces were actually built during the year. It is to be remarked, however, that up to this time none of the great lead deposits of Nevada and Utah had been discovered. The abundant occurrences of lead ore which had been previously noted, and to a small extent exploited, were after all of trifling importance. It is true that mines had already been discovered at Eureka, Nev., and in the Cottonwood and Bingham cañons, in Utah, but the great orebodies which afterward made those places famous had not yet been uncovered.

The completion of the Pacific railway, which for several years had been looked forward to with such great expectations, was followed by a feeling of disappointment, the freight rates being much higher than was anticipated. In Utah, mining did not advance much in 1869, even the completion of the Union Pacific railway failing to stimulate general activity. Numerous veins had been located in the Cottonwood Cañon district, but not much mining was in progress there, and the smelting experiment that had previously been undertaken had apparently been abandoned. In Bingham Cañon also nothing but trifling work was done. The Rush Valley mines were again attracting attention, and a furnace was erected there, with which exception there does not seem to have been any smelting done in Utah in 1869. Dr. Raymond, in summarizing the results of the year, wrote thus: "On the whole, it may be said that so far Utah cannot be classed among the mining states and territories. The developments made are all very slight and unimportant, and no shipments of any consequence of the precious metals have ever been made."

The early mineral discoveries in Utah were chiefly of what was at that time called "base-metal ores," i.e., ores containing a comparatively large proportion of copper and lead. The difficulty experienced in the treatment of such ores, together with the high cost of transportation and the opposition of the Mormon authorities, caused the earlier mining enterprises to languish and fail. In 1868 and 1869 Dr. Raymond found no mines in productive operation except the placers of Bingham Cañon, which were worked on a small scale. In 1869, however, a few parties were preparing to take advantage of the railway, and experiments of a metallurgical character were in progress at Salt Lake City. In 1870 there was a sudden and extensive development of the mining industry in Utah.

This was due to several causes. The Pacific railway had been completed, furnishing greatly improved transportation facilities. The treatment of silver-lead ores had already been accomplished successfully on a large scale at Eureka, Nev. The opposition of the Mormon Church had been withdrawn, the market of an active mining population close at hand being welcomed to replace the lucrative traffic that the railway had practically put an end to, interrupting to a large extent the Mormon trading trains, carrying grain and vegetables far into the mining districts of other territories, and diverting the procession of wayfarers across the continent who had previously paid great tribute to the farmers of the Salt Lake Valley. Finally, it was in 1870 that the famous Emma mine, in Little Cottonwood Cañon, was discovered, and the opening of its bonanza, "a lake of mineral of vast extent," which yielded a clear profit of nearly $120 per ton on shipments of ore to Swansea, Wales, "gave an impetus to mining in Utah that surpasses all other efforts made in that direction put together," these quotations being from a contemporaneous writer.

The Emma mine became a large producer in the first year of its operation. One firm of brokers in Salt Lake City reported shipments during the six months ending Dec. 31, 1870, of 4200 tons of galena ores, of an average assay of 35% lead and $182 silver per ton, the average net value being $125 per ton. Almost all of this was from the Emma mine. The total shipments of the Emma mine for the year were 5293 tons of ore, of which 2968 went to the Atlantic coast and 2325 to the Pacific, and 8.5 tons of base bullion, the aggregate value being estimated at $967,000, reckoning the ore at $182 per ton and the bullion at $400. The cost of transportation (by team to Salt Lake City, 28 miles, and thence by rail to New Jersey) and the expense of treatment amounted to $90 per ton.

The prices paid in Salt Lake City by California buyers for Utah ores in January, 1871, were as follows: Ore containing 30% lead and 50 oz. silver per ton, $22; 40% lead, $30.60; 50% lead, $38; 60% lead, $45; 70% lead, $53; 80% lead, $61; for each 10 oz. of silver in excess of 50 oz., $10 per ton additional.

The costs of labor in Utah at this time were not high. In Bingham Cañon, first-class miners received $3 per day; second-class, $2.50; surface laborers, $2. Lumber cost $40 per M., mining timber $6 per cord, wood for fuel $4 per cord, common powder $5 per keg, quicksilver 80c. per lb.

Outside of Little Cottonwood, prospecting was done in the adjacent cañons, Big Cottonwood and American Fork; at Stockton and in East Cañon, respectively 40 and 55 miles southwest of Salt Lake City; at several places in the Tintic Valley, about 70 miles southwest of Salt Lake City, where some valuable discoveries of silver-lead ores were made, and in the West Mountain district, Bingham Cañon, about 25 miles southwest of Salt Lake City, where a large number of veins of argentiferous galena had already been discovered. All of these districts were naturally tributary to Salt Lake City, which was thus marked by its location as a logical point for smelting. Woodhull Bros. built a furnace there in 1870, and other works were projected. Dr. Raymond summarized the results of mining in Utah in 1870 in the statements that the most productive mines were deposits of argentiferous galena in limestone, that the business of mining and smelting required considerable capital, and that the abundance of supplies, cheapness of labor and facility of transportation rendered it a highly inviting field for operations on a large scale, the accuracy of which forecast was borne out by the rapidity of the development during the next few years.

Even so soon as 1871 there was a great influx of prospectors, miners and speculators into Utah, and the remarkable increase in activity was manifested in the increased production of ore and bullion. The shipments of the year were estimated to be 2378 tons of base bullion and 10,806 tons of ore, of which 2185 tons of bullion and 8880 tons of ore were consigned eastward, the remainder westward. During the summer, shipments of ore were restricted by an increase in the schedule of freights. The rates were subsequently reduced, though

not to the former point. They were then $18 for ore and $20 for bullion per ton from Salt Lake to Omaha.

The Emma mine continued to be the principal producer. Up to August, 1871, it had yielded from 10,000 to 12,000 tons of ore, averaging about 160 oz. silver per ton and from 45 to 50% lead. The total value of this ore, at the cash price paid for a large part of it in Liverpool, namely, £36 per ton, was about $2,000,000. The mine had been sold to an English company for £1,000,000, a price which was contemporaneously criticised as unjustified by the appearance of the mine, and was subsequently proved to be greatly in excess of the actual value. The Flagstaff mine, near the Emma, also became a producer of rich lead ore during 1871.

Outside of Little Cottonwood Cañon, important developments were made in American Fork Cañon, where the Miller mine was worked; in Bingham Cañon, in the Tintic district, where rich smelting ores were mined in Eureka Hill, and in the Ophir and Rush Valley districts. Smelting furnaces were erected in all of these districts, their number in the latter part of the summer being reported as follows: Ophir, 5; Stockton, 2; Tintic, 2: Cottonwood, 3; Salt Lake, 4; Bingham, 2; American Fork, 2; Corinne, 1; total, 21. One plant was equipped with a reverberatory furnace for the treatment of galena ores, but the others had mostly small shaft furnaces, smelting chiefly oxidized ores and using charcoal as fuel. Most of the charcoal was brought into Utah by rail from Truckee, in the Sierra Nevada, though a considerable quantity was burned in the Wasatch Mountains, and in piñon districts farther south. The Truckee charcoal was delivered at a cost of 25c. per bushel. The Utah charcoal cost 22 to 30c., but was apt to be inferior in quality, while, moreover, its supply was precarious.

The smelting practice was very bad, the furnaces being run for the most part in an ignorant manner, with the natural results of very brief and intermittent campaigns, frequent freeze-ups, high costs and large losses of lead and silver. In many cases more than half of the lead contents of the ore were probably lost. Ores assaying 30 oz. silver per ton and 30% lead could hardly be treated at a profit. The percentage of lead recovery was estimated at 66⅔; of silver at 80.

The early history of lead mining in Utah has been related with this detail in order to show clearly the causes and manner of its development. It will be observed that the great contributory cause was the completion of the Pacific railway, furnishing an outlet to the markets east and west. Before the building of the railway, the cost of transportation was $250 and $300 per ton to the Pacific coast, and $300 and $400 to the Atlantic, which was a prohibitive charge on either ore or base bullion. By 1872 the cost of shipping bullion from Eureka, Nev., including the cost of refining and other charges, had come down to $78 per ton. With the possession of the transcontinental line, the determinative factor in the production of lead from these new sources was the opening of the great deposits of ore, which were previously known to a considerable extent, and were rich enough in silver, gold and lead to stand the high cost of imperfect mining and smelting methods and local transportation. The prices for both lead and silver were high at that time, wherefore the ores were better able to meet the high costs, which naturally were extremely variable in the different districts. In their subsequent history the dominating factors were the improvement in transportation facilities by the construction of branch lines of railway to the mining districts and the reduction in cost of mining and smelting by improvement in technical methods. The mines became thereby able to make an increased production though mining a lower and lower grade of ore, and in the face of a gradually declining price for silver and a generally downward tendency in the price for lead. Save for the exhaustion of some of the principal ore deposits, there was no cause acting greatly to restrict production until prices fell very low during the monetary panic in 1893.

While Nevada and Utah became contemporaneously large producers of lead, the conditions in the two states were widely different. The large production of lead in Nevada was derived almost entirely from the mines of Eureka. These were the only really important lead mines ever discovered in Nevada, and when they were exhausted the lead production of the state dwindled to insignificance. The ores of Eureka were self-fluxing and could therefore be smelted at comparatively low cost, and being also mined easily and cheaply, they were exploited at great profit, the principal companies of the district being large dividend payers from almost the beginning.

In Utah the principal mining districts are situated in the Wasatch and Oquirrh ranges of mountains, lying, respectively, east and west of the valley south of Salt Lake, into which their gulches debouch. All of these districts are within a comparatively short distance of Salt Lake City, and within less distance of the points eight or ten miles south of the city which were early determined to be advantageous locations for smelteries. Lines radiating from that center reach Bingham, the Cottonwoods, Park City and Tintic in comparatively short distances. In the first stage of mining in Utah, the general idea was to smelt the ores at or near the mines where produced. Few or none of those mines, however, had ores of character that made them self-fluxing, and the cost of bringing in the necessary fluxes by the imperfect means of transportation of that time was high, and the cost of smelting was consequently high, on which account many of the early attempts proved failures. After the Utah Central railway was completed to Salt Lake City (in December, 1869,) and extensions were continued to the various mining camps of that time, especially Alta, Bingham and Tintic, it became possible to bring ores of different character together at a central point, near Salt Lake City, where smelting could be profitably conducted.

Utah, on the other hand, was a region of many lead-mining districts, none of which, until the development of the San Francisco or Horn Silver district, was in any way comparable industrially with Eureka. There was none of the early mines which in magnitude, richness and ease of exploitation approached the Eureka and Richmond properties, and none which was so profitable. Many of the best mines, like the Emma and Flagstaff, were the subjects of inflated promotions, bad financiering and eventual disaster, thus impeding industrial progress. The ores of the various districts were not self-fluxing and were incapable of successful reduction save at a suitable central point. When that was recognized and the construction of railways radiating from Salt Lake City made such practice possible, the production of lead in Utah was put on a sound basis, and a great industry,

lasting to the present time, was established upon it. Salt Lake City became the first point in the United States where a general smelting business of magnitude came to be conducted, and its practice was the prototype after which that of Denver, Pueblo and El Paso was fashioned.

In Utah there was a noteworthy increase in the output of lead in 1872, the product of base bullion amounting to 8125 tons, while 10,347 tons of ore were shipped out of the state for smelting elsewhere. Estimating the yield of the ore shipped at 40%, the total lead product of the state in 1872 was 12,335 tons, which is probably an underestimate rather than an overestimate. The major part of this output was derived from the Cottonwoods. The Emma mine alone shipped 4000 tons of ore to England during the first eight months of the year, and subsequently sold 6300 tons in the open market, a total of 10,300 tons, which averaged 45% lead and 69 oz. silver per ton. The Flagstaff mine produced 3000 tons of base bullion, obtaining one ton of bullion from 3.5 tons of ore. The Miller mine produced 1536 tons of base bullion, smelted from very rich ore. The Winnemuck mine of the Bingham district produced 1232 tons of base bullion, smelted from an ore which averaged 38% lead and 56 oz. silver per ton. Smelting at the Winnemuck works was very expensive. Charcoal cost 30c. per bushel; limestone, $7 per ton; iron flux, $22.50 and $25 per ton. The iron flux had to be obtained from Rawlins, Wyo., and the firebrick from Golden, Colo. The furnace charge consisted of 13 parts ore, 4 parts iron flux, 5 parts limestone, 2 parts old slag and 6 parts charcoal. There were two furnaces, each smelting about 14 tons of ore per day. At the works of the Utah Silver Mining & Smelting Co., also in Bingham Cañon, the cost of smelting per ton of ore was $6.96 for fluxes, $15.80 for charcoal, $4.27 for labor and $5.30 for roasting, a total of $32.33 per ton. The construction of the railroad up Bingham Cañon, which would enable the ores of that district to be taken to meet the ferruginous ores of the Cottonwoods, was eagerly awaited.

Both the miners and smelters of Utah in 1872 reaped great advantage from the fierce competition for ores and bullion among the Eastern smelters and refiners, especially of St. Louis and Chicago, who bid up prices to a point which left dangerously small margins. The freight rate on ore from Salt Lake to Chicago at this time was $25 per ton; on bullion, $28.50 per ton. The Selby Smelting Co., of San Francisco, was also a buyer in this market, and the refining of base bullion was begun at the Germania works at Salt Lake City, this being the first refinery in the Rocky Mountains. Altogether there were in Utah in 1872 smelting works to the number of 21, of which six had roasting furnaces; the total number of blast furnaces being 36 and of roasting furnaces seven. The Wahsatch works had begun with a Flintshire reverberatory furnace and a slag hearth, but those had been abandoned. These works, which were situated just south of Salt Lake City, were showing the advantage of a central location since they were able to mix the siliceous lead ores of Bingham with the ferruginous lead ores of the Cottonwoods and dispense with the use of costly iron flux. The cost of smelting in the blast furnace was $13 per ton of ore; of slag roasting in reverberatory furnaces, $4 per ton, lignite being employed as fuel. Coke was used in the blast furnace instead of charcoal. It cost $30 per ton delivered, and as compared with charcoal at 30c. per bushel was reckoned to be about $4 cheaper per ton of ore smelted. All the above values are currency. A comparison of these figures with those which have previously been given for smelting at Bingham will explain why the smelters in the Salt Lake Valley soon displaced those of the mines.

In Utah the operation of many of the mines and smelting works was stopped in 1873 by the panic, wherefore the lead output did not show any large increase over the previous year. The English companies suffered the worst and most of them fell into serious financial difficulties. Bingham and the Cottonwoods continued to be the chief lead-producing districts, and in the latter the Emma mine was still the largest shipper, but at the end of the year it was practically exhausted and never afterward was it of importance except as a memory. It has been a hope in Cottonwoods lasting to this day that someone would discover an ore deposit like the famous Emma bonanza. The Miller mine, of American Fork Cañon, was also exhausted this year.

Many new smelting works were erected in 1873, and the importance of the Salt Lake Valley as a smelting center increased materially. A narrow-gage railway was completed from Sandy, on the Utah Southern railway, to the Winnemuck smelting works in Bingham Cañon, thus affording a cheaper outlet for the lead ores of that district. Dressing works were erected at Bingham Cañon, inaugurating a system of preliminary treatment of the ore that furnished to the smelters an improved class of smelting material. In general the smelting industry in Utah continued to be characterized by bad metallurgical practice, save at the Germania works, which were better managed than the others, and began to take a distinct place in the lead industry of Utah.

There was a very considerable increase in the lead production in 1874, which was chiefly due to the Bingham district, then the most important lead-producing district of the territory. A large output was still made, however, by the Cottonwoods, especially by the Flagstaff mine, which produced 14,767 tons of ore. There was a noteworthy increase in the number of dressing works in the Bingham district.

The production of lead in 1875 also remained substantially at a standstill. This was apparently due, to a considerable extent, to the great competition among the smelters for ore which prevailed during the year, extinguishing their profits and compelling many of them to shut down. The year was marked also by the completion of a narrow-gage railway to Alta, in the Cottonwoods, reducing the freight from Alta to Sandy to $2.50 per ton. Coke from the San Pete district of Utah was also used this year by the smelters of Utah for the first time.

Subsequent to 1875, the lead production of the Cottonwood and Bingham districts of Utah fell off, but the decrease in the output from these sources was much more than compensated for by the great yield of the Horn Silver Mining Co., which began to come into prominence about 1878. The mines of this company were situated in San Francisco mining district, near the town of Frisco, 240 miles from Salt Lake City. The output of the district was made almost entirely by two companies, the Horn Silver Mining Co., owning the Horn Silver mine, and the Frisco Milling and Smelting Co., owning the

Cave and Carbonate mines. Both of these companies smelted their own ore. The Horn Silver Milling Co. originally had a plant at the mines, but that proving to be uneconomical, a new plant was erected at Francklyn, near Salt Lake City, and a refinery was also erected at Chicago, Ill. For about five years the production of the Horn Silver Mining Co. was very large, as appears in the following table:

Year	Ore Smelted, Tons	Lead Assay	Bullion Produced, Tons	Lead Sold, Tons	Average Price per Cwt.
1879 } 1880 } 1881	51,758	36.12%	16,915	1,556 3,900 7,893	$4.07 4.53 4.61
1882	48,551	37.79	16,127	14,568	4.60
1883	42,663	36.83	15,008	14,991	4.20
1884	39,185	30.91	11,603	10,976	3.50

The price for lead in the above table is what was realized in Chicago. Besides the ore smelted the company sold 6150 tons to other smelters. Previous to the sale of the property to the Horn Silver Mining Co., there had been smelted 16,299 tons of ore assaying an average of 38.49% lead, which produced 5180 tons of pig lead. The total output of this famous mine up to the end of 1884 was 204,607 tons of ore, which yielded 69,380 tons of base bullion and 7,260,566 oz. of fine silver.

The cost of mining in 1884 was $5.07 per ton of ore. Miners were paid $3.50 per day and laborers $3. The smeltery at Francklyn had five furnaces, which reduced 39,185 tons of ore at a cost of $13.29 per ton, but the total quantity of material smelted, including fluxes and fuel, was 103,079 tons. The cost of refining base bullion at Chicago was $8 per ton.

In 1885 the Horn Silver production declined greatly, and in 1886 the mine became practically dead. Subsequent to this time, the chief lead-producing districts of Utah were Bingham Cañon and Park City, the latter, discovered in 1871, having attained prominence in 1873 when the famous Ontario mine was opened, but as a lead producer it did not become of great significance until about 1884, when the Crescent mine was a large producer. Subsequent to 1884 the lead production of Park City increased very largely, and at the present time it is the most important lead-producing district of Utah. The mines at Tintic, Stockton and Alta have been continuously worked, but during the last 20 years the major portion of the lead production of Utah has been derived from the mines of Bingham Cañon and Park City.

Utah Apex Remodeled Mill

SALT LAKE CITY CORRESPONDENCE

The Utah Apex Mill at Bingham, Utah, has lately been remodeled and now is the largest mill treating lead ore in Utah. It is treating over 300 tons of lead ore per day, or at the rate of 10,000 tons per month. The mill was designed and built by the General Engineering Co. of Salt Lake City.

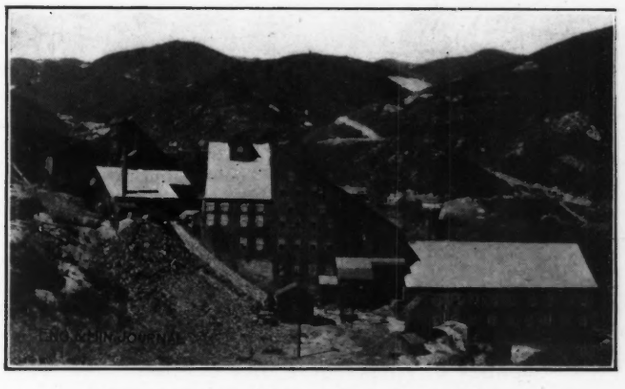
Ore passes over a 1-in. grizzly to a 700-ton storage bin, then to a hand-picking belt and then to the crushers. Coarse crushing is done by Blake-type crushers. Fines go to coarse jigs and oversize, over ½-in., to 16x36-in. Allis-Chalmers rolls, and is crushed to ¼ in. Product from rolls is sized into four sizes by Callow screens which take place of trommels. Oversize goes to fine rolls and is crushed to two millimeters, $\frac{1}{12}$ in. Undersize from Callow screens goes to fine jigs. Tailings from coarse jigs are reground in two Hardinge mills. Part of undersize from screens is sent to hydraulic classifiers. Sands from classifiers are treated on Wilfley tables, and fines and slimes pass to Callow tanks, and are treated on Isbell vanners. Mill is equipped with automatic samplers both for crude ore and tailings. Woodbury jigs are used. Ratio of concentration is 4:1. First-class ore is cobbed on a picking belt between storage bins and crushers, and 10 to 12 tons of first-class ore is picked out daily. Ore reserves are at present largest in mine's history.

The Mines Operating Co., Park City, Utah

BY G. H. DERN*

The plant of the Mines Operating Co., at Park City, Utah, is of unusual interest because of the new methods that have been successfully applied. Although it has been in operation nearly two years, we have preferred not to give out information regarding the process and results until our various problems had been solved and the whole scheme demonstrated as a success.

The Mines Operating Co. has a lease on the Ontario mine down to the 900-ft. level and is milling the old stope fillings. These fillings assay from 6 to 14 oz. silver, averaging 9 to 10 oz. They also carry very small amounts of gold, copper and lead. The ore is not amenable to cyanidation and could not be profitably worked until the present process was introduced. In the treatment, the ore is given a chloridizing roast, after which it is leached in open vats with an acid salt solution and the dissolved metals precipitated upon scrap copper and iron. The novel part of the process, and the key to the situation, is the method of roasting. It is believed that this is the first time internal-combustion roasting has been successfully used in conection with lixiviation, and that it promises results of far-reaching importance.



OLD ONTARIO MILL, PARK CITY, UTAH
(Now used by the Mines Operating Company)

The ore is crushed dry by means of rolls, to pass a ⅝-in. screen. It is then mixed with about 7.5% salt and 2.5% coal dust and properly moistened. The mixture is then roasted in a shaft type of roaster, a columnar charge being ignited at the bottom and roasted through by means of a blast of air. Eight of the roasters now in use are of the hand-operated, intermittent type, and are crude in many respects. However, they are operated at a cost of less than $1 per ton, including salt, and even with the coarse crushing that experience has

*General manager, Mines Operating Co., Park City, Utah.

proved most economical in the present installation, an extraction of about 80% of the silver is obtained.

Since the foregoing furnaces were built, a continuous, mechanically operated roaster, called the Holt-Dern roaster, has been perfected, and one of these has been in operation for six months. Test runs in this roaster on ore crushed to ¼ in. show an extraction of 90%. A careful estimate shows that in a good-sized installation this roaster can be operated for close to 15c. per ton, exclusive of the salt. The company is now getting ready to tear out its old roasters and install Holt-Dern roasters in their stead.

The advantages of the roasting process employed in this plant over old styles of roasting furnaces are claimed to be as follows: (1) Volatilization losses, which have always been the bugbear of chloridizing plants, have been totally eliminated. (2) The roaster makes no dust, hence there is no loss from this source. (3) The fuel cost is low, because the cheapest grade (coal dust) is used, and a very small percentage is required. (4) Fine grinding is not necessary to get high extractions. Owing to the depth of the charge, the heat is retained in intimate contact long enough to fracture and thoroughly chloridize comparatively coarse pieces. (5) Slimy ores are converted into a permeable, readily leachable product, thereby simplifying and cheapening the subsequent treatment. (6) The roaster gases are readily condensed for leaching purposes. When the ore carries the proper percentage of sulphide, the leaching solution is a byproduct of the roast, and no additional reagents are required.

After roasting, the ore is leached in wooden vats, 20 ft. in diameter by 12 ft. deep. This depth of column leaches very freely and rapidly, and could just as well be deeper. Wooden pipe lines are used, and the solutions are handled by means of air-lifts. The solutions are extremely corrosive, and one of the hardest problems to solve was the pumping. The present method of handling solutions is entirely satisfactory.

The pregnant solution is first conducted to the silver precipitator. This is a concrete apron, set at an angle, looking like an immense amalgamating plate. It is covered with a thin layer of scrap copper, and as the solution flows over it the silver and gold are precipitated upon the copper, making a gray precipitate carrying 50 to 60% silver. As the silver is precipitated, about an equal quantity of copper goes into solution. The silver precipitator was only recently installed, but has proven efficient and economical. The head solution assays about 3 oz. and the tail solution 0.2 oz. silver. The solution then goes to the iron boxes, which look like large zinc boxes, and are filled with scrap iron. Here the copper, part of which is extracted from the ore and part dissolved on the silver precipitator, is precipitated in the head compartments, the lead coming down in the lower compartments. Precipitation is practically complete. the iron-box tail solution showing only a trace of silver The iron-box precipitate runs about 65 to 70% copper and 500 to 600 oz. silver. It is dried and shipped to the smelter. The silver precipitate is dried, fluxed and smelted directly into bullion, running about 975 fine.

The plant is treating 150 tons per day, and the total cost of milling in May was $2.07 per ton, including repairs and general and overhead charges. It is anticipated that the proposed remodeling will reduce the costs at least 40c., and that on an increased capacity the whole operation could be carried on for $1.50 per ton. The cost of operating the process will of course vary with the location. When chloridizing is to be used, the cost of salt will always be one of the main items. Under favorable conditions, the process could be carried out on a large scale for $1 per ton or less. Theo. P. Holt, one of the inventors of the process, is superintendent.

Park City Milling Co.

By George H. Scibird*

Operations will be started at the custom-milling plant of the Park City Mills, at Park City, Utah, about Aug. 15. The first unit of the plant is a 50-ton chloridizing-leaching installation, so arranged that its capacity may readily be doubled. An additional unit is to be a concentrator to handle the heavier sulphide ores.

The leaching plant will follow established practice, the ore being dry crushed with rolls to pass a 0.1-in. aperture. It will then be roasted with salt and pyrite to form chlorides of the metals, lead, copper and silver, the gold being taken care of in the leaching tanks. After the roast the ore is leached with an acid solution of common salt, to which is added bleaching powder in sufficient quantity to chlorinate the gold. Precipitation will be effected by the use of scrap sheet iron and copper. The copper throws down the silver and gold, and the iron recovers the copper and some of the lead.

The ore, while still hot, is charged into the leaching tanks from the after-chloridizing bin, the result being that the first leach is made with a boiling solution, thus effecting a rapid extraction of the metals. All solution lines are, of course, of wood, as the solution rapidly corrodes any metal. Air lifts are used to elevate the solutions, this form of pump being particularly suitable under the conditions.

The mill will be operating on ore from the American Flag mine for a number of years, at the present capacity, but it is the intention of the company to enlarge the plant in the near future to meet the needs of the camp. However, recent developments in the American Flag mine have been so favorable that it is not improbable that the enlargement of the mill will be necessary to handle the output of this property. The concentrator unit will be supplied by the same mine, which has a considerable tonnage of gold, silver, lead, zinc ore blocked out in readiness.

The leaching plant will handle only the siliceous ores from the mine, as lime is harmful in the process. Experimental work has demonstrated the fact that the American Flag ores are particularly suitable for the process. The officers of the company are: George H. Short, president; M. W. Kishman, vice-president; George H. Scibird, treasurer and manager, and John Cain, secretary.

A Safe and Sane Fourth Celebration can most properly include a first-aid field contest. Such a contest formed part of the program on July 4 this year at Ely, Nev. The officials of the Bureau of Mines rescue car, which was just finishing its work in the district, helped in carrying it through. Of the two teams in the mine-rescue contest, the Nevada Con. Veteran-mine team defeated the Coppermines team, 86 to 85, out of a possible 100, according to the Nevada Con. bulletin "Safety First." Both these scores were high. In a competitive exhibition drill of first-aid crews, nine crews were entered from the various works of the two companies. The team from Copper Flat got first place and two teams from the Steptoe concentrator, second and third. In a special contest a Greek team worked against a Japanese, both making excellent showings.

*Manager, Park City Milling Co., Park City, Utah.

Details of Practical Mining

Energy of Hammer Drill Blow*

No mine in the country pays more attention to its drilling practice than the North Star at Grass Valley, Calif. The Paynter rock-drill tester developed here was described in the JOURNAL, Nov. 1, 1913. It is a remarkably ingenious and useful machine, by means of which a graphic record of a drill's hitting ability is obtainable. In a recent paper, the North Star management describes a series of experiments conducted with the machine from which interesting conclusions were drawn. The machine registers the intensity of the drill's blow and makes it possible to count the number delivered per minute.

To express the energy of the blow in foot-pounds, the tester was calibrated by allowing a sphere of known weight, suspended as a pendulum, to fall through meas-

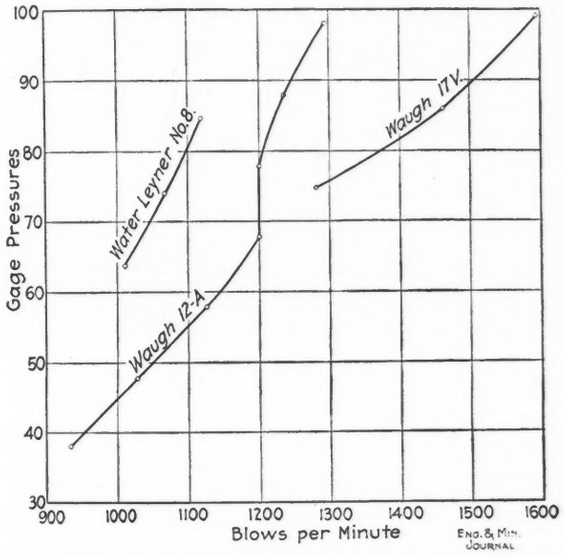


FIG. 1. CHARACTERISTIC CURVES OF TYPICAL MACHINES, SHOWING INFLUENCE OF GAGE PRESSURE UPON BLOWS PER MINUTE

ured distances against the plunger of the tester. The corresponding distentions of the diaphragm, which controls the movements of the recording pencil, were noted. By forcing oil into the system with a pump, the diaphragm was distended to each of these points in turn, and the static pressure corresponding to each was read on the gage. A curve was then constructed with foot-pounds as abscissas and pounds of static pressure as ordinates. The strength of any blow, recorded on the graph, can be measured by pumping oil into the system until the distention of the diaphragm moves the recording pencil out the corresponding distance. The pressure in the system at this point is read on the gage. The foot-pounds corresponding to this can then be taken directly from the curve. Since the areas of the plunger and of the diaphragm do not change, equal blows will produce the same pressure, even though permanent straining of the diaphragm may result in their producing unequal distentions. Errors which might be caused by these inequalities of distention are avoided by thus expressing strength of blow in terms of equivalent static pressure instead of magnitude of distention.

From the graphs taken by testing a drill at different gage pressures, characteristic curves may be constructed, as shown in Figs. 1 and 2. There are also given the results of tests made to determine, if possible, the relations existing between drilling speed, blows per minute and foot-pounds per blow.

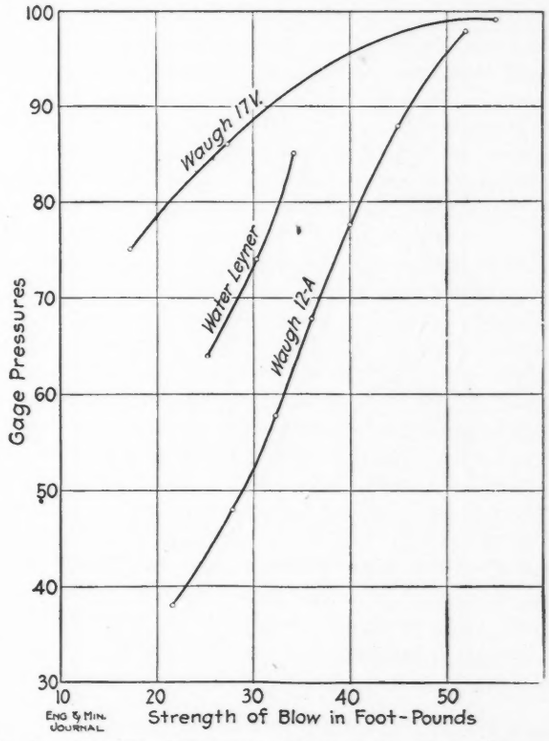


FIG. 2. CURVE, SHOWING EFFECT OF GAGE PRESSURE UPON STRENGTH OF BLOW

Table I compares: *a*, Three drills striking a hard blow; *b*, two drills striking a medium blow. These were tested in extremely hard ground with holes at an inclination of 25°, 1¼-in. cross steel with 2¼- and 2-in. bits being used; conditions, however, were kept the same for each test, which lasted 5 min.

TABLE I—COMPARISON OF DRILLING SPEEDS

	Foot-Pounds	Blows per Minute	Drilling Speed, Feet per Minute
a	52	936	0.126
	52	1320	0.165
	55	1584	0.250
b	40	1260	0.108
	42	2352	0.195

These results indicate that drilling speed varies approximately with the blows per minute, the strength of the blow remaining constant.

*From paper by Robert H. Bedford and William Hague prepared for the Salt Lake meeting of the A. I. M. E.

Table II compares drilling speed with varying strengths of blow. The conditions of test were: Ground only medium hard; length of each test 5 min.; 1¼-in. cross steel with 2-in. bit; holes at an inclination of 45°; drill, air-feed stoper.

TABLE II—CHANGES IN STRENGTH OF BLOW

Blows per Minute	Foot-Pounds per Blow	Feet Drilled per Minute
1272	48½	0.378
1222	43	0.447
1200	38½	0.308
1170	34½	0.250
1090	30½	0.188

A test under the same conditions as that of Table II, except that the inclination of the holes was 20°, gave the results shown in Table III.

TABLE III—RESULTS WITH FLAT HOLE

Blows per Minute	Foot-Pounds per Blow	Feet Drilled per Minute
1272	48½	0.251
1222	43	0.206
1200	38½	0.198
1170	34½	0.135

A test was made under the following conditions: Ground hard; length of each test, 5 min.; drill, No. 8 water Leyner; 1⅛-in. hollow steel with 2¼-in. bit; holes nearly horizontal. In this test varying strengths of blow were obtained by means of stops of different lengths screwed into the ends of the valve chest. The results are shown in Table IV. Test *a* was first made and the results confirmed with test *b*.

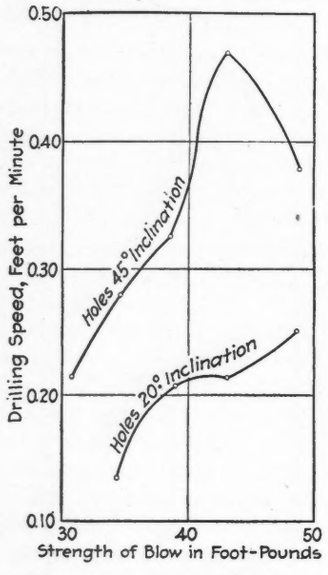


FIG. 3. INFLUENCE OF STRENGTH OF BLOW ON DRILLING SPEED OF AIR-FEED STOPER

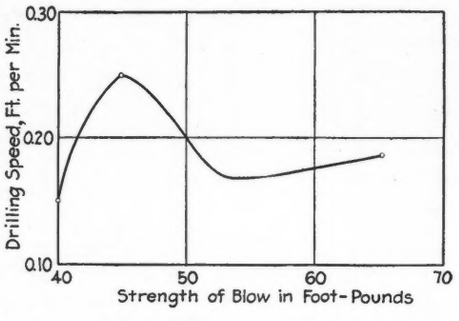


FIG. 4. INFLUENCE OF STRENTH OF BLOW UPON SPEED OF WATER LEYNER NO. 8

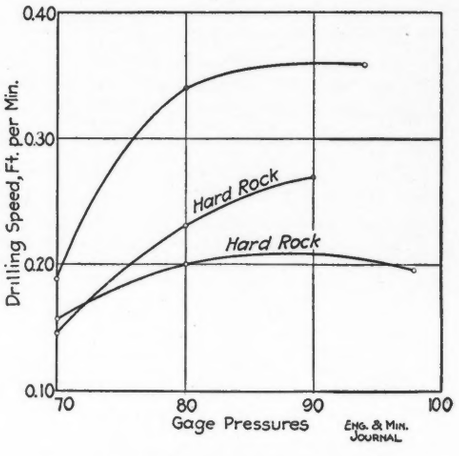


FIG. 5. INFLUENCE OF GAGE PRESSURE ON DRILLING SPEED

TABLE IV—LEYNER TESTS

	Blows per Minute	Foot-Pounds per Blow	Feet Drilled per Minute
a	1368	40	0.162
	1272	45	0.234
	1260	52	0.119
	1212	65	0.129
b	1368	40	0.135
	1272	45	0.224
	1260	52	0.183
	1212	65	0.195

As already stated, Table I indicates that for blows of equal strength the drilling speed is approximately proportional to the number of blows, even when these differ as much as 40%. In constructing the curves of Figs. 3 and 4 from Tables II, III and IV, where the maximum variation in the number of blows is 15%, the drilling speed has been arbitrarily adjusted according to the results obtained from Table I, so that the effects of the strengths of blow may be comparable.

These curves all show the same tendency to flatten at above a certain strength of blow, which in this ground happens to be about 45 ft.-lb. It will be noticed that the curves for the Leyner and for the stoper at 45° inclination are almost exactly similar. This is thought due to the fact that in each case the face of the hole is clear of cuttings. In the cases of the flat holes, which do not clear themselves, the drilling speed is not only lower, but does not show the same peak. This suggests that where holes can be cleared of cuttings a 45-ft.-lb. blow is sufficient to obtain the fastest drilling, whereas, in holes where the deadening effect of cuttings exists, the limit of effective blow is higher. This also emphasizes the desirability of a stoper with water feed to the face of the hole.

From these tests, and others giving similar results, it has been decided that for conditions existing at this mine, stoping drills should strike a minimum of 40 ft.-lb. As none of these drills has yet been found that strikes over 55, it remains solely a question of maintenance to keep them at this point.

The Leyner, with blows as high as 65 ft.-lb., presents a different problem. In this type the valve was so adjusted by means of standard plugs screwed into the ends of the valve chest, as to give at average gage pressure, blows in the neighborhood of 45 ft.-lb. It is hoped that this reduction in strength of blow will result in lessened breakage of steel, decreased repair costs, and maximum drilling speed. The adjustment has not been in use long enough to give any figures on the first two points.

The effect of setting the minimum strength of blow in the stoping drills at 40 ft.-lb. has been to increase the breakage of steel by 1 lb. per drill-shift, and the cost of repairs by 27c. per drill-shift. The footage drilled, however, has been increased 15%, reducing the cost per foot of hole drilled from 20.3 to 18½c. The cutput per drill shift has increased 10% during the same period, but this figure is complicated by the width of stope broken, and is therefore not quite comparable.

Examination of Table II shows the decrease in drill-

ing speed that may be expected with a stoper striking 30 ft.-lb., as compared with 45 ft.-lb. Of this point it may be stated that many confirmatory tests have been made. Unless the drills are maintained at their best, the strength of blow drops rapidly (sometimes after 100 drill-shifts), with resulting decrease in drilling speed. The cost per drill-shift, however, remains practically the same. It is obvious what the result will be.

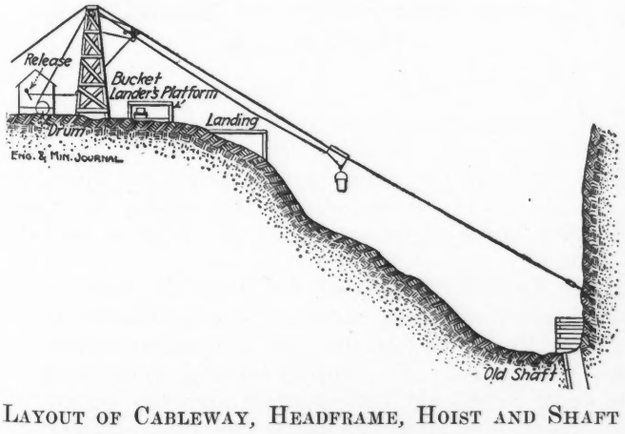
Cableway-and-Carrier Bucket Hoist

By R. B. Wallace*

An unusual hoisting arrangement is in use for some small-scale work at the property of the Republic Iron Co., Republic, Mich. A cable is stretched across an old openpit from the tower to a point over the shaft opening, which lies on the other side and at the bottom of the pit.

Relation of Hoisting Equipment to Openpit and Shaft

A cableway carriage runs across the pit on this cable and carries the bucket; at the lower end it automatically releases the bucket and drops it into the shaft. This



Layout of Cableway, Headframe, Hoist and Shaft

shaft descends at about 85°, and enters some old workings where floors and pillars are being cleaned up.

The hoisting is done by electricity and the bucket is landed by the engineer. At the completion of a hoist, the carriage is automatically held stationary while the bucket is allowed to descend to the lander's platform. When the bucket has been hoisted up to the carriage again, the moving of a lever in the engine house releases the carriage. Two buckets are used, one being filled while the other is hoisted. The diameter of the track rope is 1⅛ in., and of the hoist rope, ⅝ in. The capacity of the bucket is 0.6 ton. In an awkward situation, such as this, where the quantity of ore does not warrant an elaborate hoisting plant, this scheme works satisfactorily.

In the photograph the track leading toward the observer goes to the rock dump, while the stockpile trestle leads back over the hill. The topographic conditions are shown in the photograph and the general arrangement in the diagrammatic drawing.

*Mining engineer, Republic Iron Co., Box 82, Republic, Mich.

Increasing Compressor Capacity by Cooling Inlet Air

By L. D. Anderson*

In the installation of air compressors, a method of increasing their capacity is often overlooked, although well recognized by engineers. It may be stated that the capacity of a compressor with inlet air at 90° F. is only about 95% of its capacity with an inlet temperature of 60° and about 90% of what it would be if this temperature were 32°. Frequently the air for compression is drawn from the engineroom itself or from the sunny side of the building.

At the Centennial-Eureka, Utah, the master mechanic, James Knowles, hit upon the scheme of drawing his inlet air from an old tunnel extending into the hill alongside the compressor house. In the tunnel the air in the summer time was always much cooler than outside. The use of this cool air resulted in a perceptible increase of compressor capacity, the machine running noticeably slower after the innovation was adopted.

Undoubtedly many mines could obtain for their air compressors a similar source of cool air. If the tunnel be any distance from the compressor house, it is advisable that the air conduit be a wooden box to avoid heating, with a cross-sectional area large enough to eliminate losses due to the possible creation of partial vacuums, as might happen in smaller conduits; it should probably be equal to the area of the piston. The adoption of such a scheme will help to keep up the air pressure in the day time when all the drills are running and may besides save some fuel.

Leyner vs. Piston Again†

For the Leyner drill, the cost of sharpening, breakage, and repairs, makes a high cost per drill shift. Comparison with a type of machine in which these items are low is valuable, as it proves that the expense is justifiable. A 5x7-ft. drill in the North Star mine requires 11 holes, aggregating 43 ft., to break a round. A 2¼-in. reciprocating drill, striking 40 to 50 ft.-lb. blows, 600 to 800 times per minute, used to require two drill shifts for drilling the round, at a cost of $4.45 per drill shift, or 20½c. per foot of hole. The Leyner does this in one drill shift for 15½c. per foot of hole.

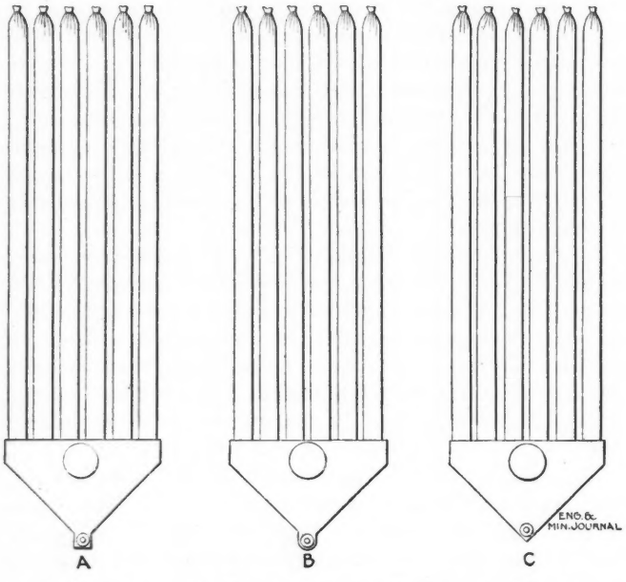
*Superintendent U. S. Smelting Co., Midvale, Utah.

†From a paper by Robert H. Bedford and William Hague, presented at the Salt Lake meeting of the A. I. M. E.

Details of Milling and Smelting

Collecting Baghouse Dust

In the baghouse at Midvale, Utah, the filtered products are caught from the bags in V-shaped steel hoppers, through the bottom of which run 9-in. screw conveyors, delivering the baghouse dust into tram cars. This, according to L. D. Anderson[1], is better than putting the conveyors in the bottom of a rectangular chamber or in a hopper having a small rectangular or semicircular cross-section. The baghouse dust is inclined to "hang up" and hence there is a likelihood that the screw conveyors may not be entirely effective when applied in rectangular chambers; with the small square or semicircular boxes,



ARRANGEMENT OF CONVEYORS IN BAGHOUSE HOPPERS
A and B not good. Arrangement C approved

the worms will invariably get choked up. The arrangements shown in the accompanying illustrations in *A* and *B* are not recommended. A better arrangement is shown in section at *C*. This gives the dust a chance to relieve itself on the side instead of choking up and breaking the screws.

Roasting in Wedge Furnaces without Fuel

In discussing the roasting of lead matte in the JOURNAL of July 11, L. D. Anderson commented upon the use of the Wedge mechanical furnace at Midvale, Utah, where it was found that the lead matte could be roasted without the fuel necessary with the old furnaces used for this purpose. At the United States Smelting Co.'s works, four seven-hearth Wedge furnaces, 21 ft. 6 in. in diameter, have been installed. In the treatment of lead matte in these furnaces, a preroast is all that is desired, as it is followed by sintering on Dwight-Lloyd machines. Care must be taken to leave a sufficient percentage of sulphur in the product to promote ignition on the sintering machines. When first started, at Midvale, fuel was used with the Wedge furnaces. In an effort to prevent too great elimination of sulphur, the speed of the rabbles was increased and a larger tonnage fed to the furnaces; the fuel was gradually lessened until it was entirely cut off, yet the matte kept on roasting and gradually the operators were able to control the operation with sufficient skill to eliminate fuel regularly after the furnace was satisfactorily started. Three Wedge furnaces are used for a similar operation at the American Smelting & Refining Co.'s plant at Murray; these furnaces, like Midvale furnaces, have seven roasting hearths and a dryer hearth, but are 22 ft. 6 in. in diameter.

Previous to the installation of these furnaces, lead matte was roasted either in single-hearth mechanical furnaces, such as the Godfrey, or in hand reverberatory furnaces, the fuel consumption ranging from 12% up to as high as 25%, in some cases. Wedge furnaces are being installed for similar roasting operations at the lead-smelting plants of the Ohio & Colorado Smelting & Refining Co., at Salida, Colo., and of the American Smelting & Refining Co., at Leadville.

Roasting without fuel in Wedge furnaces is also being done at copper works, such as at the Consolidated Arizona Smelting Co., at Humboldt, Ariz., where a White-Howell roasting furnace was formerly used with fuel. Now about 110 tons per day of copper concentrates, limerock and basic ore, having an average sulphur content of 22%, is roasted down to 5% S. Wedge furnaces will be installed at the new copper works of the International Smelting & Refining Co., at Miami, Arizona.

[1] "Effects of the Baghouse on the Metallurgy of Lead," Bull. A. I. M. E., July, 1914.

Cross Sections of Smelting Buildings

BY PERCY E. BARBOUR*

The accompanying illustrations show a panel of each of two typical copper smelters. One is a strictly blast-furnace plant and the other a reverberatory- and blast-furnace plant. In the case of the latter works, the reverberatory- and blast-furnace panels are shown in separate figures.

The Tennessee Copper Co. has a strictly blast-furnace plant which, of course, makes the length of panels much shorter than would be the case if long reverberatories had to be housed. The Garfield smelting works has both types of furnaces. The converter craneway section in this plant is the same for both the blast and reverberatory sections, but is shown in the illustration only in connection with the long panel.

The cranes in the two plants are naturally of different capacities and the consequent crane columns and crane girders are interestingly different, in one case as to weight

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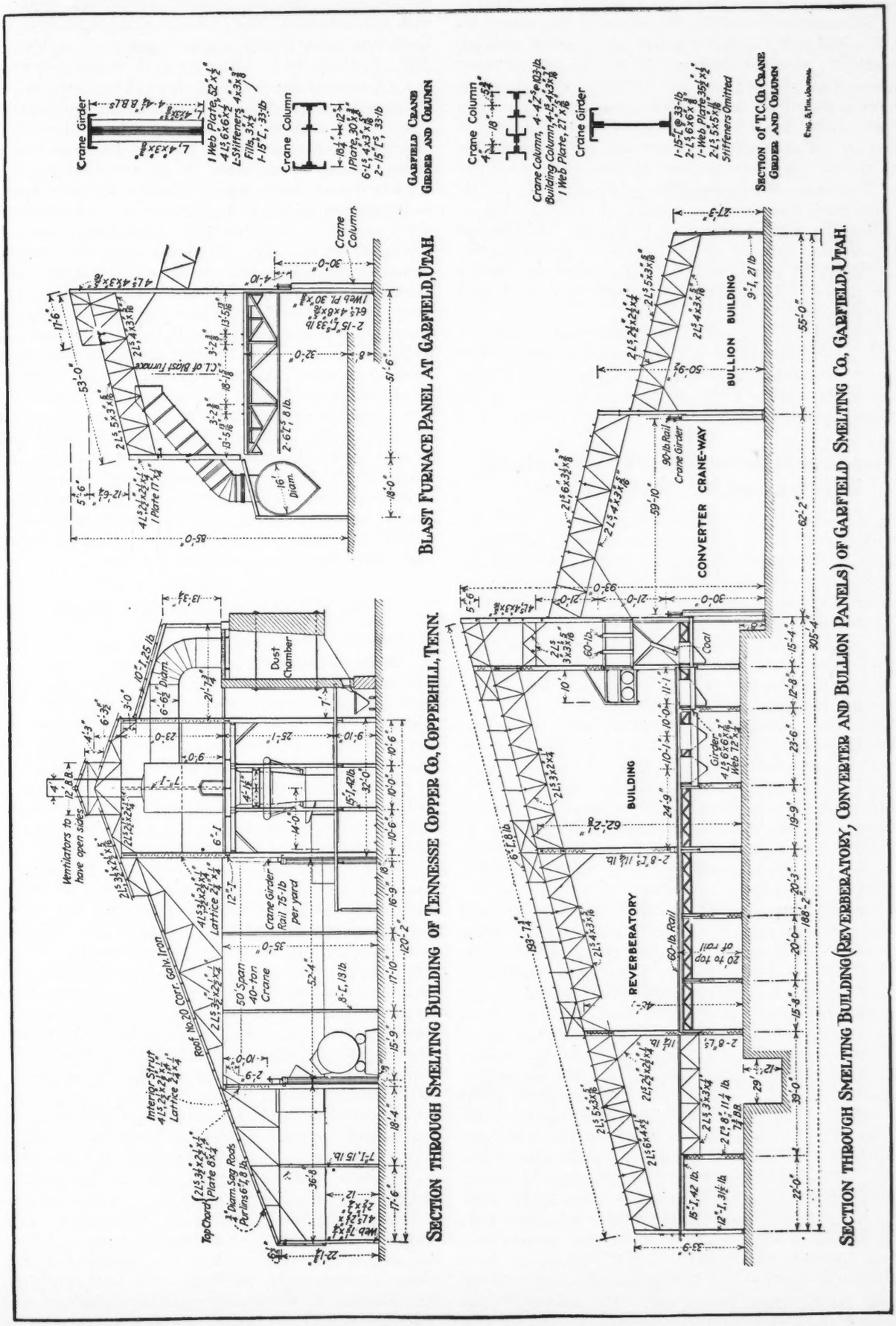

Crane Girder
Crane Column
Garfield Crane Girder and Column
Crane Column
Crane Girder
Section of T.C.Co. Crane Girder and Column
Blast Furnace Panel at Garfield, Utah
Section through Smelting Building of Tennesse Copper Co, Copperhill, Tenn.
Section through Smelting Building (Reverberatory, Converter and Bullion Panels) of Garfield Smelting Co, Garfield, Utah.
CONVERTER CRANE-WAY
BULLION BUILDING
REVERBERATORY
BUILDING
Dust Chamber
Crane Girder Rail 75-lb per yard
50' Span 40-ton Crane
Roof No. 20 corr. Galv. Iron
Ventilators to have open sides
Interior Strut
Top Chord
Purlins
Coal
90-lb Rail
Crane Girder
60-lb. Rail

of cross-section and in the other case as to difference in built-up cross-section. The Tennessee works uses a 40-ton crane of 50-ft. span. Garfield uses a crane with 60-ton capacity on main hoist and 10 tons on the auxiliary. The crane span is 59 ft. 10 in. In both plants the crane girders are built up of similar sections, differing only in weights, each consisting of a channel, four angles and a web plate. The crane columns, which are built together with the building columns, are of quite different types. The Tennessee column is made up of four 4in., 10.3-lb. Z bars, and the building column of four 4x3x$\frac{7}{16}$-in. angles with a common web plate, 27x$\frac{5}{16}$ in. The Garfield crane column is made up of one 15-in., 33-lb. channel, four 4x3x$\frac{5}{16}$-in. angles and the building column of one 15-in. channel and two 4x3x$\frac{5}{16}$-in. angles with a common web plate, 30x$\frac{3}{8}$ in.

The length of bays, or distance from center to center of the panels, should be given in order to give proper value in considering the weights of the two panels if comparisons are made. This length is 18 ft. 1 in., at the Tennessee plant, and 30 ft. at the Garfield plant.

Intermittent Shaft Roasting Furnaces at Park City

In the new chloridizing-leaching mills in Utah, the crucial part of the process was to secure a satisfactory roast without the loss of valuable metals, the operation in other respects being similar to former practice. A number of the mills have been experimenting with roasting furnaces. At the Mines Operating Co.'s plant, in Park City, the Holt-Dern continuous roaster has supplanted the original intermittent furnaces, which are described by Theodore P. Holt in the July bulletin of the American Institute of Mining Engineers.

Eight shaft roasters of the intermittent type were originally installed. The shaft furnaces are 10x10 ft. inside the walls, which are of reinforced concrete 10 in. thick. About 2 ft. above the bottom there is an inclined wooden grate supporting a layer of coarsely crushed rock; the space below this grate forms an air chamber. The tops of the furnaces have a sheet-iron cover, the gases being drawn off below this cover. The method of operating is as follows:

A special starting "mix" of about one ton is prepared in front of the roaster. A layer of coal dust mixed with oil is then spread over the gravel floor of the roaster. This is ignited and sufficient blast admitted to burn it rapidly to glowing coals. The special mix is then shoveled evenly over the surface. By the aid of the air blast, the coals ignite the fuel in the ore, which begins to roast. When the starting layer has roasted through, so that the fire appears on top, the air is shut off for a few minutes, while the first charge of about five tons is dropped from the mixed-bin gate into the roaster. This is spread out by hand and the air again turned on. The roast is allowed to proceed until the surface on the charge glows. Then a second charge of about 10 tons is dropped on and four hours later a final charge of about the same amount. This brings the total depth of charge up to about 7 ft. Under normal conditions, this will roast through in 8 to 12 hours.

When the roasting zone has reached the surface at all points, the air blast is shut off. The discharge door is opened and a sluicing apron inserted, to connect with the launders. The hot roasted ore is then sluiced out with mill solution. The sluicing nozzle is made of hardwood and has a 1⅛-in. nozzle opening. It operates under a head of 45 ft. The nozzle is suspended in position in front of the discharge door. The operator stands at one side, to avoid the numerous steam explosions, and directs the nozzle with a long rod. Under normal conditions it takes from one to three hours to sluice out a roaster charge of 24 tons. From the roasters the hot ore mixed with mill solution passes by means of launders to leaching tanks, 20 ft. in diameter by 12 ft. deep.

During 1913, the Holt-Dern continuous roaster was developed at this mill to overcome the difficulties experienced with the old furnaces. A commercial-size roaster was installed in December, 1913, and except for a few brief delays for changes has been in continuous operation ever since. In the Holt-Dern furnace, a column of ore moves down at intervals as the roasting zone proceeds upward. As the air blast travels in an opposite direction to the ore, it becomes highly heated when it reaches the roasting zone where active combustion of the fuel in the charge is taking place. It finally passes through a layer of moist, unroasted ore and leaves the roaster fairly cool and free from dust. A comparison of the costs with the old and new furnaces showed $0.539 for the intermittent furnaces, as against $0.165 for the Holt-Dern roaster, which has reduced hand labor to a minimum.

Nodulizing Flue Dust

In the JOURNAL of May 24, 1913, p. 1037, reference was made to the experiments in nodulizing blast-furnace flue dust in a 60x6-ft. cement kiln at the copper-smelting works of the United States Metals Refining Co., at Chrome, N. J. Some further details of these experiments are contributed by Lawrence Addicks in a paper to be read at the Salt Lake meeting of the American Institute of Mining Engineers.

The kiln, which had a 6-in. brick lining, was set at an inclination of ⅝ in. to the foot and made 1½ r.p.m. The kiln was fired with oil except during a short period when the fuel-oil market ran away, the top prices reaching nearly 6c. per gal.; then a large firebox for coal, similar to those used in reverberatory practice, was tried, but did not operate satisfactorily, owing to the impossibility of keeping an even temperature at the mouth of the kiln when firing. Most cement kilns are now fired with pulverized coal, but the nature of the Chrome experiment did not permit of the considerable investment required for coal drying and pulverizing. Fuel oil is an ideal fuel for such work when its costs are low and at the time these experiments were begun, it was selling at about 2½c. per gal. The oil consumption was lower than had been indicated by preliminary experiments with a smaller test kiln. With the 60x6-ft. kiln, a granular sand could be made with about 8 gal. per ton, a first-class smelting nodule with 12 gal. and great chunks with 16 gal. per ton.

When perfectly clean, 75 tons of flue dust could be nodulized, but with a choked-up shell, only about half this output was made. There is a decided tendency to form accretions within the shell, and it took some time for the operator to acquire the necessary skill to control the formation of the rings. Steady conditions of flame

are necessary; if the kiln is overheated, semi-molten material forms on the walls and a subsequent overchilling will plaster the sand on rapidy. Various mechanical contrivances for removing accretions were tried and abandoned; spraying with a hose was more effective; with reasonable care on the part of the attendants, and a few hours' work for two or three men once in two weeks, accretions were kept down to a point so that the cylinder delivered an average of 50 tons per day without difficulty.

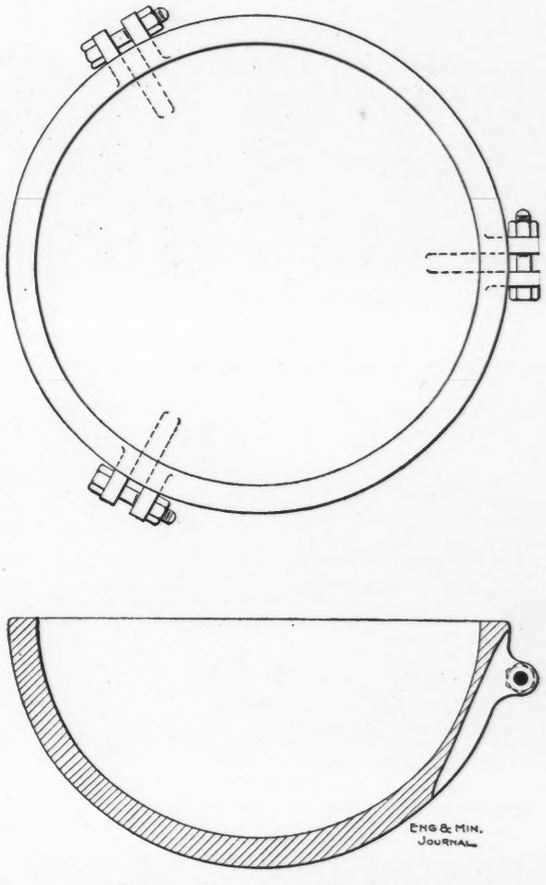
The normal operating condition of the kiln is to have the first 40 ft. next the flue, acting simply as a preheater, without any real nodulizing action. The material then begins to stick and ride around, which is the first step toward the formation of nodules. The actual nodulizing should be completed in the next 15 ft., leaving the last 5 ft. for hardening to nodules in the cooler zone back of the flame. This is to keep the nodules from sticking together in a semi-fused mass when they drop into the receiving car. Nose rings will be confined to the 15-ft. nodulizing zone, where they are readily accessible from the end when the firing hood is rolled away. No trouble was experienced from flue dust blowing out of the kiln. It was expected that a considerable saving would result by delivering red-hot nodules to the blast furnace, but they smelted so much faster than the rest of the charge that better results were obtained by feeding the nodules cold. This probably would not be true in the case of nodulizing ores where the product was not self-fluxing. About 25% of the flue dust fed would pass 100 mesh, and a screen test when making small nodules gave the following results: Between ½ and ¼ in., 54.21%; between ¼ and $\frac{3}{16}$ in., 23.16%; between $\frac{3}{16}$ and $\frac{1}{16}$ in., 20.6%; between $\frac{1}{16}$ in. and 80 mesh, 1.9%; through 80 mesh, 0.08%. The oxidizing action, though marked in a small test kiln, was much less so in the larger kiln, nodules having 4.95% S being obtained from flue dust containing 11.86% S or an elimination of 58 per cent.

While nodulizing is comparable with blast roasting, the two processes have different limitations, much as in the case of a comparison between blast furnace and reverberatory smelting. Sintering requires a properly balanced internal fuel supply, while nodulizing is entirely independent of this. To nodulize properly, a material must have a sufficient interval between the temperature of becoming sticky (incipient fusion) and that of actual melting to give a practical range of operating flame temperatures. As a nodule is formed from individual grains stuck together, every piece has a solid structure and there are no defective ones full of unsmelted material. Mr. Addicks believes that the kiln is deserving of a wider application in the metallurgical field than it has as yet obtained, but the extent of this expansion can only be determined by experiment. While these notes cover but a single material, blast-furnace flue dust, and that from but a single plant, yet this material is much more like ore than pyrites cinder and other refractory products. It would be advisable to use a kiln 7 or 8 ft. in diameter to lessen the nose-ring difficulty, and this is in line with the experience in other classes of work. As to length of kiln for low-temperature work, 60 ft. is probably long enough; for refractory materials calling for a greater unit fuel consumption longer kilns will pay in fuel saving. As far as operating cost goes, the crux of the whole matter lies in the cost of fuel. A single operator can attend to the firing of several kilns.

It may be mentioned in passing that experiments have indicated the nodulizing kiln to be well adapted to the agglomeration of flotation concentrates for subsequent blast-furnace smelting. An experimental kiln has been shipped to the Braden Copper Co. for this purpose. The disposal of flotation concentrates has been something of a problem at those smelting plants where they have been received, both on account of their high moisture content and on account of the fineness of the material.

Saving Speiss Pots

Running speiss from the blast furnace into pots is likely to crack them after a short time, and it has been difficult to find an iron that would give an economical life. At the plant of the Deloro Mining & Reduction Co., Deloro, Ont., an attempt has been made to increase the life of the pots by a change in design. In place of casting them of even thickness, three channels are cast at



SPEISS POT WITH CHANNEL

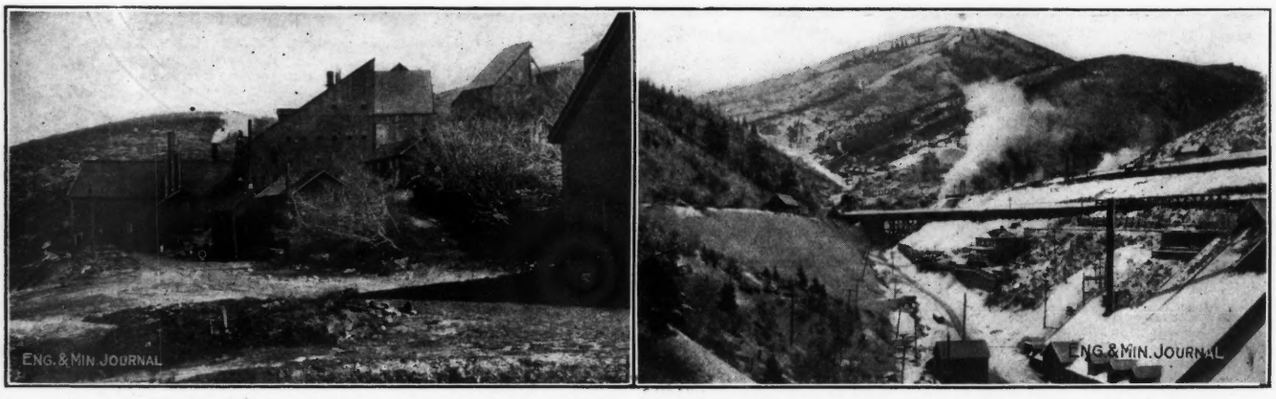
equally distant points on the sides, the channels reaching about halfway down the side of the pot. The thickness of the iron at these points is reduced to about ⅛ in. At the sides of the channels lugs are cast, provided with bolts. The idea is that if the iron cracks, it will do so at these weakest points, and then the bolts can be tightened up, bringing together the edges of the crack, which can also be luted to prevent leakage.

The pots have not been in use long enough to definitely prove the value of this design, but so far there seems to be some advantage. The pots hold about 750 lb. of speiss.

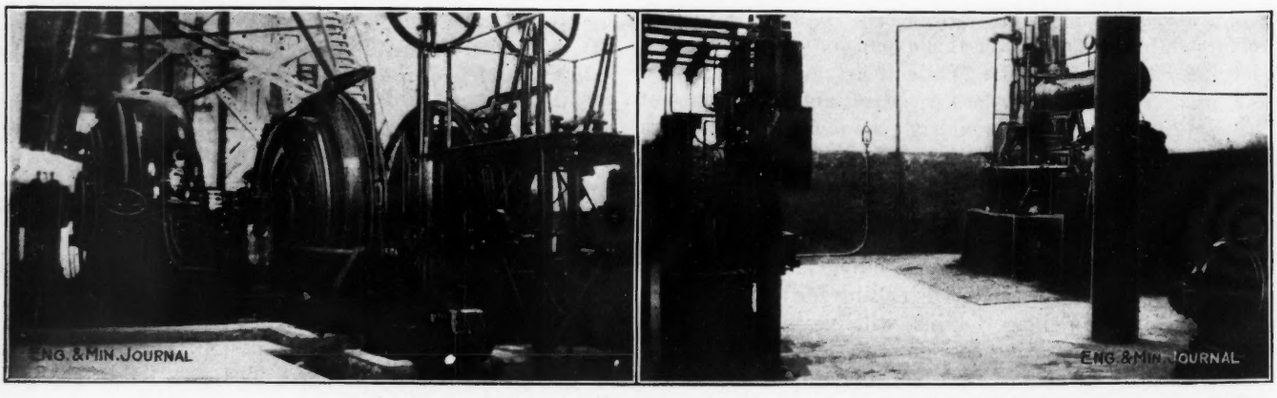
Photographs of Utah Mines

OUTCROP OF ROCK ASPHALT ABOVE SUNNYSIDE, CARBON COUNTY
Some streets in Salt Lake City have been paved with this material

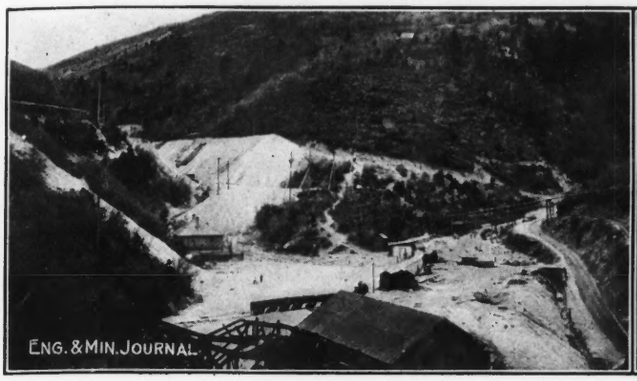
ONTARIO MINE AND SILVER KING MINE IN SUMMIT COUNTY
Two lead-silver ore producers of Park City



MINES OPERATING CO.'S MILL AND DALY JUDGE MILL AT PARK CITY
The Mines Operating Co. uses a chlorination process and recently made its first shipment of bullion; previously shipped product having been a precipitate

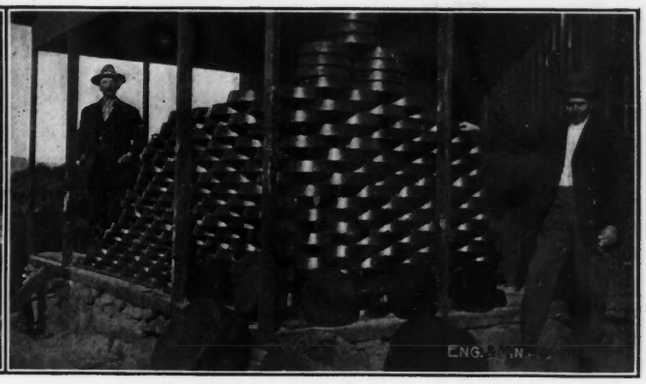


UNDERGROUND HOIST AND COMPRESSOR AT SILVER KING COALITION MINES
This installation on the Alliance Tunnel level was completed in May



OLD TELEGRAPH MINE DUMP

The Old Telegraph is one of the oldest mines in Bingham

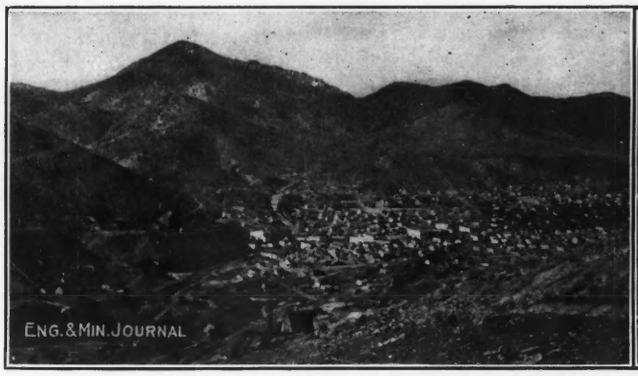


OZOCERITE READY FOR SHIPMENT

A hydrocarbon mineral product of Emery and Uintah Counties

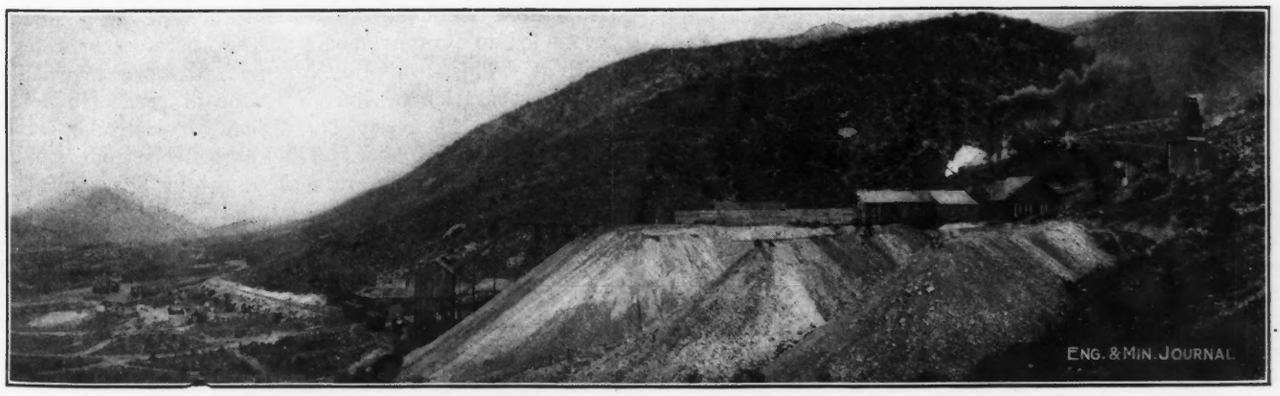
U. S. MINING CO.'S TRANSFER HOUSE AND UTAH COPPER MINE AT BINGHAM

Bingham has been a producer, first of gold, then silver-lead and now principally copper ores



EUREKA AND MAMMOTH IN THE TINTIC DISTRICT

A large number of small and moderate size mines keep up the production of this silver-lead district



PLANT OF THE EAGLE & BLUEBELL MINE AT EUREKA

One of the steadily producing mines of the Tintic district

Electrostatic Ore Separation

By I. C. Clark*

SYNOPSIS—Electrostatic ore separation is based upon the principles of static electricity and the relative conductive powers of minerals. The Huff electrostatic separator is used almost universally in the process. The feed must be warm and dry and some system of dust collection should be installed. The electrical equipment is comparatively simple and is independent of atmospheric conditions. Flowsheets vary according to the class of ore treated. In order to obtain satisfactory returns from a mill, exhaustive tests should be made on the minerals before erection of a plant.

The basic principles of electrostatic ore separation are those of static electricity. When two electrical conductors of like polarities are made to approch each other, they are mutually repelled; conversely, conductors of opposite polarities will attract each other. The force of this repulsion or attraction depends upon the conductive power of the bodies and the strength of the current with which they are charged. The conductors always remain separated by a nonconducting medium called the dielectric. Examples of such a nonconducting medium are air, mica, glass and rubber. The dielectric constant of air is assumed to be unity, and the constants of other dielectrics are obtained by comparison with it. The principles of electrostatic ore separation are entirely distinct from those of electromagnetic ore separation. These two processes must not be confused, for in reality they are totally different.

Conductivity of Minerals

Every mineral will conduct electricity through its body or over its surface if subjected to an electric current of sufficient voltage. A great difference exists, however, between the relative conductive powers of various minerals. Many metallic sulphides and some other minerals are comparatively good conductors. Most gangue-forming minerals and a few metallic sulphides are poor conductors. The following substances fall into one or the other of these classes, the good conductors being native metals, pyri[illegible] chalcopyrite, chalcocite, pyrrhotite, galena, argentite, tetrahedrite, pyrargyrite, molybdenum, tellurides, garnet, magnetite, hematite, hornblende, biotite, graphite, black sands, most sulphides, and most copper, iron, silver and manganese minerals, while the poor conductors comprise quartz, quartzite, sandstone, granite, porphyry, feldspar, epidote, garnet, calamine, spinel, slate, fluorspar, monazite, calcite, limestone, dolomite, siderite, sphalerite, smithsonite, barite, gypsum, most siliceous minerals, most carbonates and most sulphates.

If a mixture of minerals containing good and poor conductors in a neutral state be allowed to fall upon a conductive surface charged to a high potential, the good conductors will immediately become charged with like polarity and be repelled with more or less force. The poor conductors, however, will require considerable time to become similarly charged. They may either fall from the conductive surface by their own weight or be repelled with only a slight force. Let this same mixture of minerals be charged with electricity opposite in polarity to that of the conductive surface, and the operation repeated. The good conductors will immediately reverse their charge of electricity upon contact with the surface and be repelled as before. On the other hand, the poor conductors will be strongly attracted to the conductive surface, being charged with electricity of the opposite kind. Some time is required for the poor conductors to lose their initial charge and receive a charge similar to that of the conductive surface. Even then these minerals would either be repelled with only a slight force or merely fall from the surface by gravity.

Similar minerals from different places often possess different units of electrical conductivity. Sphalerite or blende is generally classed as a poor conductor. Occasionally this mineral will contain appreciable quantities of iron or manganese chemically combined with it. These impurities may alter the conductive power of the mineral in a marked degree. Instead of remaining a poor conductor, it may become a fairly good conductor, depending upon the relative amounts of combined impurities. Theoretically, an electrostatic separation may be made between minerals having only a slight difference in conductive powers. Practically the process is quite a delicate operation. In order to insure a clean separation the minerals treated must have a marked difference in conductive power. Much trouble has been experienced in separating minerals where combined impurities alter their conductance. Careful watching is required when such minerals are treated in electrostatic separators.

Some minerals may be changed from poor to good conductors by electrochemical action. This is the practice at Ouray, Colo., to a limited extent. Zinc sulphide, sphalerite, is immersed in a solution of copper sulphate, its surface becoming coated with a film of copper sulphide. After being dried this mineral is treated as a good conductor. Heat is also used to alter the conductive properties of minerals. Carbonates of poor conductivity may be changed to oxides of good conductivity in this way.

The Huff Separator

The Huff separator is used almost universally in electrostatic separation plants. The principles of operation of this machine are illustrated in Fig. 1. The framework is made almost entirely of iron and is grounded to prevent shocks to the operators by contact with it. This grounding of the framework also assists in the separation by increasing the difference in potential between the charged and neutral electrodes, which will be explained later. The charged electrodes to the left in the diagram are maintained at a potential of 20,000 volts and are carefully insulated from the iron framework. The neutral electrodes, to the right in the diagram, readily form a portion of that series of guides which are grounded with the framework of the machine. A dielectric of air separates these two series of electrodes, forming an exceedingly strong electrostatic field between them. All lines of force emanating from the electrodes are confined to this comparatively limited field.

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The ore in a neutral state is fed continuously on the machine by a revolving roller beneath the feed hopper. The feed is regulated by an adjustable feed gate and by the speed of the roller. After passing over the roller the minerals fall on a series of metal guides which direct them between the electrodes. While thus falling between the electrodes the minerals are subjected to the intense action of the electrostatic field. The good conductors are immediately charged with electricity similar to that of the electrodes and are repelled to the left as indicated in the diagram. The poor conductors require a much longer time to absorb this charge of electricity and fall through the machine by gravity before any appreciable repulsion takes place.

On some varieties of ore minerals three or more products may be obtained by making more than one split. In such a case the best conductor would be repelled farthest to the left and be collected in a hopper suitably placed. The poorest conductor would fall directly through the machine and be collected below, as indicated in the diagram. Minerals of intermediate conductivity would be collected in hoppers placed at intervals between these two. This triple operation is not often feasible, for in most cases a clean separation can be made between only two products. The majority

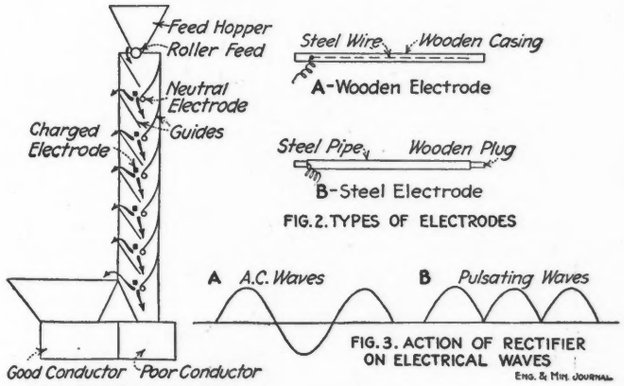

FIG. 1. DIAGRAM OF HUFF ELECTROSTATIC SEPARATOR

FIG. 2. TYPES OF ELECTRODES

FIG. 3. ACTION OF RECTIFIER ON ELECTRICAL WAVES
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of static mills now in operation make but one or two shipping products.

Electrodes, Two Types Being Used

The electrodes on all of the Huff machines are adjustable, thus permitting a wide variation in the strength of the electrostatic field. In order to accomplish uniform mechanical work, the upper electrodes are placed far apart and the lower electrodes are held quite close together. The upper electrodes having first "pull" at the mineral particles will repel the good conductors with the greatest force. Consequently they are placed at a considerable distance apart, this distance being determined by experiment for every class of ore treated. The lower electrodes have the hardest work to perform, cleaning the poor conductors from last traces of good conductors. They accomplish this work by being placed closer together. The adjustment of electrodes can be determined only by careful experiment and will vary with each class of ore treated.

Two general types of electrodes are in common use in electrostatic mills, as illustrated in Fig. 2. The first type is made of wood, coated with shellac and inclosing a steel wire. This wire is directly connected to the electrifying apparatus. The second type consists of a hollow steel-rod, insulated from the framework of the machine by wooden plugs or supports, and connected to the electrifying apparatus. The wooden electrode was the type first used, though at present the metal electrodes are largely replacing them. The wooden casing is generally covered with a coating of shellac. After remaining in use for some time these electrodes become heated, due to the intense electrical action and the warm feed. The shellac coating becomes somewhat sticky and the falling mineral particles will adhere to it. This adhering mass may become large enough to form a short-circuit between the charged electrode and the grounded framework. In this case all the current generated would be immediately grounded and the minerals would fall directly through the machine, no separation taking place. Adhering mineral particles might still do damage without causing a direct short-circuit. All lines of electrical force will concentrate at the points of least resistance between the electrodes. A mass of adhering mineral particles will decrease the resistance of the dielectric between the electrodes at that point. The concentration of electrical action at this point will cause sparking and may eventually burn out the electrode. Dust is liable to collect at the ends of the hollow-steel electrodes. This layer of dust may bridge over the wooden insulating plugs, thus grounding the charged electrode through the iron framework of the machine. Drops of oil or grease are apt to fall on either type of electrode. Dust and mineral particles will collect at such places with the above deleterious effects. All electrodes must be kept free from grease and dirt, and constant attention is necessary to insure this. This is one of the most important features of the process and carelessness here may lead to serious results. A single charged electrode on one machine becoming grounded will ground all the remaining electrodes in the mill. In case the electrodes become grounded, the feed to all machines should be immediately shut off until the trouble can be remedied. An ample supply of new electrodes should always be kept conveniently at hand.

It is common practice in electrostatic mills to ground the neutral electrodes. This aids the separation by insuring the maximum difference in potential between the charged and neutral electrodes. The earth is always assumed to be at zero potential and everything connected with it will have a like potential. If not grounded the neutral electrodes might accidentally be maintained at a considerable potential above that of the earth. This would decrease the difference in potential between them and the charged electrodes, thus materially hindering the separation.

How Moisture Interferes with Separation

In order to obtain a good separation all machines must be fed with warm, dry ore. The feed, necessarily crushed to a comparatively small size, would cause endless trouble by mechanically clogging the machines, if much moisture were contained. Dampness would also cause the mineral particles to stick together, thus resisting the separating action of the electrostatic field. A moist feed would render the electrical features of the process absolutely useless. The electrodes would be grounded almost immediately, the electricity generated being wasted be-

fore any work is accomplished by it. Even a small percentage of moisture in the feed hinders the separation materially. Water is a good conductor of electricity. A poorly conductive mineral might readily be changed to a good conductor by a film of moisture adhering to its surface. This increase in conductivity might be sufficient to cause the supposed poor conductors to be repelled with the good conductors, the value of the products formed being materially decreased. The dielectric of air between the electrodes should also be free from moisture, as damp air is a partial conductor of electricity. If this dielectric consisted of damp air sparking might ensue, current be wasted, and the lines of electrical force weakened. The electrical equipment of an electrostatic plant in itself may be independent of atmospheric conditions, but the process as a whole is not. The more moisture contained in the atmosphere the hotter must the drier be fired in order to insure a warm, dry feed to all machines. This will prevent water from condensing on the mineral particles or on the machines and dry the dielectric of the electrostatic field. The drier should be maintained at a temperature between 300° and 600° F., depending upon atmospheric conditions and the character of the minerals treated.

Treatment of Dust

Large quantities of dust are formed during electrostatic separation, which is readily understood from the nature of the process. This is particularly true when a considerable percentage of the minerals treated is finer than 200 mesh. When falling between the electrodes the finer particles have an excellent opportunity to float off into the air. This dust, if not confined, represents a loss of mineral and impairs the health of the machine operators. At best the machine room of an electrostatic mill is an extremely dusty place in which to work. The operators generally wear respirators.

In order to reduce the bad effects from large quantities of dust formed, ventilators are placed over each machine. These ventilators are connected with a baghouse, suction being provided by an electric fan. A large percentage of the total dust formed may be recovered in this manner. A baghouse equipped with a dozen 30-ft. bags, 12 in. in diameter, is large enough to handle all the dust from a fair-sized mill. These bags must be shaken and emptied every few weeks. A suction fan is usually necessary in the flue, in order to maintain a good draft through the drier. Large quantities of dust are given off here and a chamber for collecting it should be built below this fan. This dust chamber should be cleared once a month or oftener, as required. Without the installation of a system of dust collection, mineral losses from this source may reach a surprising figure during a month's run. Sanitary considerations alone will require the installation of such a system sooner or later.

All minerals require some sizing before becoming amenable to electrostatic separation. The extent to which close sizing is required depends entirely upon the character of the ore treated, and can only be determined by extensive tests upon it. Many combinations of sizing should be tried until the one giving maximum recoveries is plainly evident. A coarsely mineralized ore requires less initial crushing than a finely crystallized variety. Some ores require no sizing below 12 or 16 mesh, while others demand close sizing down to 150 mesh. As a rule, from four to six distinct sizes are necessary to insure a clean separation. The following examples give the average sizing required for different grades of material:

1. Through 4 on 8 mesh. Through 20 on 50 mesh. Through 8 on 20 mesh. Through 50 on 100 mesh. Through 100 mesh.
2. Through 20 on 40 mesh. Through 60 on 80 mesh. Through 40 on 60 mesh. Through 80 on 100 mesh. Through 100 mesh.
3. Through 40 on 60 mesh. Through 80 on 100 mesh. Through 60 on 80 mesh. Through 100 on 150 mesh. Through 150 mesh.

No. 1 is coarsely crystalline, No. 2 of medium texture and No. 3 finely granular.

Sizing is often accomplished by means of inclined "toboggan" screens. After being discharged from the drier the ore is immediately elevated to a series of these screens. Motion is imparted to the screens by revolving hammers striking against projections on them and opposed by springs, or revolving cams at the sides of the screens, also opposed by springs. Ample screening surface should be provided to make a sharp division between sizes. These screens discharge the ore into chutes or conveyors leading to the machines treating their respective sizes.

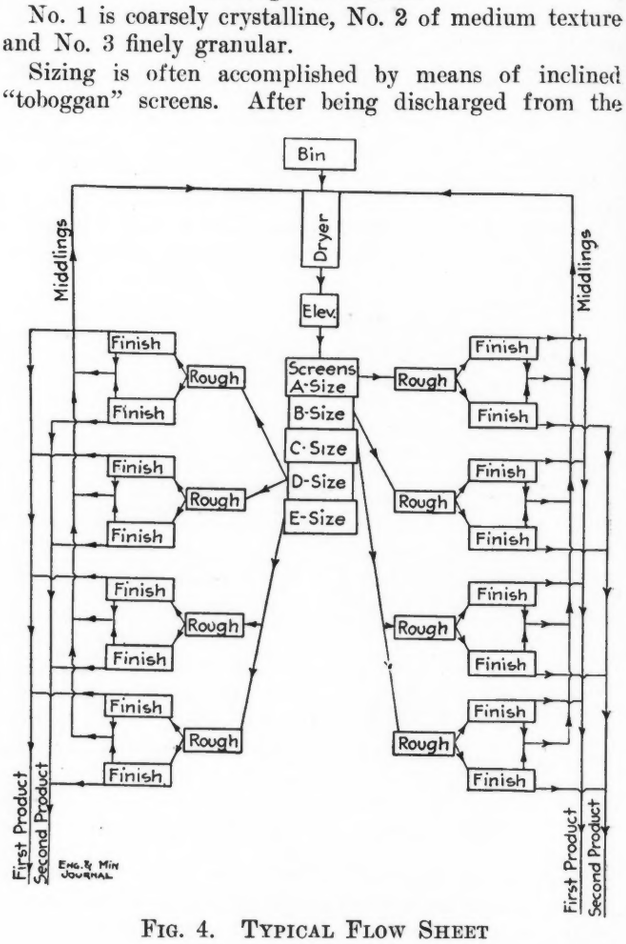


Fig. 4. Typical Flow Sheet

The necessity for sizing is apparent. In the separation of a good from a poor conductor, the good conductor is repelled with considerable force. If much difference exists between the various sizes of mineral particles, a large particle of the good conductor might mechanically carry off one or more smaller particles of the poor conductor. If, however, the particles are all of ap-

proximately the same size, mechanical entrainment is less apt to happen.

The electrical equipment required for the operation of a static mill is comparatively simple. It consists in the main of an alternating-current generator driven by a small motor, a resistance box and a rectifier. The generator produces an alternating current of high potential but of low amperage. From the generator the current passes through the rectifier, which changes the negative alternating-current waves to positive pulsating waves, as indicated in Fig. 3. This pulsating current is necessary so that the electrodes will receive only a positive charge of electricity. If charged with ordinary alternating current the mineral particles would be successively attracted and repelled, thus causing a poor separation. The speed of the generator is regulated by a resistance box, so that the terminal voltage may be varied at will. The electrical equipment of a static mill is itself independent of atmospheric conditions, although the process as a whole is not.

Every electrostatic mill shows some variation in its flowsheet. In all cases, however, the ore passes through a drier, is elevated to the screens, where two or more sizes are made, and then passes over the different machines. In some instances one pass over the machine may be sufficient to form finished products for each size. Generally, however, it is necessary to re-treat each product from the roughing machine on a finishing machine, thus forming two or more finished products and a certain amount of middlings. One rougher and two finishers are now built in combination, performing the work of the three smaller machines, but requiring less space. The middlings from the finishers may either be returned again through the entire mill or simply be reheated and treated on small middling machines. Fig. 4 represents a typical flowsheet in a somewhat simplified form. We will assume the proportion of sizes given in the accompanying table:

Size	Through Mesh	On Mesh	Percentage of Feed	Machines: Rougher	Machines: Finisher
A	20	40	10	1	2
B	40	60	15	1	2
C	60	80	20	2	4
D	80	100	25	2	4
E	100	..	30	2	4

This flowsheet has been simplified so that the general features of the mill are not disguised. All middling products formed are returned to the drier and pass through the entire mill again. This feature is objectionable, as these products have already been dried and sized, their return through the mill causing a waste of power and screening surface. It is always poor policy to return a middling product back over the same machine that first produced it. Such a process will eventually crowd the machine with middlings and, in order to prevent this, the grade of the finished products must be lowered. If necessary, the middlings should be separately heated again and re-treated on middling machines placed beneath the regular machines, the different sizes being treated on their respective machines. Any middlings made on these last machines would either be negligible, or, if returned through the reheater again, would be so small in amount as not to interfere seriously with the separation. Other changes would be necessary to meet local conditions, but in all cases the general arrangement of the mill would be similar to that shown in Fig. 4.

The Huff electrostatic process was originally introduced on zinc ores and the separation of blende from pyrite is still its broadest field of usefulness. It must not be thought, however, that this separation is only adapted to such materials. Practically no limitations can be placed with regard to the minerals treated provided they possess a sufficient difference in electrical conductivity. The process has already been successfully tried on many types of minerals, some of which might be mentioned here: Zinc, lead and iron middlings; chalcopyrite in quartz; pyrite and chalcopyrite in various gangues; chalcopyrite and bornite in granite; zinc, iron and silver ores; native copper in sandstone; pyrite concentration for sulphur; silver ores from a quartz gangue; molybdenite from gangue minerals; mica from graphite flake; slate from coal, etc. Electrostatic mills are now in successful operation in several places in the United States and a few in foreign countries. A broad field has already been opened to this process and the future will no doubt extend its scope.

Cyaniding in Utah

Great as Utah is as a mining state, the cyaniding process has never been widely applied, a fact which is due solely, of course, to the nature of its ore deposits. The great orebodies have been silver-lead, copper and zinc combinations, to which cyanide processes have not been considered particularly applicable.

Notwithstanding these adverse conditions, Utah has had one of the most famous of cyanide plants within her borders. This refers to the plant of the Consolidated Mercur Mines Co., a plant which, first and last, has been a useful one to the profession in general. Its value has been due to the difficulty of treating the Mercur ores, and the necessity for breaking into unexplored metallurgical fields to secure a profitable process, a proceeding that was probably much more interesting to the professional public than to the Mercur management.

The original Mercur ores, for which the district was first worked in about 1869, were silver-lead combinations, with silver chloride and silver-lead carbonate. Later the large gold veins were discovered, and a serious time followed in the endeavor to make the ores profitable. Roasting and amalgamation proved altogether unsatisfactory, and the proposition was considered almost hopeless until the advent of the cyanide process. This was early applied, and in spite of dubious results at first it was soon demonstrated that with experienced operators the ores would pay very well.

At this time only the oxidized ores were mined, these being siliceous limestones which were coarse and friable. The first leaching experiments showed that the ore could be broken to a comparatively coarse state and leached with success. This was due to the passage of solution through the cleavage planes of the ore in which the gold was mainly deposited. The gold itself was so fine as to be entirely invisible to the naked eye and only discernible upon recourse to chemical methods. Many difficulties were encountered in leaching, because if any fine grinding or crushing was resorted to, slimes were produced to such an extent that percolation was a physical impossibility. Thus it was that a separate sand and slime treatement had to be inaugurated, and much original work was done before success was attained.

It was at the Mercur that the Moore filter process was first put into practice, and in conformity with most Mercur experiments, it seems, failure was the first product. Nevertheless, the process has since been perfected, and some credit is due to the old Mercur for her first efforts. Here also zinc dust was first used as a precipitant for the cyanide solutions, with the usual unsatisfactory result. The difficulties were determined, however, and with these in view success has since been brought out of the older failures.

Dividends Equal 20% of Production

The fact that in a total production of something over $17,000,000, dividends amounting to $3,445,313 have been paid, from first to last, gives the Mercur a record which may be pointed to with pride by the operators who have brought it about in spite of all the discouraging and disappointing experimental periods which had to be gone through.

Aside from the Mercur mine, cyaniding has had practically no place in Utah, although there have been from time to time various small and unimportant plants working more or less intermittently. At the present time there are known to be only two small plants using cyanidation. One is at the Bully Boy mine, at Marysvale, which has a 100-ton plant running on gold ore and separating sulphides by concentration, followed by cyaniding of the tailings. Another is the plant operated by Griggs, Castleton & Carter, who have bought the May Day dump in the Tintic district and are treating it by cyanide. Their tonnage is from 50 to 75 tons per day. Other mills which have been in operation, but which are now idle, are those of the Norma Gold Mining Co., the Sheep Rock Mining & Milling Co. and the Utah Leasing Co. It is possible that the latter may resume work some time this year.

Utah Copper Co.

To sum up the results of operations of the Utah Copper Co., Bingham, Utah, as shown by its annual report, before going into details of the report itself, the following figures are given: At the end of 1912 the company had on hand a balance of quick assets amounting to $1,688,799 and at the end of 1913 this balance had increased $1,727,103 and totaled $3,415,902. During the year $4,747,710 was paid in dividends. Taking the net gain in quick assets and dividend payments we have a net balance of $6,474,813 over all expenditures. This was the actual amount from 1913 operations available for dividends and must not be confused with the $8,513,105 net profit for the year shown in the report. The calculations that follow were made to show clearly the difference between net profits as figured in the report and net balance available for dividends, and with no intention of criticizing the bookkeeping methods of the Utah Copper Co.

The Mountain Utah Copper Co. Is Devouring—

SUMMARY OF FINANCIAL STATEMENTS GIVEN IN REPORT

Receipts from the sale of:		
113,942,834 lb. of copper @ 14.976c		$17,063,635
28,121.244 oz. of gold @ $20		562,425
285,589.35 oz. of silver @ 59.582c		170,158
Miscellaneous mine-operating receipts		1,346
Total operating revenue		$17,797,564
Dividends on investments (not including $2 per share on 1,000,500 shares of Nevada Consolidated)		175,000
Income from rentals, interest, royalties, etc		94,200
Total income from operations and investments, excluding Nevada Consolidated dividends		$18,066,764
Expenditures for operations	$11,494,341	
Expenditures for deferred operations	1,493,242	
Expenditures for plant and equipment	817,428	
Expenditures for interest paid	60,318	
Total expenditure for operations and deferred charges		13,865,329
Balance of income from operations over all expenditures		$4,201,435

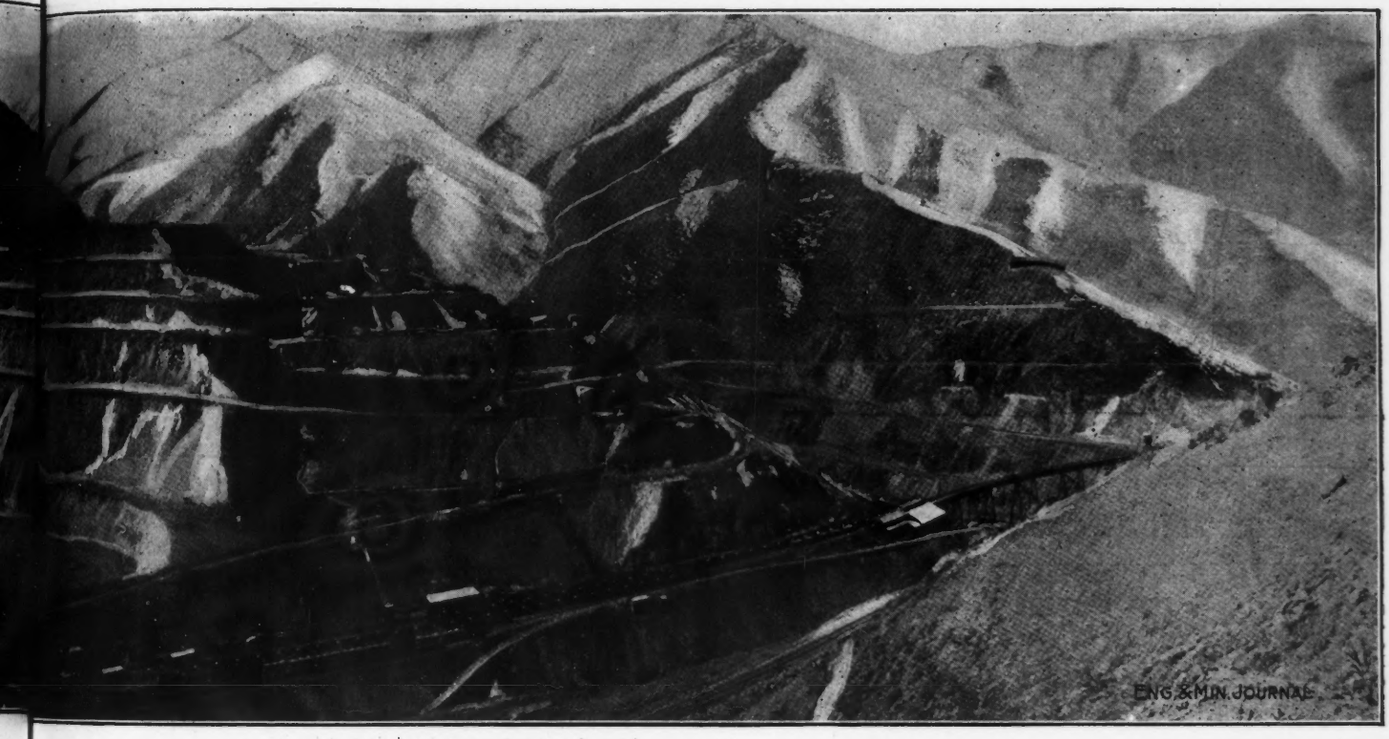
Other receipts:	
From increase in capital stock	40,400
From exchange of stock for Bingham & Garfield Ry. bonds	161,600
From decrease in investment account	70,378
Total	$4,473,813
Income from 1,000,500 shares of Nevada Consolidated Copper Co. stock at $2 per share	2,001,000
Total net balance of Utah Copper Co. for 1913 over all expenditures	$6,474,813
Dividends paid	4,747,710
Increase in quick assets as shown in statements	$1,727,103
To balance with profit as shown in report:	
Amount from 1913 operations available for dividends	$6,474,813
Spent for deferred charges	1,493,242
Spent for plant and equipment	817,428
Total	$8,785,483
Less receipts from increase in capital stock, exchange for bonds, and decrease in investment account	272,378
Net profit for 1913 shown in report	$8,513,105

It is evident from the figures just given that the net amount available for dividends before crediting the Nevada Consolidated dividend was about 3.92c. per lb. of copper. With copper selling at 14.976c. per lb., this gives total expenditures of about 11c. per lb. of copper. Crediting Nevada Consolidated dividends, its net balance over all expenditures was about 5.7c. per lb. (For details of receipts and expenditures see table on p. 270.)

The report states that no underground work was done on the original Utah Copper Co. group. On the original Boston group 24,812 ft. of tunnels, drifts and raises were driven, making total underground workings, for both properties, 83.23 miles. However, only 24.56 miles of these workings remain accessible, the remainder having been destroyed by surface and underground mining. Four development drill holes were deepened and 14 additional holes drilled, the total footage of this work was 10,153 ft. The total combined footage of development holes drilled up to the end of the year was 37,471 ft., or an average of 506 ft. for each of 74 holes.

The cost of underground development was 17.72c. per ton of ore mined underground, or 1.59c. per ton mined on surface and underground. Churn-drilling development was 0.75c. per ton on all ore produced. The total of underground development and surface development was 2.34c. per ton mined compared with 4.51c. in 1912. This charge is included in the mining cost charged to operators. Additional stripping operations have furnished data for changing the estimate of the average thickness of the capping of the developed portion of the entire property from 110 ft. to 114 ft. There was 4,835,479 cu.yd. of capping removed, making 22,125,207 cu.yd. removed to date. Of this total 14,946,276 cu.yd. was removed from the Utah group and 7,178,931 cu.yd. from the Boston group. Stripping operations were extended over an additional 15.43 acres so that the total area over which this work is now being carried on amounts to 171.13 acres. It is estimated that 59.57 acres is now completely stripped of capping. Based upon 114 ft. as the average thickness of capping, there is 183,920 cu.yd. of stripping per acre, therefore, the total capping removed is equivalent to stripping completely 120.30 acres, or, as the report states, is also equivalent to stripping 180,000,000 tons of ore. Of this tonnage about 16%, or 28,720,234 tons, has been mined and shipped to the mills. It is now estimated that the ratio of waste to ore, after considering the grades of the slopes, will be about one to three.

It is expected that underground operations will be completed by May 1, 1914, and thereafter all development work will probably be done by drilling. Of the total ore mined in 1913, 91.02% came from the steam-shovel pits as compared with 77.81% in 1912. The average cost of steam-shovel work was 29.26c. per ton of which 8.32c. represents stripping, prospecting and general charges, leaving 20.94c. for actual working costs. Underground



AS IT LOOKED ON JAN. 1, 1914

mining costs were 69.52c. per ton, including 17.72c. for development. The combined working cost at the mines per ton of ore was 23.04c.; to this is added 9.8c. for development and prospecting, including 7.5c. for fixed charges for stripping, making total mining costs 32.88c. per ton.

Both mills will be finished when a small amount of construction work now underway is completed. The Magna plant treated 4,142,700 tons and the Arthur plant 3,376,692 tons, a total of 7,519,392 tons of ore milled. The average grade of this ore was 1.25% compared with 1.36% in 1912. It is stated that this decrease was due to mining a large percentage of low-grade ore from the northern limits of the deposit. The average mill recovery at the Magna plant was 63.78% and at the Arthur plant 64.18%. The average for both was 63.95%, or 15.95 lb. of copper per ton of ore. The final recovery in refined copper was 15.2 lb. per ton of ore. The cost of milling at the Magna plant was 35.59c. and at the Arthur plant, 38.20c.; the average for both plants was 36.76c. per ton.

The ore reserves were increased 16,000,000 tons in addition to the tonnage mined and estimates at the end of the year indicate 332,500,000 tons of ore averaging 1.47% copper. The capacity of the mills on normal-grade ore is about 21,000 tons a day.

Operating costs and other expenditures and receipts may be summarized as follows:

Total tons of ore treated		7,519,392
Copper produced, pounds		113,942,834
Net yield in pounds of copper per ton ore		15.2
	Amount	Per Lb. Cu.
Operating expenditures:		
Mining and milling	$4,553,222	4.00c.
Treatment and refining	6,086,880	5.34c.
Selling commissions	170,636	0.15c.
Stripping ore	563,954	0.50c.
Mine development	119,649	0.11c.
Total operating expense as charged	$11,494,341	10.10c.
Less gold and silver contents	732,583	0.65c.
	$10,761,758	9.45c.
Less other operating income except Nevada Consolidated dividends	270,547	0.24c.
	$10,491,211	9.21c.
Interest paid	60,319	0.05c.
Net operating total	$10,551,530	9.26c.
Spent on deferred operations	1,493,242	1.31c.
Spent on plant and equipment	817,428	0.72c.
	$12,862,200	11.29c.
Less receipts from stock transactions, and decrease in investments	272,378	0.24c.
	$12,589,822	11.05c.
Less Nevada Consolidated dividends	2,001,000	1.76c.
	$10,588,822	9.29c.
Receipts from copper produced	17,063,635	14.97c.
Net balance over expenditures	$6,474,813	5.68c.

Salt Production in the United States in 1913 amounted to 34,399,298 bbl. of 280 lb., according to the U. S. Geological Survey. Bromine, produced as a byproduct of the salt industry in Michigan, Ohio, Pennsylvania and West Virginia, amounted to 572,400 lb., and calcium chloride, also a byproduct, to 19,611 tons.

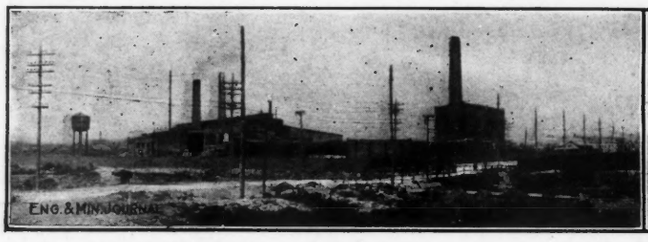
International Lead Refining Plant*

The Parkes-process lead refinery of the International Lead Refining Co., at East Chicago, was built to treat the lead bullion produced by the Tooele plant, Utah. Ground was broken Apr. 16, 1912, and exactly six months later the plant was in operation and lead was being cast. The capacity of the plant running 25 days per month is 5000 tons. The four products of the plant are: Common, corroding and antimonial lead, and doré bullion.

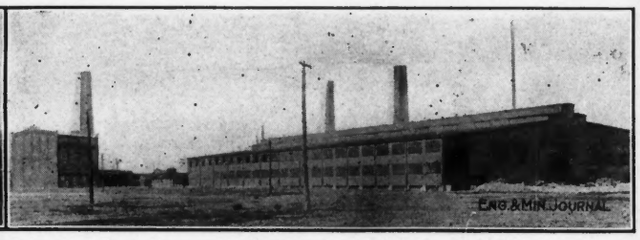
The plant is so arranged that all the principal operations are performed in one main building. This is a steel and concrete structure, 480x180x50 ft. Three broad-gage railway tracks enter the building, and two 15-ton electric cranes, one 28-ft. and one 77-ft. span, travel the entire length.

The main battery consists of the following apparatus:

	Capacity Tons
Two sample kettles	45
Two liquating kettles	60
Two softening furnaces (inside dimensions, 13 ft. 6 in. by 28 ft. 2 in. by 2 ft. 7 in. deep)	300
Two desilverizing kettles	100
One refining furnace	300
One molding furnace	200



Flue in foreground, baghouse at right.



View from opposite corner.

INTERNATIONAL LEAD REFINING CO.'S PLANT, EAST CHICAGO, IND.

The arrangement is such that the lead flows by gravity from one piece of apparatus to the next and is finally hand-molded and loaded by trucks into cars.

For the treatment of byproducts resulting from the main refining operations, the following equipment is provided:

	Capacity
Three residue furnaces, each 8x16 ft. by 20 in. deep (inside measurement)	30 tons each
Two circular blast furnaces, each 42 in. in diameter at tuyeres by 14 ft. high, with five 3-in. tuyeres	40 tons each
Eight retort furnaces	1300 lb. each
Two tilting cupels, Rhodes type	5 tons each

Common lead is further refined to yield a product suitable for corroding by the Hulst crystallizing process. The equipment of this department consists of the following:

	Capacity
Two crystallizing kettles	60 tons
Four heating kettles	20 tons
One press	

Gases from the cupel, residue and blast furnaces are conducted through brick and steel flues to a single bag house. The bag house is a building of brick and steel, 50x65x50 ft. The interior is divided into four separate chambers, each containing 144 woolen bags, 18 in. in diameter and 30 ft. long. The bags are shaken by an electric driven automatic shaking device. The gases are delivered to the bag house by an 8-ft. American Blower Co. fan, driven by a 35-hp. motor.

*An abstract for a paper by G. P. Hulst, read at the Salt Lake meeting of the A. I. M. E.

The change house is a brick building, 35x85 ft. It is equipped with sanitary toilets, wash basins and lockers. One room is arranged as a lunchroom for the men. The offices and laboratory are housed in a brick building 36x128 ft.

Lead bullion from Tooele containing about 99.5% lead, 65 oz. silver, 0.4 oz. gold, and varying amounts of copper, antimony, arsenic, zinc and bismuth, is received at the refinery in sealed cars and after being weighed is delivered into the softening furnaces by means of a steam-driven conveyor, constructed by Howe Scale Co. The sides and ends of these softening furnaces are water jacketed from the base plate to 3 in. above the slag line.

The products of the softening furnace are first skims; second skims and softened bullion. The first two are sent to residue furnace No. 1. The bullion flows to the desilverizing kettles. The copper skimmings are charged into the softener. In the desilverizing kettle bullion is treated with zinc and skimmed, yielding zinc skims and desilverized lead.

The zinc skims go to the retorts and the desilverized lead to the refining furnace. The products of the refined furnace are lead-zinc oxide, refinery skim and refined lead. The first product, depending on its composition, is treated in one of the residue furnaces or in the blast furnace. The skimmings go to residue furnace No. 3. The refined lead, in part, goes to the Pattinsonizing kettles for further treatment, and the remainder passes to the molding furnace.

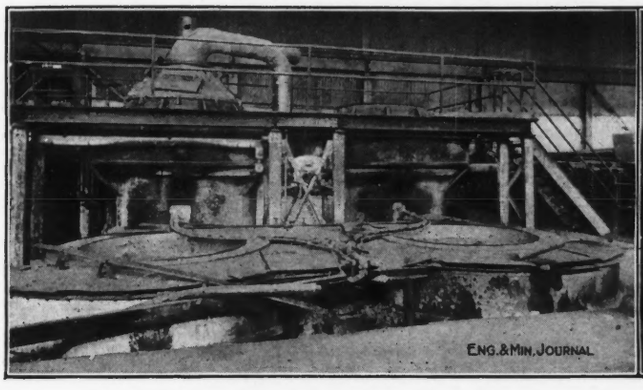
At the molding furnace the lead is siphoned into molds arranged in the arc of a circle, as shown. The bars are removed from the molds and stacked by hand and are placed in stock ready for shipment.

In the treatment of byproducts, the zinc skim produced at the desilverizing kettles is treated in four tilting retort furnaces, using oil as fuel. The products of this operation are retort zinc, retort breakings, blue powder and retort bullion. The retort zinc is returned to stock to be used again at the desilverizing kettles. Retort breakings are sent to the ore blast furnace. Blue powder is shipped to zinc smelters for treatment.

The retort bullion passes to two Rhodes-type cupel furnaces. These produce test breakings, copper litharge, yellow litharge and doré bullion. The test breakings go to the ore blast furnace, the two litharge products go to residue furnace No. 2 and the doré bullion is molded into anodes and shipped to the Raritan Copper Works for refining. The Pattinsonizing kettles are equipped for the Hulst crystallizing process.

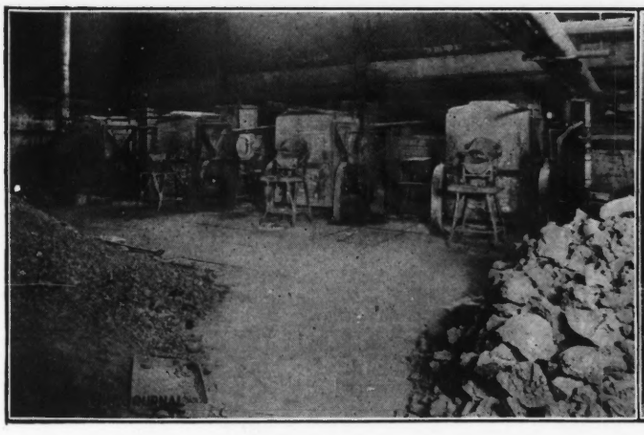
The lead received at the kettles from the refining furnace contains from 0.08 to 0.12% Pi. One crystallization reduces the bismuth from 0.08 to 0.05% and less. For lead containing 0.12% Bi, two crystallizations are necessary, if the crystals are drained by gravity; one is sufficient if crystals are pressed. With such a low-grade product subsequent treatment for the recovery of bismuth is not profitable. This department will produce 150 tons of refined corroding lead per day, with a bismuth content of 0.05% or less.

Residue furnace No. 1 receives sample-kettle dross, softening-furnace skims, flue dust from all sources and galena (80% Pb). The charge is weighed in over a small

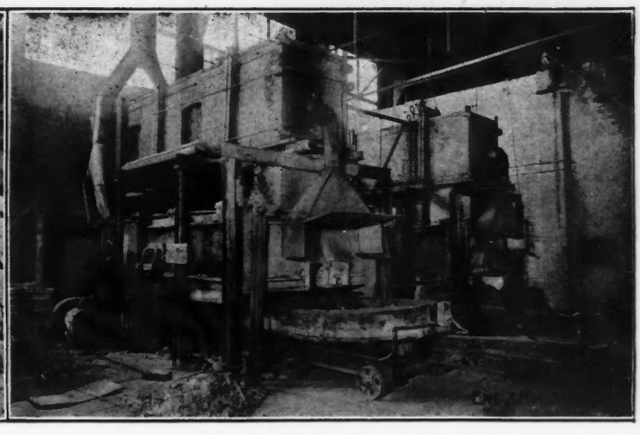


LEAD KETTLES

MOLD RING FOR REFINED LEAD



ZINC-CRUST DISTILLATION FURNACES



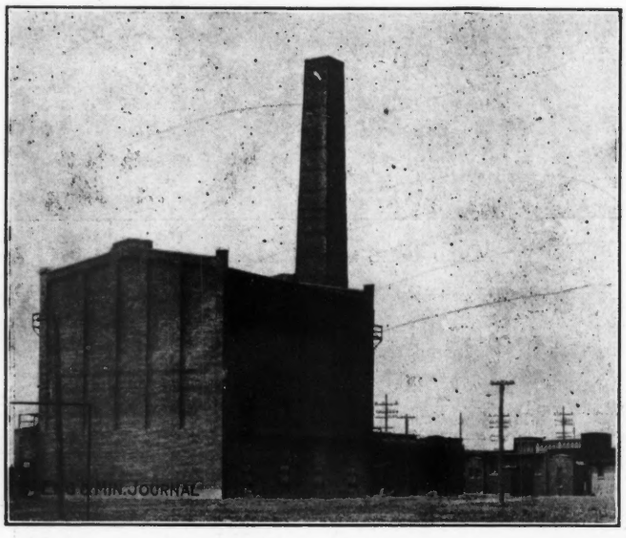
CUPELING FURNACE

charging scale, and is so proportioned as to yield products of fairly constant composition. The products are bullion, refinery matte and antimonial slag. The bullion is returned to the softening furnace. The matte is shipped to the smelter for treatment and the antimonial slag goes to the antimonial blast furnace.

Residue furnace No. 2 receives only the litharge products from the cupel furnaces and galena. Its products are bullion, slag and refinery matte. The bullion is returned to the softening furnace, the slag goes to the No. 1 residue and the refinery matte is shipped to the smelter.

Residue furnace No. 3 treats the skimmings and dross from the refining furnace and from the Pattinsonizing kettles. These yield lead and skimmings. The former goes to the refining furnace, the latter to the antimonial blast furnace.

The ore blast-furnace charge is made up of lead ores, coke and flues, and the following byproducts: Retort breakings, test breakings and slag from residue furnace No. 3. The three products are slag, matte and bullion.



BAGHOUSE, INTERNATIONAL LEAD REFINING CO.

The slag goes to the dump, the matte is shipped to the smeltery and the bullion is returned to the softening furnace.

The antimonial blast-furnace charge consists of ore, coke and fluxes, and, in addition, antimonial slag from residue furnace No. 1 and skimmings from residue furnace No. 3. The charge weighs 1450 lb. The coke used is 12% of the weight of the charge. The products are slag, matte and antimonial lead. If no ore is used, the charge contains no sulphur and no matte or speiss is formed. The charge is carried low in the furnace under a light blast pressure (5 to 6 oz.). Arsenic is burned off and recovered in the flues and bag house.

The slag produced is sent to the dump. It has the following analysis:

	Per cent.
SiO_2	24.0 to 26.0
Al_2O_3	10.0
FeO	36.0 to 38.0
CaO	10.0 to 12.0
ZnO	12.0 to 14.0
Pb	1.5 to 2.0

Matte, when produced, is shipped to the smelter.

The antimonial lead is run to a liquating kettle, from which it is east into bars for shipment. Consumers of this product commonly specify that the lead should contain: Antimony, 15 to 18%; arsenic, less than 1%; copper, less than 0.5 per cent.

July Mining Dividends

Thirty-five mining companies making public reports paid $7,654,337 in dividends in July, as against $7,234,529 paid by 38 companies a year ago. Steel, smelting and holding companies paid $3,320,245, a variation of a few dollars only; and Mexican and Canadian companies paid $1,605,950, as compared with $3,107,528 last year.

Company	Situation	Per Share	Total
Ahmeek	Mich.	$2.00	$100,000
Arizona, c	Ariz.	0.24	369,335
Anaconda, c	Mont..	0.75	3,474,375
Argonaut, g	Calf..	1.50	300,000
Kendall, g	Mont.	0.06	30,000
Brunswick, g	Calif.	0.06	23,717
Bunker Hill & Sullivan, l.s.	Ida.	0.25	81,7500
Bunker Hill, g	Calif.	0.02	10,000
Camp Bird, pf. g	Colo.	0.17	100,565
Continental, z	Mo.	0.50	11,001
Center Creek, z	Mo.	0.05	5,000
Daly Judge, s. l.	Utah	0.15	45,000
Fremont, g	Calif.	0.02	4,000
Golden Cycle, g	Colo.	0.03	45,000
Hecla, l. s	Ida.	0.02	20,000
Homestake, g	So. Dak.	0.65	163,254
Iron Blossom, s. l. g	Utah	0.10	100,000
Mary McKinney, g	Colo.	0.02	26,185
North Butte, c	Mont.	0.50	205,000
Old Dominion Cop. M. & S. Co., c	Ariz.	1.25	202,500
Osceola, c	Mich.	1.00	96,150
Pittsburgh-Silver Peak, g	Nev.	0.02	55,800
Portland, g	Colo.	0.04	120,000
Ray, c	Ariz.	0.37$	543,964
Silver King Con., s	Utah	0.10	62,000
Shattuck-Arizona, c	Ariz.	0.50	175,000
Tonopah-Belmont, g.s.	Nev.	0.25	375,000
Tonopah Extension, g. s	Nev.	0.05	70,769
Tonopah Mining, g. s.	Nev.	0.05	250,000
Utah Consolidated, c	Utah	0.50	150,000
United Globe, c	Ariz.	4.00	92,000
Vindicator, g	Colo.	0.03	45,000
Wasp No. 2, g	So. Dak.	0.01	5,000
Tom Reed, g	Ariz.	0.06	54,573
United Verde, c	Ariz.	0.75	225,000
Yellow Aster, g	Calif.	0.03$	5,000
Yosemite, g	Calif.	0.01	2,400

Iron, Industrial and Holding Companies	Situation	Per Share	Total
Am. Smelter's Sec., pf, A	U. S.	$1 50	255,000
Am. Smelter's Sec. pf. B	Mex.	.125	375,000
Bethlehem Steel	zenn.	1.25	186,350
Cambria Iron	Penn.	2.00	169,360
Guggenheim Expl.	U.S., Mex.	0.87$	727,768
Old Dominion, c	Ariz.	1.00	293,353
Penn. Salt	Penn.	3.00	150,000
Republic Iron & Stee	U. S.	1.75	357,296
Sloss-Sheffield, s. & I.	Ala.	1.75	117,250
U. S. Sm., Ref. & Min., com.	U. S.	0.75	263,332
U. S. Sm., Ref. & Min., pfd	Mex.	0.87$	425,536

Canadian, Mexican and Central American Companies	Situation	Per Share	Total
Beaver, s	Ont.	0.03	59,989
Buffalo, s	Ont.	0.05	50,000
Canadian Goldfields, g	B. C.	0.0011	50,000
Con. Min. & Sm.	B. C.	2.00	116,088
Crown Reserve, s	Ont.	0.02	35,376
Hollinger, g	Ont.	0.15	90,000
La Rose, s	Ont.	0.25	374,656
Lucky Tiger, g. s.	Mex.	0.09	64,380
McKinley-Darragh, s.	Ont.	0.06	134,861
New York & Honduras Rosario, g	C-A.....	0.30	60,000
Nipissing, s	Ont.	0.25	300,000
Nova Scotia, S. & C., pf.	N. S.	2.00	20,600
Nova Scotia, S. & C., com.	N. S.	1.50	90,000
Porcupine Crown, s	Ont.	0.03	60,000
Standard, s. l.	B. C.	0.02$	50,000
Tretheway, s	Ont.	0.05	50,000

Dividends for the first seven months of the year are: Mining companies, $40,580,220 in 1914; $45,450,722 in 1913; metallurgical and holding companies, $45,034,348 in 1914; $44,449,761 in 1913; Canadian, Central American and Mexican companies, $11,500,862 in 1914; $13,879,295 in 1913.

An Ingenious Smoke and Fume Recorder is described in "The Electrician," June 5, 1914. It appears that flue gases are highly ionized when free from smoke and solid fume. Where these are present ionization falls off. Spark gaps are arranged inside and outside the stack. If fume is present the discharge takes place outside, and actuates a bell by means of a coherer.

Editorials

The Copper and Silver Markets

In interviews with all of the leading agencies selling electrolytic copper, six in number, on Aug. 3, it was certified unanimously to me that at present there is no market for copper. There being no transactions, it naturally follows there can be no quotations based on transactions; and we are obliged to suspend our record of the market for the reason that there is none.

Similarly there are no quotations for silver.

W. R. INGALLS,
Editor.

The Great Calamity

The greatest calamity in the history of modern civilization has come. All that will happen from it no one is wise enough to prophesy. We see how the United States already is suffering, although it is a non-participant in the armed conflict of Europe. We regard it as a wicked thing and look upon it with sickening horror. But so closely is the world now knit by ties of commerce that no country doing business with Europe can escape the consequences of the crisis there.

The first manifestation in America was Europe's liquidation of American securities, precipitating huge declines in the New York stock market. The manner in which this was met for several days, after the bourses of the Continent had been closed and business had practically ceased in London, was impressive testimony of the inherent soundness of American finance.

On the afternoon of July 30, there was a wave of hysterical liquidation which sent prices to their lowest. The London Stock Exchange had practically suspended and the selling of securities from all parts of the world was focussed on New York with the result of drawing America's gold resources and completely upsetting the normal conditions of the rates of international exchange. The principal bankers of New York met that night but decided that conditions were not yet serious enough for drastic action.

On Friday morning, however, the news from Europe was worse and the opening of the New York Stock Exchange was awaited with forebodings bordering on terror. News came of the formal closing of the London exchange. The governors of the New York exchange were hastily summoned together. While they were in session came the news that the German Emperor had decreed a state of war to exist. Immediately afterward, about 9:50 a.m., the statement flashed over the wires that the New York Stock Exchange would not open and there was a murmur of relief. A panic had been averted. Immediately afterward it was reported that all other exchanges in the United States would be closed. The declaration of war by Germany upon France and Russia was made on Sunday, Aug. 2.

Commercially, there has resulted a stoppage of business, not only in Europe but also to a large extent in the United States. At the moment we cannot export our cotton, copper or wheat and have our surplus of those commodities piling up on us. The copper producers took the bull by the horns and the leaders ordered curtailment of production even before war was declared. If they had not, the banks would have refused to finance their surplus. It is probable that all of the principal producers will reduce their output 50%, which presumably will about adjust it to the requirement of the American market.

War is declared in Europe and men are thrown out of employment in Butte, and Broken Hill, far away in the antipodes, is disturbed. American steel makers are troubled by checking of their supply by manganese ore from Russia. Silver miners all over the world are rendered idle by there being no market for silver.

These are some of the ways wherein the American mining industry has already been seriously disturbed. Probably many others will develop or have already done so and have not yet been reported. Nobody yet can surely tell the consequences of this wicked, sickening war either in big things or little things.

There is one feature in this country that is highly satisfactory and that is the immediate sinking of selfish interests in patriotic coöperation for the general welfare. The brokers did nobly in promptly closing the stock exchanges, the bankers exhibited their patriotism in refusing to call loans, Washington swiftly forgot what only a few days ago was regarded as persecution of big business and loyally joined hands with the exponents of big business, the Interstate Commerce Commission tempered its rate decision, the Western railway men averted the threatened strike. All of this is as it should be and must be. In these troubled waters every American must pull together; we are all in the same boat. We may not profit from Europe's trouble. We ought not to want to. But we thank God that we are not suffering bloodshed and the destruction of property and we hope to pull into calm waters ere long.

The Situation of the Metals

All previous calculations have been upset by the war in Europe. As nearly as we can diagnose the immediate situation, it is as follows:

The little revival in iron and steel that became noticeable about the middle of July has probably been checked by the shock, but after its first effects are over there may again be a start forward.

Silver is chiefly a matter of the London market, whereof the New York market is but a shadow. The suspension of quotations in London was necessarily followed by a suspension in New York. For the moment the silver business is at a standstill. If Britain secures mastery of the sea the business in silver with India and China probably would be resumed and exports of American silver also.

Next to silver, copper is hit hardest. A few months ago we were congratulating ourselves that the international character of the copper market was its saving feature; while domestic demand was slack, the European was absorbing our supply. Now that very condition is our weakness. The only thing is for our mines to curtail their output to about the domestic requirement. Already they are doing that. At present there is no market for copper, but soon there will be, we hope, and some day we shall once more witness a big demand. We may only pray that it will not be delayed too long.

Our lead is chiefly marketed at home, but during the last six months our demand has been poor and we have exported about 20,000 tons to Europe, whose supply was shortened by the absence of the Mexican output. Just before the outbreak of the war, things had straightened out in northern Mexico, so that the American Smelting & Refining Co. was considering resuming smelting there. We should think that plan might now be delayed. Anyway, we are likely to have some accumulation of domestic lead pending the self-adjustment of business to new conditions, although a demand for this metal has continued right through these evil days.

The producers of spelter have been carrying the largest stocks in the history of their industry. Immediate conditions may cause some of them to want to realize. The spelter market is more a domestic market than any other and it is not unlikely to make the best showing during the war. Important European spelter producing districts are in the war zone. The German army invading France is passing right through the Liège district in Belgium, while the zinc mines and smelteries of Upper Silesia are only a few miles from the Russian frontier. The war may be expected to interfere with the Belgian and German production and American spelter may conceivably be needed in Europe and in other parts of the world that Europe has heretofore supplied.

We may be hampered about our supply of tin by the interruption to ocean traffic. In this and in our foreign trade in other metals we must await the development of some working arrangement in international exchange and the assemblage of ocean carriers that may sail under neutral flags or such control of the sea by Great Britain as will permit her ships to run.

Saving in Milling

The percentage of mill recovery is one of the ancient problems of the metallurgical industry. We read monthly statements from the big mining companies, porphyry coppers and otherwise, to the effect that their extraction was 71.26%, or some similarly specific figure, and we accept it as being something absolute, not pausing to consider whether it be accurate or not; in other words, nobody is concerned in going behind the returns, except a few specially interested persons, say the consulting engineer who is making a physical examination in the interest of bankers who may be contemplating lending money on the property. In fact, however, the determination of mill extraction is about the most difficult of metallurgical problems, and it is one that has never yet been quite satisfactorily answered.

Broadly speaking, there is just one way of determining positively the percentage of extraction from any ore by any process, and that is represented by the formula $X = B \div A$, in which X is the percentage of extraction, B the quantity of metal that is in the concentrate coming out and A the quantity of it in the ore going in. The difficulty of this method is that while B is ordinarily closely determined in the natural course of the business, A cannot commonly be any more than guessed. It is only in the larger and more modern mills that the input is weighed and sampled, and even so there is a good deal of guesswork about the moisture content and the allowance that should be made for it. However, assuming accuracy in the determination of input, the quotient X may be fairly determined only when the figures for A and B represent a rather long time.

The figuring for a smelting works is in some respects easier than for a mill. The input is carefully determined because it is bought and paid for, and the output because it is sold. However, we know of plenty of instances where in trying to figure the performance of one furnace for one day $X = +100$; and we know of instances where the monthly figures for a works persistently ran 89 to 91%, while the annual figure was about 87%, which agreed with the accountant's ledger. Manifestly, there was error in the metallurgist's figuring, but it was not easy to put the finger on it. A troublesome condition of any computation of this sort is the status of between-products and the difficulty of reckoning them exactly.

Another method of estimating mill extraction is represented by the formula $X = B \div (B + C)$, in which C is the metal escaping in the tailings. This method evades the difficulty of determining the input by assuming that the sum of the products is equal to what is put in. Manifestly, this method falls down completely in figuring the extraction in some new plants, wherein a good deal that is put in does not come out, but is absorbed in the apparatus, "salting" it in the vernacular. The extraction of a zinc smeltery could never be figured in this way by reason of the zinc absorbed by the retorts, which are constantly being replaced, and by reason of the vapor escaping uncondensed, which can neither be weighed, measured or sampled. Such an experience as the cleaning up of the old Anaconda copper-smelting plant several years ago indicates that it would be inapplicable to any smelting plant.

In the simpler process of milling, however, this method may be usefully employed, either as a check upon the other method, or as the sole index of results in those cases where input cannot be determined. Thus, in the mining and milling practice of the Joplin district, we cannot conceive of any practicable way of measuring and sampling the mill feed. The commercial conditions of the district do not permit of it. However, the Joplin mills as run at present do not permit of the other method either, a *sine qua non* of which is the discharge of the tailings through a single spout. Joplin mills usually discharge through a half a dozen, or more, spouts, on all sides of the building, seeing which the testing engineer throws up his hands in despair. This is one reason why no one knows, even at this late day, what is really, or nearly, the milling extraction of that district. There is nothing but surmise, based upon fragmentary evidence, which may be approximately correct, and may not be.

Whatever be done in the way of determining mill extraction, it is certain that the tailings ought always to be sampled carefully, inasmuch as the thing that, after all, primarily concerns the mill-man is what he is losing and

how far it will pay him to go in cutting down the loss. If these data afford an opportunity to compute the percentage of extraction from the ore, well and good, but it is important to bear in mind that while a 90% extraction from $2 ore is a very good accomplishment, 90% of a $20 ore leaves a tailings that demands attention, and in these days gets it, of course.

BY THE WAY

We have just received an alluring prospectus, which appears to afford an opportunity to recoup war losses:

Containing gold, silver and platinum, also a new metal yet unknown to science. These properties were originally located for their potash, borax, soda and salt that they contained, but it was found that these products could not be made to pay. They are situated in the region of Death Valley, Calif., and can be easily reached with a good auto. After many months of research work, we have discovered that these saline deposits contain gold, silver and platinum in a chloride form, and in a different form heretofore known in chemistry (not published). How to separate these values cheaply and commercially has been finally accomplished by us, after a lot of costly experimenting and a year's time. The average values that we found in gold, silver and platinum, from 75% of the assays taken, from over an area of four sections of 640 acres each (in all 2540 acres) was $100 per ton, 25% of gold. This means at the rate of $500,000 per acre, or $10,000,000 per single miner's claim of 20 acres, and that is only taking the deposit down to a depth of 4 or 5 ft. from the surface. An option on these properties can be obtained. We are looking for capital to help us finance the same. To parties who are willing to finance the entire proposition we are willing to coöperate on a fair equitable basis.

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The general manager of one of the leading zinc-smelting companies of the United States received recently a letter from an applicant for a position, which embodied some curious remarks and prompted the general manager to indite a reply as follows:

Yours of the 16th received and I must say your letter makes a very good impression. We decided for the present not to fill the position, waiting a few months until business conditions are a little better. At present we have one-third of our plant shut down. I cannot refrain, however, from referring to the last part of your letter, where you say:

Before accepting the position, however, I would have to know something about your status in the zinc industry. The past history of zinc in Oklahoma has been so characterized by inefficient mining, crude extraction and unorganized sales departments that it has looked discouraging to a technical man. I trust that the period has passed and that the industry is now on a more scientific basis.

As you never worked in a zinc-smelting plant it is supposed you know nothing about it. Of course, we admit that all the fools are congregated in a zinc smeltery, and if you look over the bunch, it is probably not surprising that the zinc industry is in such a poor shape. We admit these technical men (and you know they are all technical men these days that are in charge of our works, graduates from the best universities of Europe and the United States) are possibly the poorest products ever turned out. We have found, however, that when the well known lead metallurgists have tried zinc smelting they have admitted there may be something to this easy zinc-smelting metallurgy. In other words, they turned fools after a few years. Now we are just waiting for a "genius" to drop into zinc smelting because we surely need one. As to our own references, you may inquire of Mr. Ingalls, editor of the "Engineering and Mining Journal." We hope that reference is sufficient.

The general manager sent us a copy of his letter with the following remark: "Previously I did not know that even the children were aware of our shortcomings." This shows how excellently the "professors" have taught that the zinc metallurgists live and work in the gloom of ignorance, although we have frequently mentioned that it is the "professors" who are ignorant.

The investigation of the miners' strike, which a committee of Congress conducted in the Copper Country this spring, was productive of a good deal of technical information, as well as other material of more lively interest. At one time Congressman Casey, whose sympathies were all with the strikers, asked about the voting for the members of the Calumet & Hecla trust-fund administration board, saying that he understood the mining captains stood around while the ballots were being cast and directed the men to vote for the company candidates. Mr. MacNaughton retorted that they must have done some standing, since the voting extended over a period of a week or 10 days. Congressman Casey again asked whether it was frequent for men in the mines to change their names in order to avoid being garnisheed. Mr. MacNaughton said he never heard of their doing it for that reason, but that they did frequently change their names. He remembered one occasion on which a man sued one of the Calumet & Hecla companies, about two years ago, for an injury. He brought suit under his own name, and then went to work for the same company under an assumed name, thus working for it and suing it at the same time. Congressman Casey said that could be easily understood. It can. Mr. Casey seemed to be the chief inquisitor on the committee. He brought up the system of presenting grievances by an employee, asking whether Mr. MacNaughton thought that an ordinary man with a family of eight or nine or ten or eleven children, who had a grievance, would like to come and present it before him, Mr. MacNaughton, the man who had the right to discharge him, and thus take the risk of shutting off his income and the support of his family.

Mr. MacNaughton replied that Mr. Casey was not much acquainted with the men of the district, or he would know that such a man would readily come to the office and he would take care to bring every one of his children with him. Further, if chance permitted, he might borrow a few. Congressman Casey asked whether this was general in that part of the country, and Mr. MacNaughton said it was; but we do not suppose he referred particularly to the borrowing of children. An attorney for the strikers, grilling Mr. MacNaughton on cross-examination, attempted to find out what his salary was. It has been reported that it was $100,000 per annum. Mr. MacNaughton wouldn't answer, and some dispute arose about the question among members of the committee. At last Mr. MacNaughton apparently got irritated and said, "My salary is not $100,000 a year; and, otherwise, it is none of your affair, and I won't tell you." The record states that this was productive of applause and demonstration.

The same attorney in an impassioned speech said, "Any community that stands for and is an exemplar of a salary of $30,000, or $50,000, or $75,000, or $100,000 a year, while behind that man stands a fellow that is working for 20c. a week, or less, as shown by the evidence, is an affront to organized labor, to the dignity of organized labor, and an insult to the genius of American institutions." This provoked Congressman Switzer, who apparently had a leaning toward the operators' side, to say: "What about $7500?" We understand this is the salary of a congressman, and Congressman Switzer apparently wanted to know where he got off at in the attorney's estimation.

PERSONALS

H. C. Enos, of Mexico City, is examining mines in California for Eastern capitalists.

Clarence T. Emrich is assayer and chemist for the Caribou Mines Co., Caribou, Colorado.

Hoyt S. Gale of the U. S. Geological Survey is visiting California and examining the magnesite deposits in the State.

Harry J. Wolf, now in San Francisco on professional business, will inspect mining property in Nevada and then return to Denver.

George E. Collins expected to sail from England on his return home about the end of July, his intention being to proceed directly to Denver.

Mark R. Lamb, mining engineer and representative of the Allis-Chalmers Co. in Chile, who has lately been visiting the United States, has returned to Chile.

Edward C. Weatherly, after spending the winter in London, Eng., has returned to his home at Ouray, Colo., where he will develop his Chrysophir group on Hayden Mountain.

Kirby Thomas is at Ouray, Colo., making an examination of the Old Laut mine. He will proceed to other examinations in Nevada, California and Arizona before returning to New York.

Frank H. Sistermans has left El Paso, Tex., for Batopilas, Western Chihuahua, where he will be engaged in examination work, returning to New York towards the middle of September.

Fred. C. Bennett, formerly of the rail mill of the Maryland Steel Co., Sparrows Point, Md., has just gone to India to become superintendent of the rail mill of the Tata Iron & Steel Company.

Prof. Wyndham Dunstan, director of the British Imperial Institute, has sailed for Newfoundland to investigate the oil and other mineral resources of the colony on behalf of the British government.

Thomas H. Edwards, formerly of the National Tube Co., McKeesport, Penn., has been appointed general superintendent of the bessemer steel department of the Wheeling Steel & Iron Co.

C. M. Eye has been appointed manager for the Benguet Consolidated at Baguio, Philippine Islands, and will sail from San Francisco Sept. 26. In the meantime he has gone to Colorado to test a shipment of Benguet ore and to purchase machinery for the mine.

Walter W. Bradley, field assistant of the California State Mining Bureau is at present in Madera County, from which region he will go into Fresno and King counties. Mr. Bradley was formerly librarian of the bureau, and in the past year has done a large amount of field work for the bureau in some of the northern counties of the State.

Erroll MacBoyle, field assistant of the California State Mining Bureau, has completed work in Plumas and Nevada and some other northern counties, and is now ready to go into Sierra County. He will work from there south through Mother Lode counties to San Francisco. Mr. MacBoyle is connected with Burch, Caetani & Hershey of San Francisco, and has made mine examinations for the firm in California and Philippine Islands.

OBITUARY

George Vreeland Tompkins died at Basking Ridge, N. J., July 30, aged 65 years. He was well known as a metal dealer in New York for many years.

News was received by cable July 29 of the death of Professor Martens of the Royal Testing Laboratory, at Berlin. He was widely known as an expert metallurgist who had devoted himself to research into metallurgical problems.

B. C. Wolfram, manager of the West Dome mine, Porcupine, was on July 30 found dead in his room at a hotel in North Bay with a bullet wound in his head. A large revolver was found near the body indicating that he had committed suicide.

Archibald Blue, chief officer of census and statistics for Canada, died at Ottawa July 27, after an illness of about two years, aged 74. He was born at Oxford, Ont., and after having been engaged in journalism for many years entered the service of the Ontario government. In 1882 he organized the Bureau of Industries and in 1884 became Deputy Minister of Agriculture. He subsequently acted as secretary of a commission of inquiry into the mineral resources of the Province and when the Bureau of Mines was formed in 1891 he was appointed director. Mr. Blue retained this position until 1900 when he went to Ottawa as chief census commissioner for Canada, becoming in 1905 chief officer of census and statistics. He was the author of several works dealing with the growth and industries of the country. He leaves a widow and three sons.

Arthur Otis Granger died in Philadelphia, July 30, aged 68 years. He was born in Providence, R. I., but passed nearly all his active life in Philadelphia, or at Cartersville, Ga., where he had mining interests. In 1886 he was president of the United Gas Improvement Co.; in 1888, president of the Welsbach Light Co., the Chautauqua Lake R. R. Co., and the Etowah Iron Co., and when he retired he was president of the American Gold Dredging Co., the Caribbean Co., the Auer Incandescent Light Co. Mr. Granger was a life member of the Franklin Institute and the American Institute of Mining Engineers, the American Association for the Advancement of Science, and the Society of Arts of London.

W. H. Tallman, who died at Wheeling, W. Va., July 22, aged 74, was one of the pioneer iron and steel manufacturers of the Ohio Valley. He and others organized the Ætna Iron & Nut Company in 1872 and he was president of the Ætna Iron & Steel Company as reorganized in 1886, continuing in that office until 1893. He was also one of the founders of the Standard Iron Company. Mr. Tallman retired from active business in 1893 when the Ætna and Standard Steel companies were combined in the Ætna-Standard Iron & Steel Company. He was connected with a number of interests, banking and industrial, in the Ohio Valley, and had much to do with the building up of the steel industry in that section.

SOCIETIES

Oregon-California Mining Congress.—This society has just closed its session in Ashland, Oregon, electing the following officers for the ensuing year: President, Hon. James Logan, Waldo, Oregon; first vice-president, G. W. Meredoff, Kennett, Calif.; second vice-president, J. O. Gillson, of Shasta County, Calif.; third vice-president, M. E. Bittmer, Reading, Calif.; fourth vice-president, G. A. Reichman, Fort Jones, Calif.; secretary, G. F. Hellmugh, Etna Mills, Calif.; treasurer, F. J. Newman, Medford, Oregon. Etna Mills, California, was selected as the place for holding the next session of the congress, the date to be set later and during the month of April or May 1915. The congress will send an exhibit to the Portland Land Show and also to the Panama Exposition at San Francisco in 1915.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

BRIQUETTING APPARATUS—Nils V. Hansell, Bloomfield, N. J., assignor to American Grondal Co., New York, N. Y. (U. S. No. 1,105,510; July 28, 1914.)

ORE CONCENTRATOR—Peter Stenger, Fort Wayne, Ind., assignor to Deister Concentrator Co., Fort Wayne, Ind. (U. S. No. 1,105,109; July 28, 1914.)

CONCENTRATORS—Pulp Distributor for Concentrators. Wilton E. Darrow, Sutter Creek, Calif. (U. S. No. 1,104,969; July 28, 1914.)

CYANIDING—Apparatus for Filtering Valuable Compounds. Newton A. Burgess, New York, N. Y., assignor to Butters Patent Vacuum Filter Co. (U. S. No. 1,103,345; July 14, 1914.)

FUEL—Apparatus for Distributing Pulverized Fuel. Henry H. Blake, Pittsburgh, Penn., assignor to Blake Crusher & Pulverizer Co., Pittsburgh, Penn. (U. S. No. 1,104,404; July 21, 1914.)

IRON—Briquetting Iron Ores. Walther Mathesius, Charlottensburg, Germany. (U. S. No. 1,104,124; July 21, 1914.)

LEACHING—Electrolytic Apparatus. John D. Fields, Butte, Mont. (U. S. No. 1,104,646; July 21, 1914.)

MAGNESITE—Process of Making Sintered Magnesite and Dolomite. Eduard Pohl, Rhöndorf-on-the-Rhine, Germany. (U. S. No. 1,103,375; July 14, 1914.)

MINING-CAR WHEEL—Hugh W. Sanford, Knoxville, Tenn. (U. S. No. 1,104,549; July 21, 1914.)

ORE TREATMENT—Process of Treating Ores. Frank P. Arnold, Carbondale, Penn., and George F. Wedeman, Washington, D. C. (U. S. No. 1,104,239 and 1,104,287; July 21, 1914.)

RADIO-ACTIVE BARIUM COMPOUNDS—Method of Treating. Herbert N. McCoy, Chicago, Ill. (U. S. No. 1,103,600; July 14, 1914.)

The Railroad Rate Decision

WASHINGTON CORRESPONDENCE

The long-expected decision of the Interstate Commerce Commission in the so called advance rate cases was delivered by the Commission on Saturday, Aug. 1, late in the afternoon. The report covers the whole question of advanced rates on railways as affected by the application of four years ago, which was then refused, and as affected by the application which has been under consideration and is now settled. It is an interesting fact that the rate decision in a number of cases refers to mining products and assigns them a treatment different from that accorded to other items of freight. In dealing with the application for higher rates, the report now delivered says, after reviewing the general character of the problem:

"Protests against a general increase in freight rates were presented by the railroad commissions. . . . Protests against proposed increases in rates so far as they affect specific articles, of which the tonnage in some cases is large, were presented by many shippers, and particularly by shippers of coal, coke, ore, brick, cement, lumber, ice, sand, gravel, paper pulp, corn products and petroleum."

The commission reviews the merits of the argument quite fully and reaches the conclusion that the roads in Eastern territory are not receiving a satisfactory revenue and that they ought to be permitted to obtain more through an increase in rates. The claim, however, is made that there is a good deal of difference between the New England territory, the Central Freight Association territory and other portions and that a different treatment in these is required. Dealing specifically with the question of an advance, the commission exempts mining products from the application of higher rates, saying:

"We have seen that the class rates in Central Freight Association territory are on a lower scale than can be found elsewhere in the country and that many of the commodity rates are too low and are probably unremunerative, considering the diversified nature of the traffic. The class rates and many of the commodity rates may, therefore, with propriety be increased. This approval, however, is subject to the following limitations:

"(a) With respect to certain heavy commodities, namely, brick, tile, clay, coal, coke, starch, cement, iron ore and plaster, protestants made such a showing as to constrain us to hold that the carriers have failed to sustain their burden under the statute.

"(2) Reference has heretofore been made to the fact that the proposed tariffs are based on a minimum increase of 5c. per ton on all commodities moving under rates stated in cents per ton when less than $1 per ton; with respect to certain hauls, this would result in increases much in excess of 5% and in certain cases the increases would be as high as 50%. The carriers have failed to establish the propriety of this minimum increase, and the evidence offered by the protestants makes it clear that it would work hardships and discriminations and cannot be approved, since under it a disproportionate burden is cast upon the heavy short-haul traffic. . ."

There is an interesting point in the portion of the report which deals with those railways which are largely engaged in the carriage of mining products. Attention is called to the fact that the coal-carrying roads are very prosperous and then attention is turned to methods that may be employed by the railways in general for the purpose of economizing their outlays. In this connection attention is called to investigations not heretofore announced, by the Bureau of Mines, and the Commission says:

"Fuel is, next to wages, the largest item in operating expense. The railroads of the United States report their aggregate fuel cost to be about $250,000,000 a year. But the actual cost is much greater; for the reported figures do not include, ordinarily, the cost of hauling the fuel on the lines of the carrier by which it is used. Furthermore, the cost of coal is increasing. Much has been done in recent years by means of mechanical devices and otherwise to reduce fuel costs. Thus the Baltimore & Ohio since 1910 reduced its coal consumption 9.50% per unit of freight traffic moved. But it has been demonstrated clearly that by knowledge and care on the part of employees and the management much greater savings can be made. With the assistance of the Bureau of Mines, questions were framed calling upon the carriers for details bearing upon this subject. Other investigations are being made by the Commission."

In closing, the Commission says: "The contention of the carriers is that upon investments in property amounting to approximately $640,000,000 since 1910, no commensurate return has been made, and that the net operating revenue between 1910 and 1913 shows an actual decline—additional investment cannot be expected on the showing made on the last increments of investment. . . . It is not necessary to say that on such a showing the investing public will hardly be eager to intrust its funds to transportation enterprises."

Geheimrat Martens

BY DR. HENRY M. HOWE

The death of Geheimrat Martens removes a stately and inspiring figure, a man who without self-assertion, indeed with apparent self-forgetfulness, has played a very important part in the development of the present wonderful industrial eminence of Germany. Our many conferences in the meetings in the Council of the International Association for Testing Materials, from 1901 till 1912, convinced me from the first of the exaltation of his character and the breadth of his views. Representing widely divergent social conditions, the autocratic and parental on one hand and the democratic and individualistic on the other, we approached most problems from opposite points of view, but we usually came to like conclusions. When he asserted his great powers, you felt that it was not because of the prominence which this gave him, but in spite of it. His ready self-abnegation was shown by his cheerful abandonment of the work of investigation, for which he had rare powers, and accepting instead the arduous and rather thankless task of administration. All reasonable people, even in differing with him, must have felt absolutely sure of the nobility, genuineness, and depth of his convictions. Those of us who knew him even moderately well must have felt the warmth and tenderness of his heart, unmaskable by the more prominent aspects of so dominating, indeed so overwhelming a personality.

Editorial Correspondence

SAN FRANCISCO—July 29

Kennedy System of Tailings Storage will be completed by an Eastwood multiple-arch dam in course of construction at the Kennedy mine. The tailings are from the 100-stamp mill. The tailings wheels, which were completed in the early part of the year, have been operating successfully, and a careful study has been given to the action of the tailings after being passed over the wheels and distributed on the low ground beyond the hill, over which the tailings are elevated. It was practically conceded in the beginning of the installation of the wheels that a solid dam would be necessary, in order to properly impound the tailings and prevent any possibility of escaping into the streams. The tailings are elevated approximately 105 ft. from the intake at the first wheel to the plane of delivery from the last wheel, and travel a distance of 1120 ft. This hill over which the tailings are elevated is part of a low range between the Kennedy and Argonaut mines and the town of Jackson. The tailings are distributed on what is known as Bright's field, which has a gradual slope toward the town, and through it a small stream of water flows. The narrowest part of this field has been selected as the dam site. The dam will be 440 ft. long and 30 ft. high. It was necessary to get down to bedrock for a foundation. The spans of the arches are 40 ft., making the buttresses 40 ft. apart. The dam will be 2600 ft. from the last wheel. The area thus provided will be sufficient to take care of the tailings from Kennedy mill for several years. It is expected to have the work completed by November.

An Important Improvement in Dredge Construction, the manufacture of stock-steel hulls, was marked by the completion and launching of the new steel hull of Yuba No. 4 dredge at Hammonton, Calif., July 26. The early designs of steel hulls for dredges of large bucket capacity were found in some respects to be faulty. In the completion of Yuba No. 14 dredge and subsequent operation, it has been demonstrated that the faults of earlier designs were not only correctable, but easily corrected. Taking No. 14 as an example of what may be safely called a perfect steel dredge, the Yuba Construction Co. has laid plans for the manufacture of steel hulls of a common size, which may be adapted to the reconstruction of all of the smaller wooden hull boats in the Yuba Basin field, operated by the Yuba Consolidated Gold Fields. Yuba No. 3 dredge is also being reconstructed with a new steel hull. There are now five other wooden-hull dredges operated by the company which may be adapted to the stock-steel hull, of which the new hull of Yuba No. 4 is the initial example. The operating company has installed 13 wooden-hull dredges, the last one, No. 13, is a 15-cu.ft. bucket dredge; No. 1 and No. 2 were of 6-cu.ft. bucket capacity; the others were all equipped with 7½-cu.ft. buckets. No. 10 dredge was destroyed by fire. No. 5 was sunk. No. 4, the hull of which has just been launched, was taken out of commission on account of serious damage to the wooden hull. No. 3, for which a new steel hull is now ready for construction, is still in commission, and when the new hull is launched the dredge will be run alongside and the machinery transferred from the old wooden hull to the new steel one. As in the case with No. 4, there may be some new parts necessary, but on the whole the machinery is in good repair, and with some special renewals will be equal to the life of the steel hull. It is understood that all the wooden-hull boats except No. 13 will be provided with steel hulls in order, and it is not improbable that the time will come when No. 13 also will be thus provided. It is the last of the wooden-hull boats built in this field and was exceptionally well built.

DENVER—July 30

A Cloudburst at Telluride, July 27, caused considerable damage. Two deaths resulted. Much of the town was submerged in mud and débris to a depth of 5 or 6 ft., while many buildings were destroyed. The telephone operator informed most of the residents of the sudden danger.

A. S. & R. Co.'s Smelting in Colorado, states an official of the American Smelting & Refining Co., is approximately 55,000 tons of ore per month, this being about the average for the last two years. The largest tonnage in a single plant is being treated at the Arkansas Valley plant, at Leadville, where five furnaces are in blast. Three furnaces are in use at the Globe plant in Denver and the same number at the Pueblo plant, each plant occasionally blowing in a fourth unit. The Durango plant is running but one furnace. The Cripple Creek district furnishes 3000 tons of smelting ore per month. While this ore is highly siliceous, it is desired in smelting, especially for use in pot roasting at the Arkansas Valley works.

Interest in the Moffatt Tunnel, a 6-mile bore through the main range of the Rocky Mountains, at James Peak, continues even, though the tunnel is but a project. Last spring Denver voted to issue bonds for the construction of this tunnel, but a subsequent court ruling declared the city could not constitutionally incur such indebtedness. This materially affected the plans of the Denver & Salt Lake R.R., successor to the Denver, Northwestern & Pacific R.R., and for a time the project languished. However, the city's tunnel commission could not be persuaded to resign. Denver has a commission government. The five official commissioners that constitute the City Council looked with disfavor on continuance of the expensive tunnel commission. Dissension assumed positive shape in a recent act of the Council repudiating bills incurred since the proposition was declared legally impossible, and in refusing further appropriations. A dispute has therefore arisen among politicians, with the probability that, notwithstanding the utter uselessness of the commission, its existence must be financially provided for until the city can vote to discontinue it. Mining interests of western Colorado and northeastern Utah desire the building of this tunnel and an extension of the railroad beyond its present terminus, Steamboat Springs. While the dispute has been on, a party of men prominent in the affairs of the railroad has been touring the line, and General Manager Morse is reported as having said that his company has raised one-third the required capital and that the balance will probably be raised by individual investments.

SALT LAKE CITY—July 30

Report of the Surveyor-General for Utah for the year ended June 30, 1914, shows that an aggregate of 2881 miles of surveys have been made, at a cost of $38,300. The report outlines all operations in the various divisions of the work, and recommendations are made for increased funds for field and office work during the present fiscal year, as the office has a large amount of work to do on unsurveyed lands, which need early attention. Field work on 54 townships was filed during the year, and 94 townships, comprising 1,466,520 acres, were surveyed. The survey of mining claims decreased as compared to the year preceding, it being shown that only $2944 was deposited for this work, as compared to $5553 the previous year.

HOUGHTON—Aug. 3

Franklin's Developments on the Allouez Conglomerate Lode continue to be satisfactory. Work has been carried on slowly, but all of the openings to date have been in ground which averages better than that which the Franklin formerly mined at a profit. The rock which is now being taken out is treated at the Calumet & Hecla customs mill at Point Mills, and the Franklin's own milling plant has not yet resumed operations, nor is there any intention to start operations until further developments on the Allouez conglomerate assure enough rock to keep the mill running.

Mass Consolidated now has its daily rock shipments up to a total of 1150 tons, and a further increase can be made of at least 100 tons per day if the company can secure cars. All of the mines are sending so much rock from the mines to the mills that it is difficult to furnish enough cars. The Mass was the last of the mines to get back to normal production, following the strike, and this has made it particularly difficult for the Mass to get all of the cars needed. Mass has an interesting development in its lower openings in the amount of mass copper that is coming in, and substantial shipments of this material go directly to the Quincy smelting plant at Ripley. In the early days this mine was noted for the masses of copper that were encountered; in fact, the name of the present operating company came from this fact. Up to within the last few months not so much of this copper has been found, but it is now coming in again

in considerable quantities. The lower parts of the mine are being unwatered and sinking will be resumed and a larger force of men put to work to keep the advanced openings well ahead of shipping, so that the tonnage may be maintained well in the future. The rock that is now going to the mill yields 15 lb. of copper per ton, not counting the mass copper. The greater part of the rock comes from the Evergreen lode, although some of the openings are in the Butler and its north branch and some from the Ogima formation.

Winona continues to operate at the largest capacity the company has ever been able to produce, but it continues to lose much in the concentrating process, due to the peculiar character of the rock. Experiments to date have not determined how a higher saving can be made, but several other schemes are being tried by which it is hoped to evolve an economical process by which the saving of the smaller flakes of copper can be made. For several months the Lovett process has been undergoing a test. While this process secured the copper, the cost was practically prohibitive. However, there is hope that by a combination of the Lovett process with the Armstrong-Shields jig and classifiers the Winona problem may be solved. There are two leaching processes under consideration for Winona rock, and the best posted men are of the opinion that in this leaching process lies the real solution of the Winona difficulties. The application of a process similar to that which the Calumet & Hecla purposes to apply to its tailings may be made soon, and the Slater leaching process is going to be tested. Winona is one of the smaller mines that finds it just possible to keep going when it is working at full capacity, and even then it needs a good price for the output. At present the company is not losing money. It already has called assessments to the limit of its capital under the Michigan statute, and in case further capital is needed a reorganization of the company will be necessary. The St. Mary's Mineral Land Co. is the largest owner of Winona stock.

MARQUETTE—Aug. 1

Suspension of Production at the Baker Mine at Iron River, on the Menominee range, has been made by Corrigan, McKinney & Co. The Baker has considerable ore in stock, and this will be shipped. Market conditions then will dictate the program. The mine had been employing 200 men. Many of these have been laid off. The remainder have been transferred to the Tully property in the same field.

Shipments from the Lake Superior Iron Region the last few weeks have been much more brisk than heretofore this season. The outgo at present is, in fact, well up to that of a year ago at this time. There is no hope that the volume for the season will compare favorably with the record-breaking movement of 1913, since the accumulated deficiency amounts to millions of tons, but it is evident that the year will close with the deliveries at the lower lakes aggregating a materially larger total than was indicated some weeks ago. More trains are in service on the ore-hauling railroads than at any time so far this season. The product being shipped, as has been the case heretofore, is chiefly direct from the mine workings. There is, however, an increased movement from stockpiles, and it is this fact that is looked upon by the community in general with particular cheer. It has been feared that with the surplus stocks maintained practically intact the winter months would witness curtailments, depriving many men of employment. The hope now exists that mining operations in the underground districts will be continued on the present basis.

A New Record in Ore Hauling was made several weeks ago, when there was hauled from the Chicago & Northwestern Co.'s Menominee range assembling yards at Iron Mountain a train of 135 loaded cars. Never before had so much ore been forwarded to the docks at Escanaba or any other port in a single consignment. Each car contained 65 tons, on the average, so that the trainload comprised almost 9000 tons, the capacity of the ordinary lake freighter. The 135 cars were hauled by one of the Northwestern's new "Class Z" locomotives. The engine was assisted by a small locomotive while leaving the yards, and again while passing over an unusually heavy grade, but this was done, it is said, principally to relieve the strain on the couplings, railroad men insisting that the capacity of the big engine had by no means been taxed. It was not so many years ago that trains of 50 cars, each car holding 10 tons, were considered extraordinary, and when the capacity of the ore cars was doubled and 60 cars were hauled at once, the load aggregating 1200 tons, the trains were viewed with amazement. It appears likely that a few years hence, on the Northwestern at least, 10,000-ton trains may be common.

Operations in the Gwinn Field of the Marquette range are at low ebb. Of the several properties of the Cleveland-Cliffs Iron Co., only three are in commission. The only other operator is the Steel Corporation, with the Stegmuller mine. The Cleveland-Cliffs is producing ore at the Stephenson and, to a lesser extent, at the Gwinn, with the operations at the Gardner wholly confined to development. A characteristic of the ore of the district is the excessive moisture. At the Stephenson this runs from 15 to 18%. Experiments are being made with a Buttner drier, a German device, in an endeavor to rid the ore of most of its moisture as the product is mined. So far the tests have been satisfactory. The drier consists of a rotary cylinder, at one end of which is a furnace and at the other end a chamber into which the material treated is discharged. The ore and the drying gases and vapors are drawn through the drum together, and in the same direction, and the process is rapid, the claim being made that one machine can treat 2000 tons of material daily. The experimental plant has a capacity of 2½ tons per hour. The heat may be derived from any fuel. Coal is used at the Stephenson, and the test drum is rotated by electricity. In the experiments to date the moisture in the ore has been reduced from upwards of 18% to 4½%. This has been done at a cost for fuel of less than 5c. per ton of ore treated.

JOPLIN—Juy 25

Closing of the Continental Zinc Co.'s Mine was caused by the steady drop in the price of zinc ore until the maximum base price for zinc ore was below $40. The mine was one of the largest sheet-ground mines operating and it closed after weeks and months of operation under unsatisfactory prices. It is likely that further additions will be made to the list of properties that will be closed down till better prices prevail. On the other hand, the Miami camp is showing a greater activity. W. H. Frickleton and associates, of Joplin, have just opened a new mine on Tarr Creek that is proving to be a heavy producer. It is believed to be the best strike of zinc ever made in the Miami camp, a camp noted for its rich mines. A second strike by O. W. Sparks, of Galena, Kan., on a new lease in the Miami camp, is attracting almost as much attention, while still another of J. W. Barnes & Co. is said to be showing well.

Interest in Oil Flotation applied to zinc concentration in the Joplin field is unusual and is attracting the attention of mine operators and engineers. One such movement is noted in the combined efforts of the Missouri State Geological Survey and the U. S. Bureau of Mines. Each of these has placed men in the field to undertake experimental work along these lines. C. L. Wright represents the Bureau of Mines, and under his direct supervision the work of experimentation will be conducted. Otto Von Schlichten represents the Missouri Geological Survey. An experimental plant will be built and the various ores tested out and a final determination made as to the applicability of oil flotation to zinc concentration in this field. From the work already done by private interests, it seems certain that if the process is applicable from a commercial point of view, it will be confined in its use strictly to the sand and slime now being treated upon tables. The cheapness of Joplin milling, running from 15 to 50c. per ton of rock handled, with a recovery of 50 to 75%, depending upon the mill and upon the character of the ore, makes it difficult to find a substitute for present processes that will at all appeal to the practical operator. The mine operator is willing to listen to anyone who has anything to offer that will reduce his losses in the sands, the treatment to apply solely to the sands without disturbing the general milling process. In fact, he is keenly alive to the improvement of his practice along these lines, for it is now well established that the bulk of his concentration losses occur there, but he wants the remedies to be localized to that department of his mill. Before the court decision in the Minerals Separation case was rendered, a company of Butte men undertook some experiments on the Priscilla lease to determine if it were profitable to treat the accumulated tailings and slimes on this ground. All the experiments were done under cover of extreme secrecy, and nothing was told the public of the results, but the character of the operations and actions of the men led o the public's deductions that the results were not such as to lead to much optimism.

TORONTO—Aug. 1

Toronto Mining Exchanges Have Been Closed as a result of the closing of the Toronto and Standard stock exchanges. This has been done as it was apparent that the better mining stocks were being sacrificed to meet the necessities of the other exchanges.

The Mining News

ALABAMA

Jefferson County

TENNESEE COAL, IRON & R. R. CO. (Birmingham)—Company has received 200 cars of manganese ore from Cuba by way of Pensacola for use at Bessemer.

ALASKA

LAKINA COPPER CO.—Plans are being made for a mill for copper property on Lakina River.

JUMBO—A three-mile tram is being built at this copper mine to convey ore from mine to orebins.

MOTHER LODE (Kennecott)—An 80-hp. gasoline engine has been installed to operate an air compressor.

ALASKA MEXICAN (Douglas)—June production from 19,824 tons of ore, $40,969, or $2.09 per ton; profit $14,773.

ALASKA EXPLORATION CO. (Fairbanks)—Dredge on No. 8 Above, Fairbanks Creek, commenced work in June. Necessity of making some repairs delayed starting season's work.

ALASKA UNITED (Douglas)—June production from 20,244 tons of Ready Bullion ore, $45,269, or $2.26, profit $17,607; from 18,357 tons of 700 Claim ore, $30,447 or $1.67 per ton, loss $1830.

JUALIN-ALASKA (Jualin)—Contract for a number of service buildings including a large bunk house, boarding house, machine shop, assay office, and blacksmith shop, has been let, as well as contract for mill with a capacity of 200 tons of ore per day.

CRITES & FELDMAN (Fairbanks)—These operators have bought 5-stamp mill of Pioneer Mining Co. Mill was built in 1912 and has been used chiefly for custom work. It will be moved from Chatham Creek to Helen S. claim on Fairbanks Creek. A large body of ore is developed and it is hoped to keep mill running steadily for several years.

PIERSON & ANDERSON (Fairbanks)—These operators, who recently found good pay on Twentymile Creek, have been driven from their shaft by water. Although it places a serious handicap on operations, it is believed that a two-in. centrifugal pump will keep mine clear. Since there is an abundant supply of wood near at hand, cost of pumping will not be excessive.

RAINBOW (Fairbanks)—L. M. Drury, former manager for lessees of Newsboy mine, has been given a lease on Rainbow mine with option of purchase for $65,000 at any time during life of lease. Rainbow mine, which is situated in Skoogy Gulch, was formerly operated by Roth & Maddocks. Several hundred tons of ore have been shipped, but grade is too low to yield a profit except with a mill on the ground.

HANDS-ACROSS-THE-SEA ASSOCIATION (Fairbanks)—On this claim on upper Vault Creek rich ground is being worked. A recent cleanup, from one week's wheeling by four men, returned $5000. Paystreak is 10 ft. thick, pay runs $6 to $8 per sq.ft.; width is 60 ft. Owing to scarcity of water during June and July, it is possible to sluice only a part of the dirt hoisted. Rest is dumped and will be sluiced during fall rains.

ARIZONA

Cochise County

COPPER QUEEN (Bisbee)—At Czar mine old stoping ground is being worked to a decided advantage, at the Lowell good-grade ore has been encountered on 1200 level close to Oliver line. Work on Uncle Sam is under way, and a headframe, hoist and engine room are to be erected. Test mill is expected to be in operation in two weeks.

Gila County

MIAMI COPPER CO. (Miami)—Orders have been given by directors to curtail production 50%; entire force will be retained to work half schedule time.

CALIFORNIA

Amador County

VALPARAISO—All work has been suspended on this mine near Middle Bar after two years of development and exploration for paying pockets.

BUNKER HILL (Amador City)—The 97th consecutive monthly dividend was paid July 15. Ore at present is low-grade, but still is profitably treated.

KEYSTONE (Sutter Creek)—Twenty stamps of mill were started July 18, on ore from lower levels recently developed. It is stated that a large tonnage is blocked out. Ore is low-grade, but can be mined and milled at a profit. Keystone was first mine to pay dividends in early days of Amador quartz mining.

ARGONAUT (Jackson)—Dividend of $1.50 per share has been declared, making a total of $300,000. This is first dividend paid since commencement of apex suit brought by Kennedy Extension Gold Mining Co. At time action was brought company stopped paying dividends, pending outcome of suit, and accumulated a large surplus. Suit was begun in 1909 and a decision in favor of Argonaut rendered June 29, 1914.

Butte County

PACIFIC GOLD DREDGING CO. (Oroville)—Arrangements have been completed for reconstruction of Pacific No. 3 dredge, which will be installed on Butte Creek, 10 miles east of Chico, where it will operate on a part of Drexler estate. Dredge was built in Oroville in April 1904, and was operated there for a number of years.

Eldorado County

INDIANA GOLD DREDGING CO. (Oroville)—A 4-cu.ft. Bucyrus-type dredge built by this company at Michigan Bar near Latrobe on Cusumnes River, early this year, went into commission Apr. 1, and is reported to be digging in good gravel.

Mariposa County

NUMBER FIVE (Hornitos)—A new mill is practically completed and crushing of ore will begin shortly.

NUMBER ONE (Hornitos)—Preliminary work towards reopening is in progress. Mine will be pumped out and put in order for development.

SILVER LEAD (Hornitos)—Construction of a five-stamp mill has begun. This is an old property, idle for a number of years, and is being reopened.

Nevada County

INDEPENDENCE (Nevada City)—Hoist was burned July 26, fire supposed to be incendiary.

UNION HILL (Grass Valley)—This property adjoining Brunswick will probably be sold to G. C. Johnston of San Francisco, and others, and be developed on an extensive scale. Mine was bonded some time ago to L. B. Doe of San Francisco, but deal was not consummated, owing, it is said, to inability of proposed purchaser to properly develop property.

GLADSTONE (French Gulch)—Installation of new electric hoist is completed. It is designed to sink 2500 ft. and operate at a speed of 1000 ft. per minute with a load exceeding two tons. It is equipped with 275-hp. motor.

Shasta County

MAMMOTH COPPER MINING CO. (Kennett)—Rights-of-way and water rights to waters of Back Bone Creek have been obtained from Summit Copper Co. All mineral rights are reserved to granting company on eight claims, over which rights-of-way pass.

Tuolumne County

HART & JACOBS (Sonora)—Building of 10-stamp mill is contemplated to take place of a small crushing plant, formerly used for prospecting.

COLORADO

Gilpin County

ARAPAHOE MILL (Black Hawk)—Remodeling of Rocky Mountain concentrator is completed; plant treats 50 tons per day.

GILPIN ORION (Central City)—This mine, idle for years, has been reopened by lessees who have developed a good shoot in 340-ft. level east.

LILLIAN (Russel Gulch)—Eastern men have reopened this property that has been idle several years. It was formerly a producer of high-grade goid ore.

Mesa County

LLOYD well at De Beque developed a flow of oil spouting 175 ft. high. It caught fire and drilling outfit was destroyed.

Park County

SNOWSTORM PLACER (Fairplay)—Platte River Dredging Co. is making usual summer run. Operations are always restricted to 80 or 90 days per season by shortage of water that stops hydraulicking in September. This being an unusually wet season, work may continue perhaps two or three weeks longer than usual.

San Miguel County

WELLER (Telluride)—Water line 650 ft. long, just completed, will carry water from Ballard Mountain to mill. Recent cyanide tests were unsatisfactory and treatment will be restricted to concentration.

GEORGIA

Lumpkin County

TOLEDO MINING CO. (Dahlonega)—Mill building is erected and machinery is being installed. Pipe line from power canal to run turbine is completed. Company has built a flume to handle ore by hydraulicking, but extremely dry weather has cut down water supply, so a tramway will be laid to Singleton Cut in rear of plant and operations will be started on this ore. A pipe line and flume have been laid for working Barlow Cut, but this and all other mining in district including operation of a dredge, has been hampered by lack of water, which has been insufficient to supply even local hydro-electric light station for nearly a month.

IDAHO

Coeur d'Alene District

CHICAGO-BOSTON MINING CO. (Wallace)—At regular annual meeting of stockholders recently an encouraging report was made by Manager Cyrus W. Gossert. Property has been operated steadily for last two years. Flume and water-power plant have been completed and 800 ft. of tunnel has been driven by machine drills. Owing to limited amount of water operations were confined to freshet seasons, and work

was continually hampered by lack of adequate power. In June last year company suspended operations in tunnel entirely and has since then devoted its available income to acquiring and installing a new and much more powerful waterpower system. It was necessary, in order to carry work ahead on this new power plant, to buy and erect a small sawmill, which now is within one mile from mine and within national forest reserve, and to purchase from Government timber for lumber needed in construction of flume and buildings. Flume, now completed, is nearly a mile in length, grade for which in many places was made through rock. Head attained by this flume is approximately 470 ft. Company has purchased a compressor of ample size to run several drills together with a Pelton waterwheel with which to operate it. This machinery is installed on concrete foundations in a new building erected for the purpose. As soon as penstock is placed to connect waterwheel with flume plant will be ready to operate. In addition to this new equipment many minor permanent improvements have been made, such as erection of a bunk house, a commodious cabin, wagon shed and stable, laying out trails and roads, installation of an electric lighting system and a telephone line. Two new claims adjoining property have been located and added to holdings. Work in No. 6 tunnel up to time it was temporarily discontinued produced encouraging results. Work will be resumed in this tunnel very soon.

MINNESOTA

Mesabi Range

MUNICIPAL EXTRAVAGANCE ON MESABI RANGE—Consumers Ore Co., owning Frantz mine, within city limits of town of Buhl, has issued an injunction and restraining order on town officials. The 1910 census showed town's population as 1000. In 1913 tax levy was $125,000 or $125 for every man, woman and child. Only 1½% of tax is paid by residents, balance coming from mining companies. It is expected that 1914 tax levy will produce $250,000, and mine owners feel that it is time to call a halt. Among other improvements, town is expending $80,000 on streets this summer, which seems liberal for 1000 inhabitants. At Mountain Iron, Pitt Iron Mining Co. has just pursued same course of action. At this place a $25,000 concrete street is being laid, while mining company cites that there are but eight teams in town to use it. Mountain Iron has a population of 1343, and a $100,000 school building. A $20,000 library has been completed. The same condition exists throughout the Mesabi range, where the mining companies are called upon to pay large taxes and the small municipalities have huge sums to expend for improvements. $100,000 school buildings are comparatively common, the most modern fire fighting apparatus is provided, sewage-disposal plants and water systems compare favorably with those of large cities, and streets and parks are perfectly maintained.

GENOA (Gilbert)—This mine, which supplies village of Gilbert with water, was recently flooded by heavy rains, causing a temporary interruption in water service. It has now been pumped out.

MONTANA

Fergus County

KENDALL GOLD MINING CO. (Kendall)—After a lapse of two years company has resumed payment of dividends to amount of 6c. per share, totaling $30,000, on all stock of company. According to statement of secretary dividend will be paid out of surplus in company's treasury. During operation of mines at Kendall, $1,500,000 was paid out in dividends. Mines have been closed for many years, being considered worked out. Company still operates a hydro-electric power plant in Kendall district which furnishes power and light to Barnes King mines and to adjoining settlements.

Park County

WESTERN SMELTING & MINING CO. (Cook City)—Renewed activity is reported from Cook City in old camp near northeast corner of Yellowstone Park. G. L. Tanzer of Livingston, manager of company announces that a force of 100 men will be put to work to blow in custom smelter at Cook City. It will treat ore from various copper, gold and silver mines in district which, though rich cannot stand cost of 63 mile haul to nearest railroad. It is Tanzer's opinion that by demonstrating possibilities of district, he will be able to induce railroads having branches in that territory, to build a connection to camp.

Silver Bow County

ANACONDA (Butte)—It is reported that Anaconda has closed its Great Falls smelting plant and seven mines on account of European situation.

NORTH BUTTE (Butte)—New shaft on Granite Mountain claim is completed to 3000-ft. level. Connections have been made from levels in this shaft to all levels of Speculator mine with exception of 2600 level.

BERNARD REALTY CO. VS. J. P. NOLAN—Judge Bourquin in Federal court, on July 26 ordered decree to be entered in favor of Bernard company. Case involved title to placer ground and lodes in Butte district. Judge Bourquin held that as title had been in name of Bernard company for 41 years it was too late in the day to attack it.

BUTTE & ZENITH CITY (Butte)—Since installation of two Cameron No. 9 pumps, discharging 300 gal. of water per minute, shaft has been kept dry, permitting sinking without further interruption. Shaft is now down to 525 ft., which is 65 ft. below station. It is proposed to carry it down to 1000 level whence property is to be explored and developed.

BUTTE & SUPERIOR (Butte)—Development on 1500 level has proved ore on that level to be of much the same character as that taken from levels above. Most of present output amounting to 1100 tons per day comes from ground between 700 and 1400 levels. Black Rock shoot seems to lengthen with depth so that further development work on 1500 and 1600 levels is expected materially to swell ore reserves of company.

BUTTE-ALEX SCOTT (Butte)—Recent exploration work below 1900 level has strengthened belief that lower levels would show better results than those already in operation. About 100 tons of ore per day are taken at present from 2000 level. This output is to be maintained until higher prices of copper shall prevail when output will be increased. Some of the ore shipped recently ran as high as 25% copper. Present earnings pay for all operating expenses as well as for development and shaft sinking. Shaft is now down below 2100 level and when 2200 level is reached, stations will be cut on 2100 and 2200 levels and crosscutting will be started.

PILOT-BUTTE (Butte)—Regarding reported strike of zinc ore on 2400 level of this mine, Superintendent Gow has issued following statement: Development work on this level has all been in an easterly direction to intercept several known copper veins. Zinc ore has been encountered to east of shaft toward Black Rock (Butte-Superior) claim on ninth, thirteenth, eighteenth, 2000- and 2200-ft. levels and it is assumed that it would also be found on 2400 level east of shaft, but no work has been attempted on this level to verify this as mining of zinc ore on this or other levels of Pilot-Butte is unprofitable at present due to lack of a mill to treat such ores.

BUTTE-BALLAKLAVA COPPER CO. (Butte)—President Freimuth has made another appeal to stockholders for funds to carry on development work necessary to put property in position where it can be operated profitably. Long shutdown caused by litigation with Anaconda company depleted treasury so that at time of issuing annual report, May 1 cash balance in treasury was only $180. Funds appealed for are for sinking shaft to 1800 level and to liquidate outstanding obligations. Sinking has been recommended by Walter Harvey Weed, consulting engineer of company in order to exploit oreshoot on 1800 level which from a study of upper levels promises to furnish shipping ore for entire length of vein within ground awarded to Butte-Ballaklava under compromise agreement with Anaconda company; namely 425 ft. Weed also points out that to put mine on profitable basis more ground must be opened, permitting larger daily output, and increase in earnings for payment of dividends, investment in new properties and for erecting mill to treat large tonnage of low-grade ore which yields no profit if shipped to smelter under present contract.

NEVADA

Esmeralda County

KEWANAS MINING CO. (Goldfield)—Station is being cut on 700-ft. level. A 20-hp. hoist will be installed and winze will be sunk 150 feet.

WESTMINSTER GOLD & SILVER MINING CO. (Cuprite)—A two-compartment working shaft will be sunk to depth of 200 ft. This shaft is now 160 ft. deep, and 25-hp. hoist and 40-ft. headframe have been installed. Lateral development will also be done.

Humboldt County

ROCHESTER CONSOLIDATED MINING & MILLING CO. (Rochester)—Articles of incorporation have been filed; capitalization, $500,000; par value, $1. Main office will be at Lovelock. Company will build a mill at Rochester.

Lincoln County

DAY-BRISTOL MINING CO. (Pioche)—Aerial tramway from mine to Pioche Pacific R. R. has been completed at cost of $47,000 and has been accepted by receiver of company. This tramway will reduce cost of transportation to railroad and will probably make profitable several leases which have not been a financial success to date.

Lyon County

NEVADA-DOUGLAS (Ludwig)—High-grade copper ore has been struck on 200-ft. level of Casting Copper mine, copper minerals being chalcocite and tenorite. A large tonnage of milling grade ore is being developed in Ludwig mine. A new discovery of good-grade copper ore has been made northwest of Ludwig shaft. Construction of leaching plant will start at once. Crushing and leaching sections will be built first and precipitation on iron will be method used for present.

Mineral County

A NEW MILL AT CANDELARIA will be built, it is reported. Recently constructed experimental stamp mill and cyanide plant has successfully treated ores of district and plans for 200-ton mill are being drawn.

A NEW CYANIDE PLANT AT BELLEVILLE is being built to treat tailings from milling plant that operated on ores from Candelaria during early days of that camp. Water supply is piped from springs on western slope of Mono Mountain, a distance of seven miles.

Nye County

TONOPAH EXTENSION (Tonopah)—New equipment has been installed in incline winze from 950-ft. level and work will be resumed on 1020- and 1100-ft. levels.

Storey County

OPHIR (Virginia City)—Station at 1600-ft. level is being retimbered, 15-in. air pipe is being laid from 2200 winze, and good progress is being made in reopening Central tunnel.

MEXICAN & UNION CONSOLIDATED COMPANIES are making preparations to open 2650-ft. level. Pump will be installed in joint Union-Sierra Nevada winze and another in Mexican winze which is 146-ft. below 2500-ft. level.

White Pine County

DEVELOPMENT WORK IN ELY DISTRICT is being done by Giroux company, where six Star churn-drills are in operation; Boston Ely, by diamond drilling; and McDonald Ely, in shaft sinking.

MACON CITY (Lane City)—Lease and bond has been taken and development work will start at once. A milling plant to treat mine and dump ore may be built.

NEW MEXICO

Grant County

ORION MINING CO. (Lordsburg)—Dundee mine has been taken over under lease and bond by U. S. Smelting, Refining & Mining Exploration Co. Main shaft now 375-ft. deep, is being sunk. Crosscuts are being driven to walls.

NORTH CAROLINA

Mecklenburg County

PARTRIDGE SMELTER (Charlotte)—Plant has been overhauled and some test runs have been made.

SURFACE HILL MINE (Charlotte)—This mine, 12 miles from Charlotte and near Allen's Station on Norfolk Southern, is again working. A concentrating plant will be installed.

Montgomery County

UWARRA (Candor)—Mill obtains its water supply from Reedy Fork Creek, which, owing to prolonged drought, has been nearly dry for a month. Mill is now closed and will stay closed until Sept. 1 when fall rains should supply ample water. In meantime work on development under ground will go ahead, principally on 400-ft. level.

CANDOR MINING CO. (Candor)—Cyanide mill is now running nights only, all mining being done by day. Old dumps accumulated during early days of mine are also being worked, better milling facilities now permitting profit from low grade ore. It has been predicted locally for a year that this mine has been on the point of ceasing operations ,but it is probable that work will continue for some time though on a less extensive scale than formerly.

Moore County

EL ORO MINING CO. (Hemp)—Company has been incorporated by the Gearhart brothers and others to work gold prospects.

OREGON

Clackamas County

OGLE MOUNTAIN—After several years constant development work, this mine near boundary line of Clackamas and Marion Counties, will soon be operated at full capacity. Cyanide plant with a capacity of 100 to 150 tons per day has been constructed; 25 men are now at work on the property, but with the opening of cyanide plant, force will be increased to at least 40, it is stated. Some 4700 ft. of tunneling has been done. Property is owned by Oregon City men.

Josephine County

GRANITE HILL (Granite Pass)—This mine, long idle, will soon be in operation again. Machinery has been well taken care of and is in good shape, and with small repairs will be in running order. Shafts are full of water and it will take two weeks to pump them out. Power for operation of 20-stamp mill will be furnished by electrical equipment.

SOUTH DAKOTA

Lawrence County

GOLDEN REWARD (Deadwood)—Company has purchased old Hidden Fortune 60-stamp cyanide mill and started removing it to millsite in Deadwood. Purchase was made from Homestake Mining Co., which came into possession of plant when it took over Hidden Fortune property. With the addition of this plant to its mill which is running steadily, Golden Reward will have a capacity of 400 tons daily.

HEIDELBERG MINING CO. (Two Bit)—Corporation of this name has been organized to take over property in Two Bit district which was developed successfully for 10 months by syndicate promoted by Deadwood Business Club. Capital is 500,000 shares of 25c. each. Half of capital was issued in payment for property; balance was placed in treasury and small lot will be sold at par to secure funds for further development. Latest shipments show higher grade of ore. Returns at Golden Reward mill were $22.20 per ton, as against $16 to $18 for previous lots.

HOMESTAKE (Lead)—At the B. & M. shaft one of the largest steam hoisting plants in the world is being assembled. It will have a capacity for raising 6 tons from a depth of 3200 ft. Using flat steel ropes, 5⅜x7 in., on reels; hoisting will be done with skips. Engine was built by Nordberg Mfg. Co., Milwaukee, Wis., and weighs over 1,000,000 lbs., requiring 14 standard flat cars to transport it from Milwaukee to Lead. Arrived at Lead problem of removing it from railroad to shaft, a distance of 2000 ft. over rough ground and up a considerable elevation, was solved by engineering department of company. Track of heavy steel rails, 6-ft. gage, was laid, on which specially designed car was operated. Car was constructed of steel frame, with a bed composed of 12x12-in. timbers. Motive power was secured by two single-drum hoists, attached to front end of car, and operated by compressed air. In this mannear easy work was made of delivery of massive pieces, two largest of which weighed 25 tons. Engine has two hoisting reels; will handle material in two of the five compartments of shaft. Old hoisting engine will not be removed, but will be retained as an auxiliary to new machine. It is expected plant will be in full operation by end of present year. Engine cost $77,000; freight on it to Lead approximately $8000 and foundations, erection, building and headframe, $65,000. Headframe will be of steel. Concrete, reinforced with steel, is being used for foundations, which, in thickest part, are over 20 ft. Steam will be secured from boiler plant close to Chicago & Northwestern Ry. tracks, grading and foundations for which are well in hand, and which will be completed before the hoist is ready to operate. This plant will contain six 600-hp. boilers; it will also furnish steam for electric generating station.

UTAH

Juab County

MAY DAY (Eureka)—Lead ore was opened on 300 level near stope mined by lessees in early part of year.

OPOHONGO (Mammoth)—Winze from 700 level is down 25 ft., with good showing. Above here lessees are mining gold ore.

BULLION BECK (Eureka)—Two cars of concentrates were shipped from jigging plant by lessees, who are working the dump.

UTAH POWER & LIGHT (Eureka)—Substation is to be built on ground bought from Chief Consolidated. Equipment is to be moved over from substation near Colorado mine.

EAGLE & BLUE BELL (Eureka)—Ore has been followed to 1600 level, and preparations being made to sink shaft from 1550 to 1700-ft. level Shipments of 100 tons of silver-lead ore being made daily.

PLUTUS (Eureka)—This property of 14 claims has been leased for two years to Fairbairn Leasing Co., working adjoining Godiva. Plutus is consolidation of old Plutus and Tetro Companies. It was worked under lease several years ago by J. H. McCrystal and others. Development will be done at depth.

Salt Lake County

OHIO COPPER (Bingham)—During June a little over 2400 tons of ore per day were mined and milled; in all 74,600 tons Remodeling of different sections of mill is in progress; expected to give capacity of more than 3000 tons daily. Machinery for changes contemplated is practically all on hand; first remodeled section expected to be put in commission during August.

UTAH COPPER (Bingham)—According to data, not officially compiled, this property has 340,000,000 tons of porphyry ore developed and partially developed, estimated to carry 1.4% copper. Average net smelter recovery in last four years has been 63.4%, running as low as 61.%, or 17.08 lb. copper per ton at lowest recovery. Now that Bingham & Garfield R. R. bonds are largely out of the way, net earnings from railroad become available as credit against cost of operations. Cost of steam shovel mining, exclusive of stripping charge and exploration, is 21c. per ton, transportation, 15c., milling 37c., which, allowing 13c. credit for gold and silver, gives net mining, transportation, and milling cost of 60c. per ton or 3.53c. per lb. Cost of smelting, refining, and selling is 3c. per lb., making total 6.6c. per lb. Including exploration, depreciation, etc. cost is 7¼c. After first 100,000,000 tons of ore have been removed, stripping charge of 7½c. per ton mined is expected to terminate. By carrying all of ores over Bingham & Garfield, instead of one-third over Denver & Rio Grande as at present, an additional saving will be made. Costs during second quarter of 1914 were 8c. per lb.

WASHINGTON

Okanogan County

DIVIDEND—A railroad spur is to be built from this mine to Oroville, which will greatly facilitate operations.

ELLEMEHAM DEVELOPING & OPERATING CO. (Oroville)—This company is operating the Prize mine where considerable improvements have been made. Regular shipments are being made.

CAABA (Oroville)—Mine is loading out its third car of concentrates for shipment to smelters. Mine has been in operation only a short time. About 85 men are employed and 70 tons of ore per day are being treated in concentrator. Mill, which is equipped with stamps and Wilfley tables, has proved of greater capacity than was at first expected and hauling arrangements are being made to deliver 120 tons of ore per day to plant. Caaba is a silver-lead-copper property.

CANADA

British Columbia

RICH GOLD FIND reported at Edmonton by old prospector in Liard River district about 1500 miles northwest of Edmonton. Prospector says he was two years in district without seeing white man. Says it is extremely difficult to reach district. We can well believe statement.

QUATSINO—This Vancouver Island mine is surveying for a railroad, and doing development work. The Quatsino company was organized by W. E. Cullen of Spokane and M. W. Bacon of Butte, general manager for the Stewart mine in the Coeur d'Alene district, Idaho.

SILVER HOARD (Ainsworth)—Surveys have been made for power plant and company plans to have first unit of a 100-ton daily capacity concentrator constructed and operating by Jan. 1, 1915. Power plant will be constructed in relays, that water may be used repeatedly. There will be two generating stations of 200-hp. each, the first to furnish power and light for mine and second to drive mill machinery. Hoisting and compressor equipment are being installed now at mine and facilities will be increased as development justifies.

ONTARIO

COBALT PRODUCTION FOR JUNE WAS— Alladin Cobalt (Silver Queen), 53.92 tons; Beaver, 53.69; Chambers Ferland, 31.89; City of Cobalt, 42.62; Cobalt Lake, 125.50; Cobalt Townsite, 188.01; Coniagas, 155.17; Crown Reserve, 105.72; Hudson Bay, 75.35; Kerr Lake, 76.02; La Rose, 218.80; McKinley Darragh, 279.29; Nipissing, 376.02; Peterson Lake, 80.66; Penn Canadian, 20.95; Right of Way, 32.44; Temiskaming, 37.91; Trethewey, 53.39; total, 1,987.35 tons.

CROWN RESERVE (Cobalt)—Company will renew its lease on Silver Leaf property adjoining, for an additional five years.

KIRKLAND LAKE PROPRIETARY (Kirkland Lake)—Company has purchased five Stitt claims in the Kirkland Lake district.

TECK-HUGHES (Swastika)—New syndicate has taken option on control. Sufficient money will be advanced to develop property thoroughly.

NIPISSING (Cobalt)—Company has taken an option on Teck-Hughes property in Kirkland Lake. Development on Vein 98 of Meyer shaft in Cobalt has shown 500 ft. of ore. materially adding to reserves. High grade mill is treating most of the Kerr Lake and La Rose ore, all of which is shipped in form of bullion. Net earnings for first six months of 1914 were $900,000.

MEXICO

Sonora

GREENE-CANANEA (Cananea)—Latest reports state that conditions are improving. Fire in Veta Grande and Oversight mines is under control and both properties are being worked through extra shafts. One of the helmet crews of the Copper Queen mine at Bisbee, Ariz., was sent to help fight the flames. Shaft No. 11 has been entirely destroyed.

The Market Report

METAL MARKETS

NEW YORK, Aug. 5

The metal markets this week are in a condition entirely unprecedented. Owing to the closing of the foreign exchanges and the action of the leading copper producers, we are obliged, for the first time since these reports were begun, to omit the quotations of copper and silver in New York, and the quotations of all the metals in London. For copper there is for the moment no market, and the other metals are naturally slow and depressed. Recent conditions cannot last, of course; but the disturbance is so widespread that it is difficult to predict when a change will come.

Copper, Tin, Lead and Zinc

Copper—In spite of the turmoil of last Thursday and Friday some domestic consumers were courageous enough to contract for some round lots of electrolytic copper at 12½@ 12¾c. Since then there has been no business and consequently there are no quotations for copper, as announced on our editorial page. Also there have been no quotations from London since Thursday, the Exchange there having been closed.

The Copper Producers' Association will suspend the publication of its monthly statistics during the existing disruption of the world's affairs.

Curtailment of production has been ordered by the Anaconda, Phelps, Dodge & Co., the Jackling-Hayden-Stone companies, and the Miami so far as publicly announced. All of the important producers will doubtless curtail, which in general will probably be at the rate of about 50% of June production.

The Central Chile Copper Co. reports for the six months ended June 30 a production of 2,826,880 lb. copper.

Base price of copper sheets is now 18½c. per lb. for hot rolled and 19½c. for cold rolled. The usual extras are charged and higher prices for small quantities. Copper wire is 14¼ @14½c. per lb., carload lots at mill.

Exports of copper from New York for the week were 3514 long tons. Our special correspondent gives the exports from Baltimore at 2331 tons for the week.

Shipments of Katanga Copper six months ended June 30 are reported at 4520 metric tons blister copper, 96-97% pure, and 100 tons matte, carrying 65% copper.

Copper Imports in Germany six months ended June 30 were 116,904 tons, of which 102,188 tons were from the United States. Exports were 3377 tons; net imports, 113,527 tons.

Brass Prices as announced by the American Brass Co. on Aug. 1 are: Sheets, high brass, 14¾c. net per lb.; low brass, 16½c.; wire, high brass, 14½c.; low brass, 16½c. Rods, high brass, 14½c.; low brass, 17¼c. Tubes, brazed, 19¼c.; open seams, 19¼c. Angles and channels, 19¼c. Scrap allowances are 9¼c. net per lb. for high brass, 10½c. for low brass.

Tin—Since the beginning of the crisis and the closing of the London Exchange there has been no wholesale market. There have been some transactions in one-ton to five-ton lots at fancy prices, but the large interests in tin have refused to quote and pronounce that there is no market.

Exports from Baltimore for the past week included 150,005 lb. scrap tin to Rotterdam.

Tin production of Federated Malay States, as officially reported for six months ended June 30, was 24,902 long tons, an incerase of 1018 tons, or 4.3%, over last year.

Visible Stocks of Tin on Aug. 1 are reported as follows: London, Straits and Australian, 3763; London, other kinds, 3316; London, afloat, 3221; total London, 10,300; Holland, 455; United States, excluding Pacific ports, 3412; total, 14,167 long tons, a decrease of 1860 tons during July. The figures include tin afloat.

Lead—The A. S. & R. Co. maintains its previous price, but from independent quarters there has been an emphatic pressure to sell and lower prices have been accepted.

Exports from Baltimore for the week included 56,008 lb. lead to Liverpool, 728,558 lb. to Rotterdam, making 784,566 lb. lead in all.

Spelter—At the beginning of the crisis producers sold round lots of spelter at reduced prices, and overtures were made to consumers to sell very large tonnages at a sharp cut, but when it appeared that they would be promptly taken up the tentative intimations were withdrawn and asking prices were raised. A considerable volume of business was done at the advance, and at the close sellers were quite firm. It is anticipated that the war conditions in Europe may lead to exports from here.

Base price of zinc sheets is $7 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

DAILY PRICES OF METALS

NEW YORK

July-Aug.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc	
			Electrolytic, Cts. per Lb.	Cts. per Lb.	New York, Cts. per Lb.	St. Louis Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.
			12.70		3.85	3.70	4.80	4.65
30	*	52¼	@12.75	31	@3.90	@3.72½	@4.90	@4.75
			12.45		3.85	3.70	4.80	4.65
31	*	52¼	@12.55	33	@3.90	@3.72½	@4.90	@4.75
1	*	*	*	*	3.85	3.70	4.90	4.75
					@3.90	@3.72½	@4.95	@4.80
3	*	*	*	*	3.80	3.65	4.90	4.75
					@3.90	@3.70	@4.95	@4.80
4	*	*	*	*	3.80	3.65	4.90	4.75
					@3.90	@3.70	@4.95	@4.80
5	*	*	*	*	3.80	3.65	4.90	4.75
					@3.90	@3.70	@5.00	@4.85

*No market.

The quotations herein given are our appraisal of the markets for copper, lead spelter and tin based on wholesale contracts; and represent, to the best of our judgment, the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.15c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumer. To reduce to New York basis we ded uct an average of 0.15c. representing delivery charges. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic; of casting copper 0. 15 to 0. 25c. below. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb., are: St. Louis-New York, 15½c.; St. Louis-Chicago, 6c.; St. Louis-Pittsburgh, 12½c.; Chicago-Baltimore, 10½c.; Chicago-New York, 13½c.; New York-Bremen or Rotterdam, 15c.; New York-Havre, 16 @ 17½c.; New York-London, 16c.; New York-Hamburg, 18c.; New York-Trieste, 22c.

LONDON

July-Aug.	Silver	Copper				Tin		Lead		Zinc	
		Spot		3 Mos.	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
		£ per Ton	Cts. per Lb.								
30	23¾	56	12.17	57¼	61¼	132	135	18¾	4.07	21¾	4.73
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Note—London Exchange closed from July 31.

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latte 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.; £15 = 3.26¼c. = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21¾c.

Other Metals

Aluminum—The market for this metal is practically closed by the war excitement. No prices can be quoted for imported metal, as supplies are cut off. Both Germany and France have prohibited exports as contraband of war, and England is expected to follow. The home producer, while filling contracts, declines to quote on new business for the present.

Antimony—The market is entirely upset by the war news and the total uncertainty about exports. Quotations are given today at 7½@8c. for ordinary brands and 9½@10c. for Cookson's.

Quicksilver—The market is active and excited and demand just now exceeds the supply. The New York price has advanced to $42.50 per flask of 75 lb., and a further increase is expected. It is not possible to quote any London prices.

Nickel—Quotations for ordinary forms—shot, blocks, or plaquettes—are 40@45c. per lb., according to size of order and quality. Electrolytic nickel is 5c. per lb. higher.

Minor Metals—Quotations for **Bismuth** are $1.80 per lb. for imported, $1.72 for metal from native ores—**Cadmium,** 750 marks per 100 kg.—81c. per lb.—at works in Germany—**Magnesium,** $1.50 per lb., New York—**Selenium,** $3@3.25 per lb. for lots of 100 lb. or over, and $5 per lb. for small quantities.

Gold, Silver and Platinum

Gold—The gold situation is most deeply involved owing to the war excitement. There is, of course, no open market in London just now, and every nation is guarding its own stores. Exports from this country are temporarily stopped, except to Canada, the banks of that country having taken some $5,000,000 this week. There is a demand for gold almost everywhere, but no one seems to be in a position to get it.

A curious incident is that of the German steamer "Kronprinzessin Cecile," which sailed from New York last week with about $10,500,000 in gold bars on board, consigned to London and Paris. At that time no declarations of war had been made, but the vessel could be reached by wireless. It was reported first that she had reached a German port; then that she had been captured by a British cruiser, but these proved false, and on Tuesday, Aug. 4, she arrived at Bar Harbor, Me. Why that port, no one knows, for no coal nor supplies can be had there, and it is not a commercial port. The gold will probably go back to the U. S. Subtreasury for the present.

Russian Gold Production in 1913, according to the latest official statement, was 1,249,860 oz. fine, or $25,834,600. If the usual allowance for unreported gold is made, it brings the total up to $28,416,060 for the year.

Iridium—There has been nothing done in this metal, but dealers hold it at $76@79 per oz., New York.

Platinum—The market is disturbed, owing to the uncertainty as to future supplies. No new business has been done and quotations are nominally unchanged at $43@44 per oz. for refined platinum and $46@51 per oz. for hard metal. An advance is expected.

Shipments of silver from London to the East, Jan. 1 to July 23, as reported by Messrs. Pixley & Abell:

	1913	1914	Changes
India	£4,196,500	£4,227,000	I. £30,500
China	432,000	40,000	D. 392,000
Total	£4,628,500	£4,267,000	D. £361,500

Indian shipments to date are a little ahead of last year, but China still holds back, with takings very small indeed.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Aug. 1

The base price paid this week for 60% zinc ore was $39.50 @40 per ton. The base price paid for 80% lead ore was $46@47 per ton.

SHIPMENTS WEEK ENDED AUG. 1

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	3,192,890	240,000	404,200
Year	89,361,230	3,316,500	22,656,570

Shipped during week to separating plants, 2,430,640 lb. zinc ore.

JOPLIN, MO.—Aug. 1

Blende sold as high as $42.50, the assay base being $39@41.50 and the metal base $37.50@39 per ton of 60% zinc. Calamine is $22 per ton of 40% zinc. The average selling price of all grades of zinc is $32.22 per ton. The highest price paid for lead was $47.50, the base continuing at $46 per ton of 80% metal content, and the average of all grades is $45.98 per ton.

Another of the large Webb City mines closed down tonight, ostensibly until Sept. 1. This is a total of eight in two months. One thousand tons decrease in the shipment is partly occasioned by lack of cars and partly by a decreasing production.

SHIPMENTS WEEK ENDED AUG. 1

	Blende	Calamine	Lead	Values
Totals this week	$9,014,110	$493,820	$1,417,120	$205,770
Totals 31 weeks..	317,633,920	22,696,850	54,161,360	7,756,940

Blende value, the week, $168,310; 31 weeks, $6,207,180.
Calamine value, the week, $4880; 31 weeks, $256,485.
Lead value, the week, $32,580; 31 weeks, $1,293,275.

IRON TRADE REVIEW

NEW YORK—Aug. 5

The iron and steel markets are practically at a stand, and everyone is waiting for further developments as to the European war. Most people are inclined to expect an increased demand here, but others doubt it. For the present the financial disturbance resulting from the general disarrangement abroad, puts the market in a condition where a conservative course seems to appeal to most manufacturers and buyers. It may be a month before the conditions are clear.

PITTSBURGH—Aug. 4

The effect of the European war has been to stiffen finished steel prices, not by reason of increased demand but by the sellers adopting a very conservative course. Their view is that the labor supply may be inconveniently diminished and that the total demand for steel from the United States may be very considerably increased. The circumstances dictate a very conservative policy even though, when so much is in doubt, there is far from assurance that demand will actually be increased.

The immediate effect has been to decrease export shipments, because there is danger in vessels moving, but the view is that should the war as a whole last a long time the question of naval supremacy will be determined in a relatively short time and vessel room will be available, when European sources of production are so largely shut off from neutral markets.

Steel prices are being named now only for immediate acceptance, but they are not quotably higher than a week ago. The sheet market is firming up rapidly, as several independent mills have advanced prices and the movement is expected to become general.

Pig Iron—The pig-iron market, which had been decidedly more active, as to foundry grades, in July than in June, has been very quiet the past few days, owing to the war. Unlike steel makers, blast furnacemen have not materially stiffened in their price views, though as a matter of fact they have not had time to consider exhaustively the possibilities created by war conditions. W. P. Snyder & Co. report their pig iron averages for July at $14, Valley, for bessemer and $13, Valley, for basic, the same as for three months preceding. Rarely have the averages been unchanged for so long a period. We quote: Bessemer, $14; basic, $13; malleable, $13@13.25; foundry, $13@13.50; forge, $12.50@12.75, at Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—On the first threat of a general war buyers began purchasing ferromanganese, and by last Thursday dealers had sold all the foreign producers would permit them to sell, at $38, Baltimore for English and $37, Baltimore for German. Then the market came to an absolute standstill, the foreign producers refusing to sell more at any price while dealers were unable to find any re-sale material. To bring out even small lots of re-sale material very high prices will doubtless have to be offered. The Carnegie Steel Co. will possibly become a seller in time. It prepared for a large production beyond its own consumption this year, and at the beginning of the year made sales for six months, but withdrew from the market when the foreign producers made sharp reductions. Imports of manganese ore have been very large for two years, considerably in excess of the requirements for producing the amount of ferromanganese that has been made to date. Fancy prices on ferromanganese would not seriously increase the cost of making steel, for it is computed that to quadruple the price, on the basis of the recent market of $37 or $38, would only add $1 to the cost of producing a net ton of finished steel.

Steel—The market for billets and sheet bars has been very quiet, tonnages required being adjusted on old contracts. The fact is that the practice of contracting for supplies, with a monthly or quarterly price adjustment, in the light of the existing market, became so general that hardly any steel is left to be sold in the open market and furnish the required basis for this adjustment. In general the market may be quoted at $19 for billets, and $19.50 for sheet bars, f.o.b. maker's mill, Youngstown, and at $19.50 for billets and $20 for sheet bars, f.o.b. maker's mill, Pittsburgh.

IRON ORE

Iron ore shipments from the Lake Superior region are still light, and the season promises to show a heavy reduction from last year.

In the East also business is slow. The Eastern furnaces are taking only moderate quantities of imported ore this season, and even Cuban imports have been light.

Imports of Iron Ore in Germany six months ended June 30 were 6,748,053 metric tons; exports, 989,127; net imports, 5,758,926 tons. Imports of manganese ore were 391,879 tons; exports, 2871; net imports, 389,009 tons.

FOREIGN IRON

Foreign trade of Great Britain in iron and steel and manufactures thereof is valued by the Board of Trade returns as below for the six months ended June 30:

	Exports	Imports	Excess
Iron and steel	£25,169,145	£7,602,460 Exp.	£17,566,685
Machinery, hardware, etc.	29,405,727	8,619,489 Exp.	20,786,238
Totals	£54,574,872	£16,221,949 Exp.	£38,352,923
Totals, 1913	57,314,160	15,601,506 Exp.	41,712,654

The quantities of iron and steel exported were 2,504,994 long tons in 1913, and 2,376,264 tons in 1914. Quantities imported, 1,110,703 tons in 1913, and 1,170,989 tons this year.

Pig-Iron Production in Germany in June was 1,531,313 metric tons, being 75,880 tons less than in May. For the half year ended June 30, the total make was: Foundry iron, 1,595,862; forge iron, 224,860; steel pig—including spiegeleisen, ferromanganese and all similar alloys—1,218,580; bessemer pig, 156,953; Thomas (basic) pig, 6,091,941; total, 9,288,196 metric tons. This is a decrease of 288,007 tons, or 3%, from last year.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 268,290 short tons; shipments, 267,261 tons. Production of the Greensburg and Upper Connellsville districts, 38,487 tons.

Connellsville Coke—The market has continued stagnant. No demand for furnace coke developed at the month end and it is evident that the furnaces which did not make contracts for the half year covered for August at least in addition to July. There are occasional offerings of spot furnace coke at less than $1.75, but only in limited tonnages. We quote: Prompt furnace, $1.75; contract furnace, $1.75@2; prompt foundry, $2.25@2.35; contract foundry, $2.35@2.50, per ton at ovens.

Foreign Fuel Trade of Germany six months ended June 30, in metric tons:

	Exports	Imports		Excess
Coal	18,169,595	4,775,981	Exp.	13,393,614
Brown coal	31,325	3,184,095	Imp.	3,152,770
Coke	2,630,129	295,142	Exp.	2,334,987
Briquets	1,621,990	79,697	Exp.	1,542,293

Of the briquets exported this year 424,489 tons were made of town coal or liquite.

CHEMICALS

NEW YORK, Aug. 5

The general chemical market has been disturbed and uneasy, like all the markets, by the foreign news. Nevertheless there is some business forward and affairs are moving quietly.

Arsenic—The market is quiet, with only a moderate demand. The producers' agreement still holds and there is no change in prices, $3 per 100 lb. being named for both spot and futures.

Copper Sulphate—Business is on a fair scale with steady sales. Prices are unchanged. Quotations are $4.50 per 100 lb. for carload lots and $4.75 per 100 lb. for smaller parcels.

Nitrate of Soda—A steady but moderate business is being done. The curtailment of production, heretofore mentioned, seems to be in progress. The advices from Chile are that several large oficinas have closed down. If this continues there should be a stiffening of prices. Quotations here are fairly steady, at 2.02½@2.05c. per lb., according to position.

Pyrites—Imports at Baltimore for the week includes 4914 tons of pyrites from Huelva, Spain.

PETROLEUM

The monthly statement of the "Oil City Derrick" for July shows new wells completed as follows: Pennsylvania grade, 630; Lima-Indiana, 162; Central Ohio Gas, 91; Kentucky, 18; Illinois, 139; Kansas-Oklahoma, 869; Texas-Louisiana, 134. This shows a total of 2043 wells completed, a decrease from the June report of 299. New production was 131,949, or 57,682 bbl. less than in June. There were 342 dry holes, or 56 fewer than in the previous report, and 227 gas wells, an increase of 40. At the close of July, 543 rigs were up and 2201 wells drilling, the total amounting to 2744, a net decline of 167 from the work under way at the close of June.

COPPER SMELTERS' REPORT

This table is compiled from reports received from the respective companies except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield then is reckoned at 97%. In computing the total American supply duplications are excluded.

	March	April	May	June	July
Alaska shipments.	2,069,960	1,279,537	585,387	1,114,758	.....
Anaconda	23,800,000	22,900,000	23,500,000	23,800,000	.....
Arizona, Ltd.	3,286,000	3,570,000	3,092,000	3,742,000	.....
Copper Queen	7,637,042	7,562,723	8,388,203	7,613,719	.....
Calumet & Ariz.	5,875,000	5,450,000	5,495,000	4,630,000	.....
Chino	5,399,814	5,926,591	5,496,875	5,486,419	.....
Detroit	1,973,725	1,790,926	2,105,034	2,129,100	.....
East Butte	1,546,180	1,178,000	1,179,762	1,215,323	.....
Giroux	287,980	45,948	429,553	.....	.....
Mason Valley	1,250,000	862,000	916,000	.....	.....
Mammoth	1,800,000	1,850,000	1,750,000	1,725,000	1,950,000
Nevada Con.	5,218,257	4,880,043	4,959,589	4,483,175	.....
Ohio	597,520	610,518	625,000	.....	.....
Old Dominion	2,997,000	2,779,000	3,302,000	2,937,000	.....
Ray	6,036,908	6,089,362	6,300,847	6,039,710	.....
Shannon	1,082,000	1,012,000	1,056,000	.....	.....
South Utah	406,381	247,641	55,394	.....	.....
Tennessee	1,262,184	1,370,800	1,336,950	.....	.....
United Verde*	3,100,000	3,000,000	3,100,000	2,900,000	.....
Utah Copper Co.	12,323,493	12,739,757	13,208,483	12,870,063	.....
Lake Superior*	11,000,000	13,000,000	12,500,000	16,000,000	.....
Non-rep. mines*	8,200,000	8,000,000	8,200,000	8,000,000	.....
Scrap, etc.	2,500,000	2,500,000	2,500,000	2,500,000	.....
Total prod.	109,649,444	108,644,846	110,082,077	.....	.....
Imp., bars, etc.	22,676,605	17,043,191	19,081,487	.....	.....
Total blister	132,326,049	125,688,037	129,163,564	.....	.....
Imp. ore & matte.	7,029,646	10,400,122	10,586,506	.....	.....
Total Amer.	139,355,695	136,088,159	139,750,070	.....	.....
Miami†	3,361,100	3,130,772	3,347,000	3,124,750	3,257,300
Shattuck-Arizona	1,136,458	1,386,594	1,353,043	1,225,987	.....
Brit. Col. Cos:					
Granby	1,775,852	1,692,102	1,669,334	2,443,294	2,706,295
Mexican Cos.:					
Boleo†	2,535,680	2,204,720	2,213,120	2,204,720	.....
Cananea	4,260,000	2,632,000	2,222,000	.....	.....
Moctezuma	2,882,884	2,654,926	2,834,616	3,370,800	.....
Other Foreign:					
Braden, Chile	1,810,000	2,720,000	2,480,000	741,440	.....
Cape Cop., S. Af.	660,800	468,160	582,400	732,480	.....
Kyshtim, Russia	.....	.....	.....	.....	.....
Spassky, Russia	896,000	904,960	907,200	902,720	.....
Exports from					
Chile	6,944,000	9,072,000	7,616,000	7,840,000	.....
Australia	8,176,000	7,168,000	8,400,000	5,712,000	.....
Arrivals-Europe†	17,572,800	17,299,520	13,558,720	19,040,000	.....

†Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

† Does not include the arrivals from the United States, Australia or Chile.

COPPER STATISTICS

Month	United States: U.S. Refin'y Production	United States: Deliveries, Domestic	United States: Deliveries, for Export	Visible Stocks: United States	Visible Stocks: Europe	Visible Stocks: Total
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
VIII'13	131,632,362	73,649,801	73,263,469	53,594,945	66,420,480	120,015,385
IX.	131,401,229	66,836,897	73,085,275	38,314,037	63,716,800	102,030,837
X.	139,070,481	68,173,720	68,123,473	29,793,094	53,625,600	83,418,692
XI.	134,087,708	48,656,858	70,067,803	32,566,382	48,787,200	81,353,582
XII.	138,290,421	21,938,570	73,542,413	47,929,429	46,592,000	94,521,429
Yr., '13	1,622,450,829	767,261,760	869,062,784	.....	.....	.....
I, 1914.	131,770,274	47,956,955	87,955,501	91,438,867	53,916,800	145,355,667
II.	122,561,007	47,586,657	83,899,183	87,296,685	50,108,800	137,405,485
III.	145,651,982	69,852,349	89,562,166	78,371,852	47,376,000	125,747,852
IV.	151,500,531	63,427,633	82,345,216	64,609,319	46,435,200	111,044,519
V.	142,308,287	55,592,170	72,710,477	70,337,001	52,371,200	122,708,201
VI.	141,345,571	46,227,353	73,350,196	84,342,641	61,062,400	145,405,041
VII.	.....	.....	.....	106,110,663	64,220,800	170,331,463
VIII	.....	.....	.....	.....	.....	.....

Note—Visible supplies in Europe do not include copper afloat.

Assessments

Company	Delinq.	Sale	Amt.
Andes, Nev.	Aug. 10	Aug. 31	$0.03
Aurora-Sampson, Ida.	July 18	Aug. 18	0.002
Buffalo, Mont.	Aug. 2	Sept. 2	0.004
C. & R., Ida.	July 14	Aug. 18	0.001
Challenge Cons., Nev.	July 21	Aug. 11	0.05
Emerald, Utah.	July 15	Aug. 18	0.0033
Enterprise, Ida.	July 31	Aug. 17	0.002
Evergreen, Utah.	July 23	Aug. 22	0.01
Exchequer, Nev.	Aug. 13	Sept. 3	0.02
Federal-Ely, Nev.	July 20	Aug. 21	0.005
Four Timbers, Wash.	July 29	Aug. 29	0.0015
Great Western, Nev.	Aug. 10	Aug. 31	0.01
Holy Terror, Ida.	July 15	Aug. 15	0.0005
Jack Waite, Ida.	July 21	Aug. 18	0.01
Macnamara, Nev.	July 27	Aug. 17	0.03
Maryland, Ida.	Aug. 5	Sept. 5	0.003
Moonlight, Ida.	July 13	Aug. 20	0.005
Nabob, Ida.	July 20	Aug. 17	0.005
New Hope, Ida.	July 13	Aug. 13	0.002
North Bunker Hill, Ida.	July 18	Aug. 22	0.002
O. K., Utah.	Aug. 17	Sept. 2	0.005
Old Evergreen, Utah.	July 23	Aug. 22	0.01
Oreano, Ida.	July 24	Aug. 24	0.002
Paymaster, Ida.	July 15	Aug. 12	0.002
Reeds Peak, Utah.	July 6	Aug. 10	0.005
Smuggler, Utah.	July 11	Aug. 11	0.005
Spider, Utah.	July 21	Aug. 18	0.0025
Sunrise, Ida.	July 14	Aug. 24	0.002
Wasatch, Utah.	July 27	Aug. 31	0.05
Wasatch-Utah, Utah.	July 13	Aug. 17	0.01
West Century, Utah.	Aug. 2	Aug. 24	0.005

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1912	1913	1914	1912	1913	1914
January	56.260	62.938	57.572	25.887	28.983	26.553
February	59.043	61.642	57.506	27.190	28.357	26.573
March	58.375	57.870	58.067	26.875	26.669	26.788
April	59.207	59.490	58.519	28.284	27.416	26.958
May	60.880	60.361	58.175	28.038	27.825	26.704
June	61.290	58.990	56.471	28.215	27.199	25.948
July	60.654	58.721	54.678	27.919	27.074	25.219
August	61.606	59.293	.....	28.375	27.335	.....
September	63.078	60.640	.....	29.088	27.986	.....
October	63 471	60.793	.....	29.299	28.083	.....
November	62.792	58.995	.....	29.012	27.263	.....
December	63.365	57.760	.....	29.320	26.720	.....
Year	60.835	59.791	.....	28.042	27.576	.....

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

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1913	1914	1913	1914	1913	1914
January	16.488	14.223	71.741	64.304	77.750	69.488
February	14.971	14.491	65.519	65.259	71.575	70.188
March	14.713	14.131	65.329	64.276	70.658	69.170
April	15.291	14.211	68.111	64.747	74.273	69.313
May	15.436	13.996	68.807	63.182	74.774	67.786
June	14.672	13.603	67.140	61.336	70.821	66.274
July	14.190	13.223	64.166	60.540	69.446	64.955
August	15.400	.....	69.200	.....	74.313	.....
September	16.328	.....	73.125	.....	78.614	.....
October	16.337	.....	73.383	.....	79.250	.....
November	15.182	.....	68.275	.....	73.825	.....
December	14.224	.....	65.223	.....	69.583	.....
Year	15.269	.....	68.335	.....	73.740	.....

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

TIN

Month	New York		London	
	1913	1914	1913	1913
January	50.298	37.779	238.273	171.905
February	48.766	39.830	220.140	181.556
March	46.832	38.038	213.615	173.619
April	49.115	36.154	224.159	163.963
May	49.038	33.360	224.143	150.702
June	44.820	30.577	207.208	138.321
July	40.260	31.707	183.511	142.517
August	41.582	.....	188.731	.....
September	42.410	.....	193.074	.....
October	40.462	.....	184.837	.....
November	39.810	.....	180.869	.....
December	37.635	.....	171.786	.....
Av. year	44.252	.....	206.279	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	4.321	4.111	4.171	4.011	17.114	19.665
February	4.325	4.048	4.175	3.937	16.550	19.606
March	4.327	3.970	4.177	3.850	15.977	19.651
April	4.381	3.810	4.242	3.688	17.597	18.225
May	4.342	3.900	4.226	3.808	18.923	18.503
June	4.325	3.900	4.190	3.810	20.226	19.411
July	4.353	3.891	4.223	3.738	20.038	19.051
August	4.624	.....	4.550	.....	20.406	.....
September	4.698	.....	4.579	.....	20.648	.....
October	4.402	.....	4.253	.....	20.302	.....
November	4.293	.....	4.146	.....	19.334	.....
December	4.047	.....	3.929	.....	17.798	.....
Year	4.370	.....	4.238	.....	18.743	.....

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

SPELTER

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	6.931	5.262	6.854	5.112	26.114	21.533
February	6.239	5.377	6.089	5.228	25.338	21.413
March	6.078	5.250	5.926	5 100	24.605	21.460
April	5.641	5.113	5.491	4.963	25.313	21.569
May	5.406	5.074	5.256	4.924	24.583	21.393
June	5.124	5.000	4.974	4.850	22.143	21.345
July	5.278	4.920	5.128	4.770	20.592	21.568
August	5.658	.....	5.508	.....	20.706	.....
September	5.694	.....	5.444	.....	21.148	.....
October	5.340	.....	5.188	.....	20.614	.....
November	5.229	.....	5.083	.....	20.581	.....
December	5.156	.....	5.004	.....	21.214	.....
Year	5.648	.....	5.504	.....	22.746	.....

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

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1913	1914	1913	1914	1913	1914
January	$18.15	$14.94	$17.35	$13.23	$18.59	$13.90
February	18.15	15.06	17.22	14.12	18.13	14.09
March	18.15	15 07	16.96	13.94	17.53	14.18
April	17.90	14.90	16.71	13.90	16.40	14.10
May	17.68	14.90	15.80	13.90	15.40	14.23
June	17.14	14.90	15.40	13.90	15.10	13.97
July	16.31	14.90	15.13	13.90	14.74	13.96
August	16.63	.....	15.00	.....	14.88	.....
September	16.65	.....	15.04	.....	14.93	.....
October	16.60	.....	14.61	.....	14.80	.....
November	16.03	.....	13.91	.....	14.40	.....
December	15.71	.....	13.71	.....	14.28	.....
Year	$17.09	.....	$15.57	.....	$15.77	.....

STOCK QUOTATIONS

COLO. SPRINGS July 29

Name of Comp.	Bid.
Acacia	.02½
Cripple Cr'k Con.	.006
C. K. & N.	.05
Doctor Jack Pot.	.06
Elkton Con.	.47
El Paso	1.40
Findlay	.006
Gold Dollar	.02½
Gold Sovereign	.01
Golden Cycle	1.00
Isabella	.10½
Jack Pot	.05
Jennie Sample	.03
Jerry Johnson	.03½
Lexington	.004
Old Gold	.01
Mary McKinney	.50
Pharmacist	‡.009
Portland	1.10
Vindicator	1.00

SALT LAKE July 30

Name of Comp.	Bid.
Beck Tunnel	.03
Black Jack	.04
Cedar Talisman	.00½
Colorado Mining	.11½
Crown Point	.01½
Daly-Judge	5.00
Gold Chain	.10
Grand Central	.70
Iron Blossom	1.37½
Little Bell	.12
Lower Mammoth	‡.00½
Mason Valley	2.12½
May Day	.05½
Opohongo	.01½
Prince Con.	.18
Silver King Coal'n.	2.80
Silver King Cons.	1.80
Sioux Con.	.01½
Uncle Sam	‡.03½
Yankee	.01½

TORONTO July 30

Name of Comp.	Bid.	Name of Comp.	Bid.
Bailey	‡.00½	Foley O'Brien	.26
Coniagas	‡7.00	Hollinger	18.00
Peterson Lake	‡.31½	Imperial	‡.01½
Right of Way	‡.02	Jupiter	‡.06½
T. & Hudson Bay	‡35.00	Pearl Lake	‡.02½
Timiskaming	.10	Porcu. Gold	.05
Wettlaufer-Lor.	.05	Preston E. D.	.01
Big Dome	‡8.10	Rea	‡.10
Crown Chartered	‡.00½	Swastika	‡.01
Dome Exten.	.07	West Dome	‡.05

SAN FRANCISCO July 30

Name of Comp.	Bid.	Name of Comp.	Bid.
Comstock Stocks		Misc. Nev. & Cal.	
Alta	.06	Belmont	5.40
Belcher	.44	Jim Butler	.81
Best & Belcher	‡.04	MacNamara	‡.01
Caledonia	.50	Midway	.14
Challenge Con.	‡.08	Mont.-Tonopah	.56
Chollar	‡.02	North Star	.19
Confidence	‡.21	West End Con.	.64
Con. Virginia	.07	Atlanta	.12
Crown Point (Nev.)	.36	Booth	.03
Gould & Curry	‡.01	C.O.D. Con.	.02
Hale & Norcross	‡.04	Comb. Frac.	.04
Mexican	.40	Jumbo Extension	.17
Occidental	.75	Pitts.-Silver Peak	.27
Ophir	.06	Round Mountain	.34
Overman	.24	Sandstorm Kendall	.05
Potosi	.01	Silver Pick	.05
Savage	‡.05	Argonaut	2.50
Sierra Nevada	.03	Brunswick Con.	1.50
Union Con.	.08	Central Eureka	.20
Yellow Jacket	.35	So. Eureka	1.40

N. Y. EXCH. July 30

Name of Comp.	Clg.
Amalgamated	49½
Am.Sm.&Ref.,com	52½
Am. Sm. & Ref., pf.	97½
Am. Sm. Sec., pf. B.	78
Anaconda	25
Batopilas Min.	.75
Bethlehem Steel, pf.	81½
Chino	32
Colo. Fuel & Iron	21½
Federal M. & S., pf.	29½
Great Nor., ore., ctf.	23
Guggen. Exp.	40½
Homestake	110
Inspiration Con.	15
Mex. Petroleum	53
Miami Copper	17½
Nat'l Lead, com.	41⅛
National Lead, pf.	102
Nev. Consol.	10½
Ontario Min.	2⅜
Phelps Dodge	175
Quicksilver, pf.	1½
Ray Con.	16½
Republic I&S, com.	18½
Republic I&S, pf.	78
SlossSheffi'd, com.	19½
Sloss Sheffield, pf.	82
Tennessee Copper.	24½
Utah Copper	46
U. S. Steel, com.	51⅞
U. S. Steel, pf.	106½

N. Y. CURB July 30

Name of Comp.	Clg.
Beaver Con.	.21
Big Four	.05
Boston Montana	‡9¼
Braden Copper	6
B. C. Copper	1⅜
Buffalo Mines	1
Can. Cop. Corpn.	‡2
Can. G. & S.	.08
Caribou	.C8
Chambers Feriand.	‡.12
Con. Ariz. Sm.	7/16
Cons. Nev.-Utah	‡⅜
Coppermines Cons	1⅜
Davis-Daly	‡.64
Diam'field-Daisy	.05
Ely Con.	.05
Florence	.27
Gold Hill Con.	‡7/16
Goldfield Con.	1 7/16
Greene Cananea	28
Kerr Lake	5½
La Rose	.75
McKinley-Dar-Sa.	.49
Mines of Am.	2⅜
Mutual Min., pf.	2⅜
Nevada Hills	.26
New Utah Bingham	‡⅜
Nipissing Mines	5½
Ohio Copper	.10⅜
Oro	.07
Puebla S. & R.	2⅜
Stand'd Oil of N.J.	357
Stand'd Silver Lead	1 11/16
Stewart	1 7/16
Tonopah	5⅜
Tonopah Ex.	2½
Tonopah Merger	.31
Tularosa	.25
West End Ex.	.03
Yukon Gold	2½

LONDON July 23

Name of Comp.	Clg.
Camp Bird	£0 8s 3d
El Oro	0 14 0
Esperanza	0 13 9
Mexico Mines	5 0 0
Oroville	0 10 6
Santa Gert'dis.	0 11 3
Stratton's	0 0 6
Tomboy	1 1 3

BOSTON EXCH July 30

Name of Comp.	Clg.
Adventure	1
Ahmeek	260
Alaska Gold M.	19½
Algomah	‡.90
Allouez	38½
Am. Zinc	12½
Ariz. Com., ctfs.	3⅜
Bonanza	.51
Butte-Balaklava	‡2
Butte & Superior	25
Calumet & Ariz.	56
Calumet & Hecla	394
Centennial	15⅜
Cliff	‡1
Copper Range	30
Daly West	‡2
East Butte	9
Franklin	3½
Granby	67½
Hancock	11⅜
Helvetia	‡.30
Indiana	3
Island Cr'k, com.	46
Island Cr'k, pfd.	87
Isle Royale	17½
Keweenaw	3½
Lake	5
La Salle	‡3½
Mass.	‡4
Mayflower	4½
Michigan	‡.60
Mohawk	39
New Arcadian	3½
New Idria Quick	‡3½
North Butte	20⅛
North Lake	‡1½
Ojibway	‡.90
Old Colony	3⅜
Old Dominion	45½
Osceola	70
Quincy	53
Santa Fe	‡1½
Shannon	4 1/16
Shattuck-Ariz.	‡21
Superior	23
Superior & Bost.	1½
Tamarack	29
Trinity	3
Tuolumne	‡.35
U. S. Smelting	31½
U. S. Smelt'g, pf.	43
Utah Apex	‡1½
Utah Con.	10
Victoria	1
Winona	2
Wolverine	37
Wyandot	.50

BOSTON CURB July 30

Name of Comp.	Bid.
Bingham Mines	.04½
Boston & Corbin	.25
Boston Ely	.25
Butte & Lon'n Dev.	.27
Calaveras	1½
Calumet-Corbin	.05
Chief Cons.	.80
Corbin	.90
Cortez	.30
Crown Reserve	1 7/16
Eagle & Blue Bell	.88
First Nat. Cop.	1 7/16
Houghton Copper	1⅜
Iron Cap Cop., pf.	4½
Majestic	.16
Mexican Metals	.16
Nevada-Douglas	1
New Baltic	.99
Oneco	.60
Raven Copper	.12
Smokey Dev.	.15
So. Lake	3½
Tonopah Victor	.18
Trethewey	‡.09¼
United Verde Ext.	.70

‡Last Quotations.