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## Mining and Smelting in the Ducktown District

The Ore, Which Averages 2 Per Cent. Copper, Occurs in Great Lenses in Metamorphic Schist; Copper and Sulphuric Acid Produced

BY EDWIN HIGGINS

The Ducktown district lies in the extreme southeastern corner of the State of Tennessee and extends across the State line into Georgia and Alabama. The main portion of the district lies in Polk county, Tenn., and extends about four miles north and south and a little over two miles east and west, as shown in Fig. 5. The smelting plant of the Tennessee Copper Company is situated at Copperhill, on the Louisville & Nashville Railroad running

The Ducktown area is an eroded plateau, ranging in elevation from 1600 to 1800 ft. above sea level, and inclosed on three sides by mountains rising from 500 to 2500 ft. in height. The rolling hillocks are devoid of timber and vegetation, this condition being due chiefly to the smelting operations conducted in the early days when the ore was roasted in heaps. The chief water course of the district is the Ocoee river, shown at the bottom of the

occurs in great lenses from 500 to 3000 ft. in length and from 25 to 75 ft. in width, although in one or two cases a width greatly in excess of this is attained. These lenses, or orebodies, indicated on the map in dotted lines, strike in a north-easterly-southwesterly direction; the dip is usually between 70 and 80 deg. southwesterly. They usually have well defined walls, but sometimes the ore is found grading into the country rock.

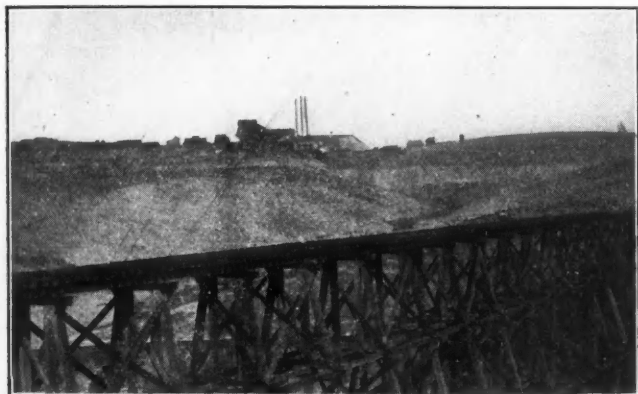


FIG. 1. POLK COUNTY MINE AND SURROUNDING COUNTRY



FIG. 2. BURRA BURRA OUTCROP FROM WHICH IRON ORE HAS BEEN MINED



FIG. 3. MCPHERSON SHAFT, USED FOR PROSPECTING PURPOSES

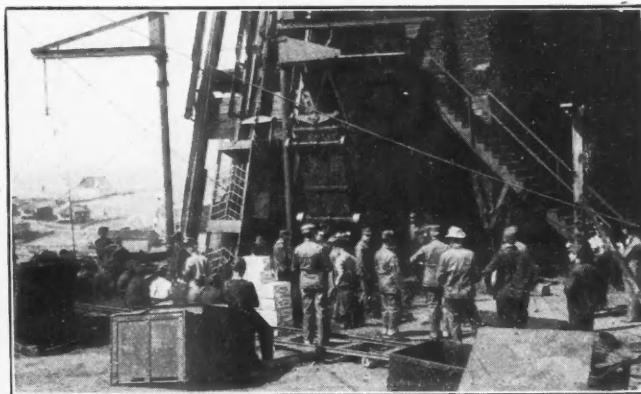


FIG. 4. COLLAR OF BURRA BURRA SHAFT SHOWING SKIP-CHANGING APPARATUS

between Knoxville, Tenn., and Atlanta, Ga. Connected with the Louisville & Nashville Railroad are two separate branch lines which connect the mines and smelters of the two companies operating in the district, the Tennessee Copper Company and the Ducktown Sulphur, Copper and Iron Company, Limited.

map. The creeks shown contain little water, especially in the dry season.

### THE ORE

The country consists chiefly of foliated mica schist, with occasional intercalated bands of gneiss. These rocks are probably of lower Cambrian age. The ore

The oxidized zone is shallow, extending down only from 50 to 75 ft. To this depth a heavy gossan occurs, and it has been worked at most points for use in the iron blast furnace. This ore carries from 46 to 50 per cent. iron. The outcrop of the Burra Burra mine, from which the iron ore has been mined, is shown in Fig.

2. Fig. 7 shows an open cut in the Eureka-Isabella orebody; it is said that about 500,000 tons of iron ore have been mined here.

The ore below the oxidized zone and

sphalerite are found in varying small amounts. In general it may be said that the ores have the following range of composition: copper, 2 to 2.5 per cent.; sulphur, 17 to 30; iron, 18 to 40; silica, 10

1854, several mines were being worked and there were two small matting furnaces in operation. Most of the ore, however, was hauled by wagon 40 miles to a railroad, and shipped thence to Swansea for reduction. All work was suspended in 1863 on account of the American civil war. After the war the work was again taken up and the district prospered until about the year 1878. During this early period the mining was almost wholly confined to the exploitation of the rich "black ore" in the zone of secondary enrichment. In 1891 a British concern came into the district, and by 1893 had begun operations on a fairly large scale. This was the Ducktown Sulphur, Copper & Iron Company (hereafter referred to as the Ducktown company).

The Tennessee Copper Company (hereafter referred to as the Tennessee company) entered the district in 1897 and prosecuted diamond-drill exploration work. On account of the low price of copper this company relinquished its options, but had them renewed in 1898. In the spring of 1899 mining operations were started. The Tennessee company and the Ducktown company are the only operators in the district at present.

MINES OF THE DISTRICT

The Tennessee company is operating the Burra Burra, Polk County and London mines. The Burra Burra is now down over 700 ft. and no change in the ore is indicated. The production of this mine is 1100 tons per day. The London mine is 562 ft. deep and produces 250 tons per day. The Polk County mine will soon reach the fourth level, at which point it will be 385 ft. in depth. Its production is 250 tons per day. The Old Tennessee orebody of the Tennessee company is not in operation. The Eureka-Isabella orebody is large, but will average only about 0.9 per cent. copper. It will, however, average about 40 per cent. sulphur. The Tennessee company owns two-thirds of the orebody, and the Ducktown company the other third.

The Ducktown company is developing its East Tennessee mine and is producing 500 tons per day from its Mary mine. The Isabella will be worked for pyritic ore. The Ducktown company also owns the Calloway mine, which was abandoned about a year ago, and an undeveloped property near the Ocoee river, about four miles from Isabella. The Tennessee company's smelter is at Copperhill; that of the Ducktown company is situated at Isabella.

The accompanying table shows the production of the Tennessee company's mines since 1901:

Year.	Burra Burra, Tons.	London, Tons.	Polk County, Tons.	Total, Tons.
1901	71,075	35,342	39,721	146,138
1902	105,820	85,840	59,109	250,769
1903	120,046	92,266	75,153	287,465
1904	88,510	31,716	24,573	144,799
1905	131,654	63,375	17,802	212,831
1906	201,926	72,212	89,603	363,741
1907	225,040	60,557	98,034	383,631
Total	944,071	441,308	403,995	1,789,374

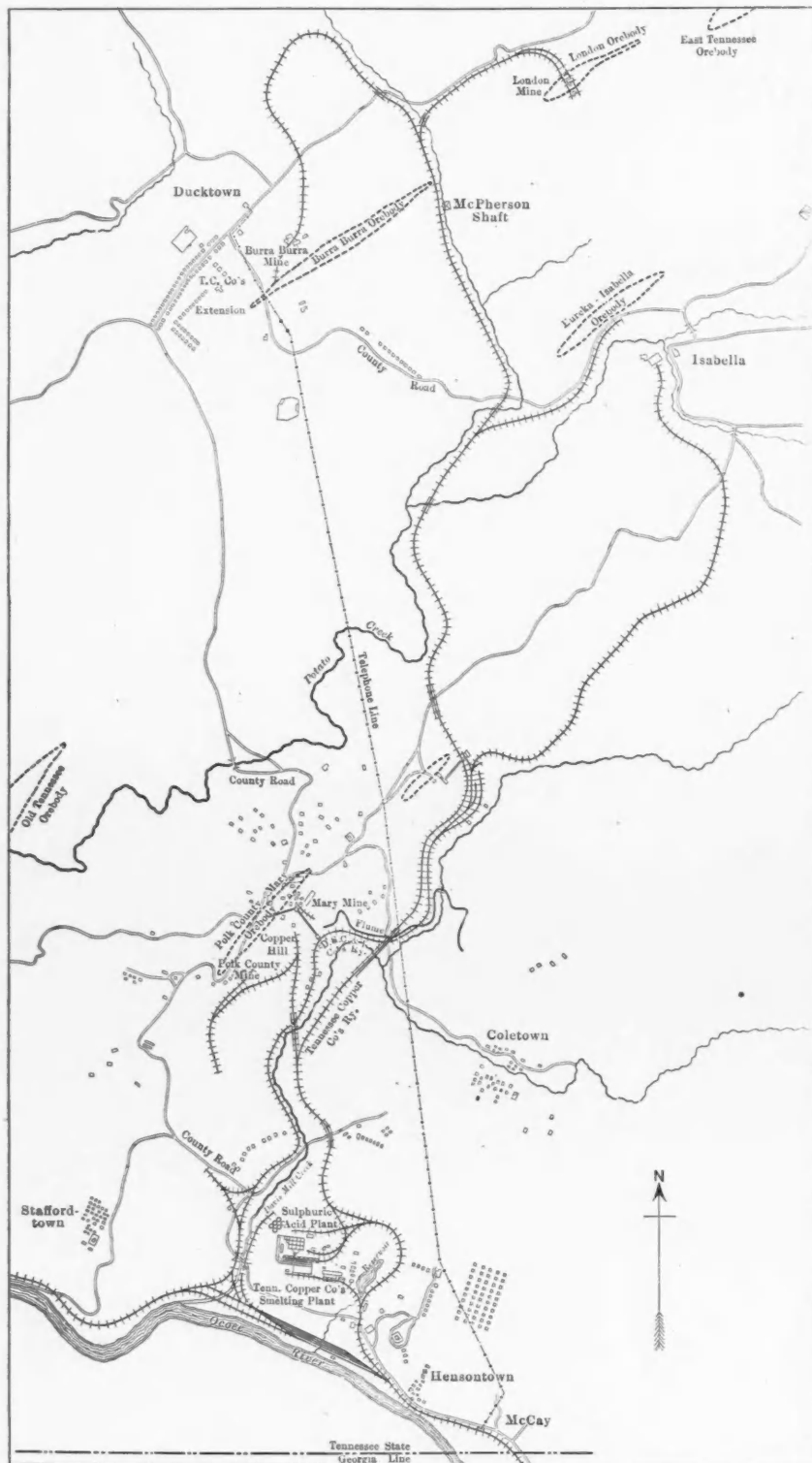


FIG. 5. MAP OF THE DUCKTOWN DISTRICT

the narrow zone of secondary enrichment varies in the different lenses, but in general may be said to consist of chalcocopyrite associated with pyrite and pyrrotite in a gangue of quartz and metamorphic minerals. Biotite, calcite, actinolite and

to 45; lime, 5 to 8; alumina, 2 to 4; magnesia, about 2; zinc, 1 to 2.

HISTORICAL

Copper was discovered in the Ducktown district in the year 1843. By the year

**MINING METHODS AT THE BURRA BURRA MINE**

The mining methods of the Tennessee company are exemplified in the Burra Burra mine. Here the main shaft is sunk about 100 ft. from the orebody, in the footwall side, and at an inclination of 75 deg. Levels are opened at intervals of 100 ft. Six levels are now in operation and the shaft is being sunk to the seventh. At each level crosscuts are driven to the ore and a raise put up opposite the shaft to the level above. Stopping is started from this raise by cutting out about 30 ft. below the level above; thus a floor pillar of 30 ft. is left between each two levels. Underhand stopes are started in both directions on the vein and carried the full width of the orebody. These stopes are 70 ft. in height. Where considered necessary additional pillars are left in the stopes. At a later period all pillars and floors will be robbed as completely as possible.

The broken ore is shoveled by hand into 2½-ton cars, which are trammed to the station and loaded into the skips; the skip holds two cars. At the surface the ore is dumped into bins, whence it is fed to an 18x36-in. Blake crusher. From this crusher the ore is carried by conveyer belts to storage bins of 2000 tons capacity.

working six hours per day, and pumping from 50 to 60 gal. per minute.

**CHANGING APPARATUS**

An interesting feature at the collar of the Burra Burra shaft is the apparatus for changing the skips. This arrangement is shown in Fig. 4. To the left is seen the



FIG. 6. BURRA BURRA HEADFRAME

trammer, \$1.90; general underground work, \$1.75.

**SURFACE PLANT**

The surface plant at the Burra Burra mine consists of a housed headframe and crusher house (see Fig. 6), power and boiler house, machine, carpenter and blacksmith shops and change house for the men. The hoist is a Nordberg first motion, 18x32-in. cylinders with two conical drums, 7 ft. diameter at the small end and 9 ft. diameter at the large end, by 5 ft. face. The hoisting rope is 1¼ in. plough steel. There are two Nordberg two-stage compressors, steam cylinders 14 and 28x42 in., air cylinders 15 and 24x42 in. These machines have a capacity of 2000 cu. ft. of free air per min. each, furnishing air to the drills at 80 lb. pressure. There are four 150 h.p. Babcock & Wilcox water-tube boilers, equipped with Murphy automatic stokers. A small dynamo furnishes electrical power for lighting the surface and also the stations at each level in the mine.

**RAILROAD AND EQUIPMENT**

The company's railroad has a total length of about 7½ miles, including the branches to the three mines. There are in addition about 4½ miles of track in the



FIG. 7. OPEN CUT, EUREKA-ISABELLA OREBODY; ABOUT 500,000 TONS IRON ORE MINED HERE

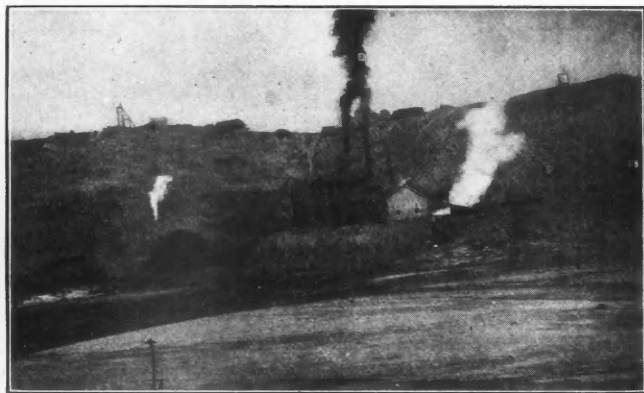


FIG. 8. MARY MINE OF THE DUCKTOWN SULPHUR, COPPER AND IRON COMPANY

The conveyer belt is also utilized as a picking belt.

For the purpose of exploration, drifts are driven on every third level. From these drifts, at 100-ft. intervals, diamond-drill holes are bored into both foot and hanging walls for the purpose of determining the width of the ore. On the third level the orebody has been explored its total length, about 3000 ft., from the MacPherson shaft on the north to the Hiwassee shaft on the south. These are old shafts which were sunk during the early operation of this mine. On the sixth level drifting has progressed about 400 ft. north and 400 ft. south.

The Burra Burra mine makes about 12 gal. of water per min. This amount of water is easily handled by a small pump

post and beam arrangement. On the right-hand side the ore skip is seen hanging from the beam. The cage for hoisting men is seen in position over the shaft. When it is desired to place the ore skip in position, the cage is quickly detached and swung on the beam, the ore skip then being swung into position.

**LABOR**

The men employed in and about the mine are white and nearly all Americans; negroes are unknown in the Ducktown district. Most of the work underground is done by contract, the trammers receiving from 19 to 28c. per car of 2½ tons. Miners are paid by the foot drilled. The following wages are paid men working by the day: chucker, \$1.75; driller, \$1.90;

sidings in and about the smelter. The road is standard gage and is laid with 65-lb. rails.

The rolling stock includes four 105,000-lb. Schenectady locomotives of the switching type, and sixty-three 30-ton cars, of which 50 are Rodger ballast cars with drop bottoms and 10 are low-sided gondolas. One train transports the ore from the mine to the smelter, working only on the day shift. Day and night crews handle the traffic from the smelter to the railroad company. In connection with the railroad, storage yards for coal, coke, quartz and ore are maintained.

**THE SMELTER**

The smelter bins have a capacity of 10,000 tons of ore, 800 tons of coke, and

additional space for the storage of flux and furnace products to be retreated. The four tracks under the bins are provided with scales for weighing charges. The cars used are side dumping, have a capacity of 44 cu.ft., and are hauled by electric locomotives.

There are seven blast furnaces, three of which are 56x180 in., and four 56x270 in. at the tuyeres. These furnaces are 18 ft. from tuyeres to charge floor, and 3½ ft. from tuyeres to sole-plate. Sole-plates are cast iron and water-cooled. The smaller furnaces have twenty-six 5-in. tuyeres; the larger ones, fifty 3¼-in. tuyeres, arranged in pairs.

Blast is furnished to the furnaces at a pressure of 50 oz. at the power house. Each furnace takes about 1000 cu.ft. of free air per min. per ft. of length. From 70,000 to 90,000 cu.ft. of air is consumed per ton of ore smelted.

the blast-furnace settlers to the converters by two 40-ton cranes. The copper is cast into pigs of 210 lb., and will run about 99.4 per cent. fine.

#### THE SMELTING OPERATION

Pyritic smelting is practiced here. There are two stages to the process. In the first stage the ore is concentrated to a low-grade matte which will average 15 per cent. copper. This matte is cooled on the slag dump, broken up, and hauled to the smelter bins. In the second stage the first matte is concentrated to a matte of converting grade. Although this can be varied at will, the present practice is to produce a matte of about 32 per cent. copper; this is easily handled in the converters. In the first operation only quartz is used as flux; on the concentration charge limestone is added in addition to quartz. The coke used in the two opera-

cent. copper; the concentration slag will carry from 0.35 to 0.42 per cent. copper.

In accompanying tables is shown the amount of ore and copper produced since 1901.

#### ORE PRODUCED BY THE TENNESSEE COPPER COMPANY

Year.	Tons.
1901	57,314
1902	221,194
1903	284,202
1904	241,855
1905	229,116
1906	362,900
1907	389,603
Total	1,786,184

#### COPPER PRODUCED BY THE TENNESSEE COPPER COMPANY

Year.	Pounds.
1901	1,948,759
1902	7,961,734
1903	10,690,389
1904	8,617,697
1905	7,977,982
1906	11,319,591
1907	12,599,019
Total	61,115,171

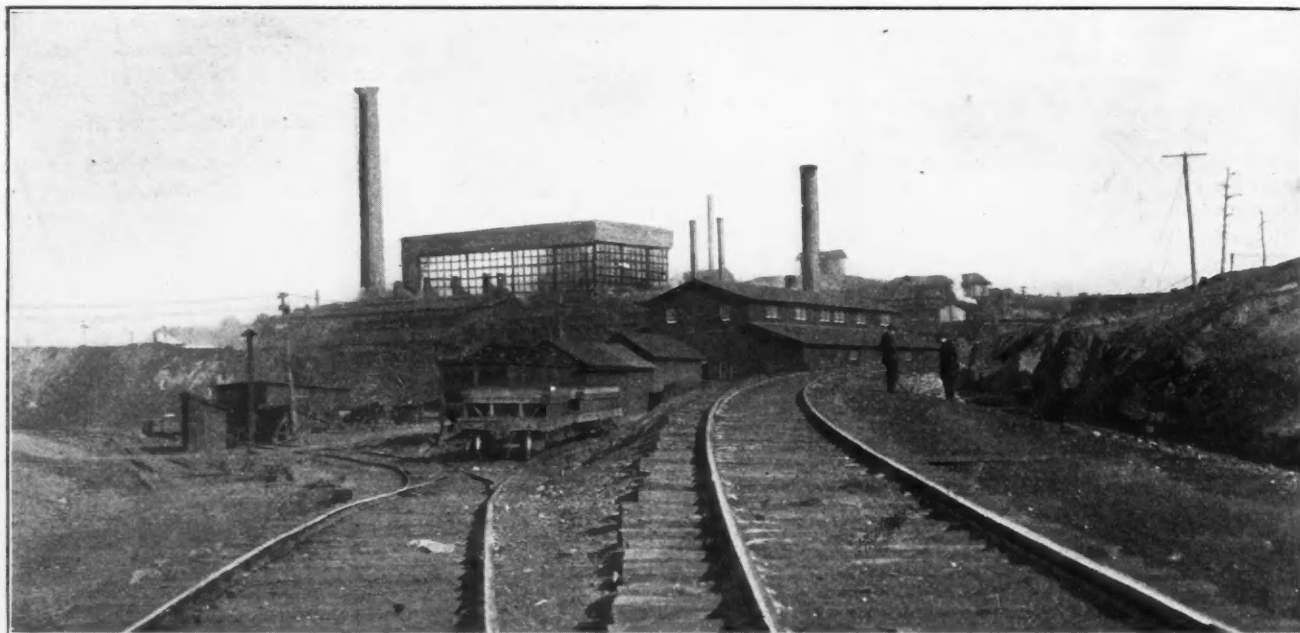


FIG. 9. SMELTER AND ACID PLANT, TENNESSEE COPPER COMPANY

The furnaces are provided with circular settlers, 16 ft. in diameter, lined with fire-brick; chrome brick is used around the tap hole. The tapping plate is a block of cast iron inclosed in a copper plate. Slag overflows into sectional cast-iron pots of 105 cu.ft. capacity. These are hauled by locomotives.

The gases from the furnaces discharge either into a brick-lined balloon flue, or into a concrete flue below and back of the furnaces. These flues discharge into a dust chamber 209 ft. long, 30 ft. wide, and 20 ft. high, at the end of which is a brick stack 325 ft. high and 20 ft. inside diameter. Two 12-in. conveyer belts, working in a tunnel under the chamber, remove the dust from the chamber.

In the converter department there are four electrically operated stands and 15 converters of the trough, or Leghorn, type, 7x10½ ft. Matte is handled from

tions is from 6.5 to 7 per cent. of the weight of ore smelted, or about 5 per cent. of the total charge. Typical charges for the different ores are given in an accompanying table.

#### TYPICAL BLAST FURNACE CHARGES

BURRA BURRA MINE		Lb.
Ore	.....	4500
Quartz	.....	1400
Coke	.....	140
POLK COUNTY MINE		Lb.
Ore	.....	5000
Quartz	.....	400
Coke	.....	240
LONDON MINE		Lb.
Ore	.....	5000
Quartz	.....	none
Coke	.....	240

For the second operation the charge is about as follows; matte, 3500 lb.; quartz, 1400 lb.; limestone, 700 lb.; coke, 70 lb. The ore slag will carry from 0.2 to 0.3 per

A late development in the work of the company is the manufacture of sulphuric acid from the blast-furnace gases. Construction of the present plant was started early in 1906, and was completed late in 1907, the manufacture of the acid beginning about Dec. 1, 1907. The plant has been in practically continuous operation since that time. Its production is 200 tons of acid per day, and this will soon be increased to the full capacity of 400 tons per day.

#### POWER PLANT

There are six boilers of the Babcock & Wilcox type, four of which are rated at 250 h.p. and two at 550 h.p. each. These are all equipped with Murphy automatic stokers. Blast at 50 oz. pressure is furnished by Nordberg duplex cross-compound piston blowing engines. There are six of these engines, three of which are

rated at 20,000 cu.ft. of free air per min., with steam cylinders 13 and 24x42 in., air cylinders, 57x42 in. The three larger engines are rated at 30,000 cu.ft. of free air per min., and have 15 and 33x42-in. steam cylinders and 70x42-in. air cylinders.

The converters are supplied with air by Nordberg blowing engines, two of which were installed in order to guard against a breakdown. These have a capacity of 10,000 cu.ft. of free air per min. each, and furnish blast at about 12 lb. pressure. The steam cylinders are 15 and 30x42 in., and the air cylinders 40x42 inches.

Electrical power is provided by two 250-kw. 500-volt Westinghouse generators, direct connected to Nordberg tandem-compound engines 15 and 26x36 inches. The blowing engines are run condensing, whereas the engines running the generators are non-condensing and are used to heat the feed water.

The pumping station on the bank of the Ocoee river contains two 10-in. two-stage, Worthington turbine pumps, belt driven by motors, each delivering 2800 gal. per min. to large storage tanks located above the smelter. Only one pump is necessary to supply the requirements of the plant.

In connection with the plant there are maintained blacksmith, machine, plate-working, carpenter and pattern shops, and a foundry. The company also operates a hospital which is in charge of a competent medical staff. Here there are accommodations for 14 patients. The equipment is thoroughly modern and up-to-date.

### The Rare Metals V.—Thorium

By CHARLES BASKERVILLE\*

Thorium is a rare metal of the titanium-zirconium group. It occurs in combination in numerous minerals as shown in the accompanying table.

#### THORIUM MINERALS.

Mineral	Thorium Content.
Thorite, anhydrous thorium silicate	48-72%
Calciothorite, a hydrous silicate of calcium and thorium	59-60%
Uranothorite, uraniferous thorite	48-52%
Auerlite, a silico-phosphate of thorium	70%
Orangite, identical with thorite	—
Monazite, phosphate of the cerium metals	1-18%
Samarskite, a tantalum-columbate of iron, cerium, etc.	0-3%
Annerödite, a pyro-columbate of uranium and yttrium	2-3%
Hielmite, a stannum-tantalate of yttrium, etc.	—
Aeschynite, a columbate and titanate of the cerium metals	15-18%
Polymignite, a columbate and titanate of cerium, etc.	4%
Zirkelite, a thoriferous titanum-zirconate of calcium, etc.	7-8%
Euxenite, a columbate and titanate of yttrium, etc.	0-6%
Polycrase, a columbate and titanate of yttrium, etc.	—
Arrhenite, a heterogeneous decomposition-product	—
Rogersite, a columbate of yttrium, etc.	0-4%
Xenotime, yttrium phosphate	—
Rhabdophanite, a hydrous phosphate of the cerium and yttrium metals	—
Churchite, a hydrous phosphate of cerium and calcium	—

Uraninite, a uranate of uranyl, lead, thorium, etc.	1-10%
Bröggerite, thoriferous uraninite	6%
Cleveite, uraninite containing about 10% of yttrium earths	5%
Nivenite, a soluble variety of uraninite	6-8%
Urannobite, uraniferous samarskite	—
Gummite, an alteration-product of uraninite	—
Thorogummite, thoriferous gummite	41-42%
Yttrogummite, a hydrous compound containing yttrium, etc.	—
Mackintoshite, allied to thorogummite	—
Gadolinite, a complex orthosilicate of yttrium, etc.	0-0.9%
Eucrasite, a variety of thorite	36%
Freyalite, a variety of thorite	28-29%
Cyrtolite, an altered zircon	—
Tachyaphaltite, an altered zircon	—
Metagadolinite, an altered gadolinite	—
Yttrialite, a silicate of thorium and yttrium metals	12%
Thalenite, a hydrous silicate of yttrium	—
Allanite, a silicate of the cerium metals, calcium, etc.	0-3.5%
Bodenite, a variety of allanite	—
Muromontite, a variety of allanite	—
Orthite, a variety of allanite	0-2.0%
Uralorthite, a variety of allanite	—
Cerite, a silicate of the cerium metals, etc.	—
Cenosite, a silico-carbonate of yttrium and calcium	—
Keilhauite, a titanum-silicate of calcium, yttrium, etc.	—
Tscheffkinitite, related to keilhauite	0.7-21%
Johnstrupite, a complex silicate of the cerium metals, etc.	0.8%
Mosandrite, related to johnstrupite	0.3%
Rinkite, near johnstrupite and mosandrite	—
Thorianite, cubical mineral from Ceylon, isomorphous with uraninite	58-79%
Dysanalyte, a titanum-columbate of calcium and iron	—
Pyrochlore, chiefly a columbate of cerium, calcium, etc.	4-8%
Hatchettolite, a tantalum-columbate of uranium	—
Microlite, chiefly a calcium pyro-tantalate	—
Fergusonite, a metacolumbate of yttrium, etc.	—
Koehelite, a variety of fergusonite	1-2%
Sipylite, chiefly a columbate of erbium	—
Columbite, columbate of iron	—
Stibiotantalite, tantalite containing antimony	—
Yttrotantalite, a tantalum-columbate of iron, yttrium, etc.	—
Mossite, a tantalum-columbate of iron	—
Skogbölite, iron tantalate	—
Tapiolite, a tantalum and columbate of iron	—
Tysonite, a fluoride of the cerium metals	—
Fluocerite, a fluoride of the cerium metals chiefly	—
Yttrocrite, a fluoride of calcium with cerium and yttrium	—
Cassiterite, tin dioxide	—
Ainalite, tantaliferous cassiterite	—
Parisite, a fluocarbonate of the cerium metals	—
Bastnaesite, a fluocarbonate of the cerium metals	—
Lanthanite, hydrous lanthanum carbonate	—
Tengerite, an yttrium carbonate	—
Lavenite, a silico-zirconate of manganese, calcium, etc.	—
Wöhlerite, a silico-zirconate of calcium, sodium, etc.	—
Eudialyte, a silicate of uncertain formula	—
Eucolite, a silicate of uncertain composition	—
Cappelenite, a boro-silicate of yttrium and barium	0.8-1.4%
Melanocerite, a fluo-silicate of the cerium and yttrium metals	1-2%
Caryocerite, related to melanocerite	14%
Tritomite, a fluo-silicate of thorium, cerium, yttrium, etc.	8-10%
Zircon, zirconium silicate	0-2%

Note.—Minerals containing undetermined, variable and negligible amounts of thorium are followed by a dash.

The important thorium minerals are thorite, auerlite, thorianite and monazite. Orangite and uranothorite, two varieties of thorite, will also be described.

#### USES OF THORIUM

The economic interest in the thorium minerals centers in the property of thorium of emitting an intense white light when heated in the flame of a Bunsen gas burner. The mantle of the Welsbach in-

candescent lamp consists of about 99 per cent. thorium and 1 per cent. ceria.

Filaments for incandescent electric lamps have been prepared from thorium and thorium carbide, and thorium is used in the manufacture of filaments requiring an admixture of a refractory oxide, as the filaments for osmium lamps. Thorium has also entered into the manufacture of electric glowers, such as that of the Nernst lamp. Thorium alone is too easily volatilized to be used in the glower mentioned, unless yttria and zirconia are employed.

Alloys of thorium with other metals have been prepared. The crystalline alloy of thorium and aluminum has the color and appearance of aluminum, but is unattacked by aqueous solutions of the alkalis. As yet, thorium alloys have no technical application.

It should be mentioned here that thorium compounds exist in monazite, the chief source, as variable impurities, and that this mineral is the principal source of the cerium earths at the present time. Cerium salts are utilized in the incandescent lighting industry, in medicine, and in metallurgy; they have also been used in the paint, dyeing, and ceramic industries.

The production of Welsbach mantles is increasing at a tremendous rate. One factory increased its output in three years from 15,000,000 to 25,000,000 mantles. Each mantle weighs about 5 grams.

#### THORITE

The typical thorium mineral, thorite, is found in orange-yellow, brownish yellow, and black tetragonal crystals, which resemble those of zircon. It is also found massive and compact. Specimens of thorite are always more or less altered, and all analyses show water, and often uranium, lead, iron, cerium, calcium, magnesium, alkali metals, and aluminum. Thorite is a brittle mineral, having a conchoidal fracture, a hardness of 4.5-5, and a specific gravity of 5.19-5.40. The luster is resinous, and the streak is light orange to dark brown.

When heated in a closed tube, thorite yields water, and the orange variety becomes dull brown while hot, but changes to an orange color again on cooling. It is infusible before the blowpipe. It dissolves in borax, and the saturated bead is opaque on cooling, but may be otherwise, depending on the specimen. When it cannot be rendered opaque by flaming, the borax bead shows iron. With salt of phosphorus, it leaves a silica skeleton, and becomes opalescent and greenish on cooling. With soda on charcoal it yields a yellowish brown slag. It gelatinizes with hydrochloric acid before being heated by the blowpipe, but not after.

Thorite occurs chiefly in Norway. It has been found in granite of the Trotter mine, Franklin Furnace, N. J.

#### ORANGITE

Orangite occurs in bright orange-yellow

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crystals like those of zircon in angle. It was first described from the Brevik region, Norway, and the identity of orangite and thorite was early shown. Its specific gravity varies from 4.88-5.4. Orangite has not as yet been found in the United States.

Its deportment before the blowpipe is the same as that of thorite.

#### URANTHORITE

This mineral occurs massive. Its color is dark reddish brown, and the luster is resinous to subvitreous. Its hardness is 5, and the specific gravity is 4.126. The streak is yellow-brown. Uranthorite has been found in the Champlain iron region, New York; a specimen examined from this locality contained 52.07 per cent. thorium and 9.96 per cent. uranium trioxide.

Uranthorite is infusible before the blowpipe. For other reactions, see thorite.

#### AUERLITE

This mineral is found in tetragonal crystals, resembling zircon in habit and angles. Its color is a dull yellowish white to dark orange-red, and the luster is resinous. The hardness is 2.5-3, and the specific gravity is 4.42-4.77. It occurs in disintegrated granite or gneiss in Henderson county, North Carolina, being associated with zircon.

Auerlite is infusible before the blowpipe, but becomes brown on ignition and turns orange again on cooling.

#### MONAZITE

Monazite occurs in small brown crystals, having a resinous luster, or in yellow grains, disseminated or in the form of sand. It has also been found in masses yielding angular particles. Monazite is distributed as an accessory constituent of gneissoid rocks in North Carolina and Brazil. It is found in the United States in Connecticut, at Norwich and Chester; Yorktown, N. Y.; Amelia Court House, Va., and in Alexander, Madison, Mitchell, Yancey, Burke, Polk, McDowell, and Rutherford counties, N. C. It also occurs in the gold sands of southern Idaho, and in Greenville county, S. C. Some monazite has been found in the black sands of the Pacific slope. Monazite has a hardness of 5-5.5, and a specific gravity of 4.9-5.3, mostly 5-5.2. Its fracture is conchoidal to uneven, and the streak is white.

Monazite is infusible before the blowpipe, but turns gray, and colors the flame a blue-green when moistened with sulphuric acid. Its borax bead is yellow while hot and colorless when cold; a saturated bead assumes an enamel-white color on flaming. It is decomposed by hydrochloric acid, leaving a white residue. With boric acid and iron, iron phosphide is formed. A monazite solution added to a nitric acid solution of ammonium molybdate causes a yellow precipitate.

#### THORIANITE

This interesting mineral was discovered

in 1905 near Balangoda, Ceylon, associated with corundum, zircon, tin, topaz, spinel, etc. It was found to contain 78.86 per cent. thorium oxide. The specific gravity is 9.32, and it was found in hard, black cubical crystals, giving a brown streak. It is not improbable that this mineral may be found in the tin, topaz, zircon, and monazite localities of the United States.

Thorianite has the advantage of containing uncombined thoria, soluble in nitric acid with the formation of thorium nitrate. The pulverized mineral dissolves easily in dilute sulphuric acid, but is scarcely attacked by hydrochloric acid.

#### OTHER MINERALS

Thorogummite and nivenite will be described under uranium minerals; they occur in Llano county, Texas.

### Phelps, Dodge & Co. Form a \$50,000,000 Corporation

The various mining enterprises controlled by the Phelps, Dodge & Company's interests are on Jan. 1, 1909 to be consolidated into a single corporation under the name, Phelps, Dodge & Company, Incorporated. The new company will have a capitalization of \$50,000,000, and the stock is to be listed on the Boston or the New York Exchange. The announcement was made on Dec. 10, and on the same day the purposes of the change as explained by the partners were mailed to the shareholders concerned.

The old firm will transfer its metal-selling business and its good will to the corporation and go into liquidation. The \$50,000,000 of capital stock of the new corporation will be used for the purchase of the following shares at the valuations stated:

Copper Queen Consolidated Mining Company at \$135 for each \$10 share	\$27,000,000
Moctezuma Copper Company at \$307 9-13 for each \$100 share	8,000,000
Detroit Copper Mining Company of Arizona at \$150 for each \$25 share	6,000,000
Stag Cañon Fuel Company at \$800 for each \$100 share	4,000,000
To be held for future issue	5,000,000

Subscriptions will be binding when holders of 75 per cent. of the stock of each company have signed in approval of the incorporation. There will be nine directors in the new company.

On Nov. 1, 1908, the investment in the plants to be taken over by the corporation, exclusive of the mines themselves, was \$28,949,739.53.

The partners in the firm of Phelps, Dodge & Co., are: James Douglas, Cleveland H. Dodge, Arthur Curtiss James, James McLean, George B. Agnew, E. Hayward Ferry, Francis L. Hine, George Notman and William Church Osborn.

The old firm of Phelps, Dodge & Co. began business in 1885. The members of the firm were William Earl Dodge D. Willis James, James McLean, Cleve-

land Hoadley Dodge and Arthur C. James.

In 1885 the partners owned the Copper Queen, which was then 700 miles from a railroad. Fuel was brought from England by way of San Francisco, and the mine had many ups and downs. It finally became a great money maker and the firm built railroads and developed it and gradually bought other mining properties.

The number of employees directly engaged by the copper and coal mines, ore-treating works and railroads operated by the Phelps-Dodge interests in Mexico and the United States is 10,000. Directly and indirectly these copper mines and railroads and the fuel-producing interests under the same management support upward of 60,000 persons. The length of the railroads is about 1000 miles. From July 1, 1907, until June 30, 1908, the Phelps-Dodge railroads carried 4,582,728 tons of freight, the great bulk for their own and adjacent mines in Arizona and Mexico.

None of the stocks in any of these mines has ever been listed on a stock exchange, all the shares being owned by the partners and affiliated interests in commercial life.

A statement by the comptroller gives the following information about the various properties.

#### COPPER QUEEN CONSOLIDATED MINING COMPANY

This property consists of 135 mining claims in the Warren mining district, Cochise county, near the town of Bisbee, Arizona, a large smelting plant at Douglas, of a capacity of 3000 tons a day, which treats the product of the mines of the Copper Queen Company, and for the time being the ores of the Moctezuma Copper Company, and does general custom work. The company conducts a mercantile business, and has large stores and warehouses in Bisbee and Douglas, and a branch store in Naco, Arizona, as well as other pieces of real estate. It also owns mining interests in other localities.

For the last five years the production of the mines has been as follows:

1903	37,257,470 lb.
1904	50,151,552 "
1905	64,625,955 "
1906	79,219,655 "
1907	63,341,055 "
Total	294,595,687 "

The output of the Douglas Reduction Works, including purchased and custom ores, for five years has been 363,121,911 pounds.

The earnings of the company during the five years have been as follows:

1903	\$2,201,640.40
1904	2,960,659.70
1905	5,609,486.30
1906	7,625,854.76
1907	4,471,137.08
Total	\$22,868,778.24

The difference between earnings and dividends is represented by expenditure on increased plant facilities, and undistributed

assets, consisting of the larger stock of coke and fuel necessitated by increased operations; and the accumulated stock of ores at the works, amounting in value to over \$1,000,000, as well as by increased cash and increased reserves.

A large portion of the company's mining property has as yet been undeveloped, though situated within the recognized mineral zone of the district, and, owing to the difficulty of holding up the soft, shifting ground in which the ore occurs, it has always been found impossible to block out ore reserves as large as mines of such capacity elsewhere have usually maintained, as nominally "in sight." There is, however, at the present time as much ore "in sight" as at any other period of the mine's history.

The valuation of the company's property as of Nov. 1, 1908, exclusive of the mines, is as follows:

Invested in plant.....	\$4,974,866.77
Other assets.....	10,915,492.97
Liabilities.....	1,275,573.40

MOCTEZUMA COPPER COMPANY

This property consists of about 2500 acres of mineral ground in the State of Sonora, Mexico, on which has been opened the Pilares mine. This is in a mineralized body, oval in shape, and which retains approximately its dimensions between surface and the 700-ft. level. It is about 1700 ft. in diameter from north to south, and 1200 ft. in diameter from east to west, and contains a large area of profitable ore. A narrow-gauge steam railroad five miles in length connects the mine through the Pilares tunnel with the concentrating mill at the town of Nacozari. The tunnel itself, with its branches, is over a mile in length, and is large enough to allow of the railroad cars' reaching through it the different sections of the mines, and receiving their charge from large bins excavated out of the ore. These bins are of a capacity of several thousand tons each, and are fed through chutes extending to the surface levels, the chutes also being excavated from the mineralized ground.

The quantity of what may be considered ore depends entirely upon the grade which it is profitable at a given price for copper to work, but the mine is at present opened up for an extraction of 1500 to 2000 tons a day of ore of an average grade of 3 per cent. The daily capacity of the concentrating mill just completed at Nacozari is 2000 tons. At Nacozari is a well designed power plant, equipped with Curtis turbines of over 4000 h.p., for transmitting high-voltage current to both the mill and the mine. For the time being it is found to be more profitable to convey the concentrates and rich ores by the Nacozari Railroad to Douglas, Arizona, 70 miles distant, than to smelt them on the spot, the ores being treated at Douglas at the same profit to the Copper Queen Company as though they were custom ores supplied by an unallied customer. This feature of the com-

pany's operations explains the comparatively small quantity of supplies carried by the Moctezuma Copper Company as compared with the other companies.

The old concentrating mill, which is still intact, with its very efficient gas engine and gas generating plant, which up to within a few months treated 600 tons of ore a day, is now out of commission, though it can be started at short notice as a supplemental plant to the new mill, should this course be desirable.

The production for the last five years has been as follows:

1903.....	10,281,970 lb.
1904.....	11,061,849 "
1905.....	10,160,016 "
1906.....	12,714,726 "
1907.....	9,640,390 "
Total.....	53,858,751 "

The increased capacity of both the mine and the concentrating mill, owing to recent improvements, is indicated by the fact that in May, 1908, the production was 784,892 lb. of metallic copper, whereas by the month of October it had reached 2,300,000 lb. of copper, contained in 9500 tons of 12½ per cent. concentrates. A production of approximately two million pounds of copper a month can now be maintained; and, if the market demanded it, this production could be increased to three million pounds per month.

The net earnings for the last five years, while the mine was still in a stage of development and the works were contracted, were as follows:

1903.....	\$456,524.55
1904.....	598,992.36
1905.....	533,117.66
1906.....	1,195,424.18
1907.....	833,236.25
Total.....	\$3,617,295.00

The company has built and owns the whole town of Nacozari, and has provided it with a well furnished library and amusement hall, a thoroughly equipped hospital, hotel boarding houses and schools. At the Pilares mine the company has provided its workmen with comfortable houses and supports a school. At both Nacozari and Pilares the company has large stores and warehouses, and conducts a profitable mercantile business.

The valuation of the company's property as of Nov. 1, 1908, exclusive of the mines, is as follows:

Invested in plant.....	\$3,046,384.32
Other assets.....	944,663.08
Liabilities.....	347,221.22

DETROIT COPPER MINING COMPANY OF ARIZONA

The mines of this company are situated in the Clifton district, Arizona, in the same beds of felspathic rock which at the present time are yielding the product of the Arizona Copper Company, the Shannon Copper Company, and certain less prominent organizations. The property owned by the company consists of 145 mining claims, and the ore now extracted amounts to about 36,000 tons per month, yielding about 3 per cent. of copper. The

bulk of the ore is concentrated mechanically to a grade of about 15 per cent., and smelted at Morenci in the company's own smelting works.

The company's production for the last five years has been as follows:

1903.....	16,869,300 lb.
1904.....	16,424,394 "
1905.....	14,632,117 "
1906.....	20,347,497 "
1907.....	17,974,581 "
Total.....	86,247,889 "

The production for the eleven months of the present year has increased to 21,500,000 lb. owing in great measure to improved facilities for treatment. The future production with the present equipment can be maintained at approximately two million pounds of copper per month.

The earnings during the last five years have been as follows:

1903.....	\$543,456.00
1904.....	603,340.00
1905.....	532,684.28
1906.....	973,456.42
1907.....	814,874.11
Total.....	\$3,467,810.81

The company runs a large store and hotel, and owns considerable other property in the town of Morenci, besides a powerful pumping plant on the San Francisco river seven miles distant.

The valuation of the company's property as of Nov. 1, 1908, exclusive of the mines, is as follows:

Invested in plant.....	\$2,158,106.00
Other assets.....	2,934,465.97
Liabilities.....	149,878.88

The ores from the Copper Queen mines carry about twice the quantity of copper contained in those of the Nacozari and Morenci districts, but this advantage is offset by the higher cost of mining the Queen ores, owing to the character of the deposits in which they occur. Moreover, as the Queen ores cannot be subjected to preliminary mechanical concentration, which raises the smelting grade of the Nacozari and Morenci ores, they must be subjected to furnace treatment as they come from the mines; hence the cost of smelting a ton of Queen ore is higher than the cost calculated on a ton of crude Nacozari or Morenci ore, as it comes from the mine previous to mechanical concentration.

STAG CANYON FUEL COMPANY

The Dawson coalfields are situated at Dawson, Colfax county, New Mexico, and were purchased in 1905 to secure for the copper mines of the Southwest a certain and steady supply of coal and coke. They were the property of the El Paso & Northeastern Company, and are represented by \$1,000,000 stock and \$1,000,000 bonds of the Dawson Fuel Company, which are pledged as collateral and additional security for two mortgages on portions of El Paso & Northeastern Company property aggregating \$5,000,000. A sinking fund provision of 5c. a ton begins in 1911. The equity in the Dawson Fuel Com-

pany has been transferred to the Stag Cañon Fuel Company, which owns 11,078 acres of coal lands adjacent. These combined properties consist, beside surface plants, of 38,718 acres, of which about 36,000 acres are underlaid by coal. The company likewise has the right to mine coal over 17,500 acres, of which, however, only 2500 are known to be underlaid by coal. All this property has been acquired from the owners of the Maxwell Grant, and is, therefore, held under unquestionable title.

There are several beds of coal on the property, but only one has been prospected and worked. From it 437 acres of coal have been worked out, leaving approximately 38,000 acres available for future extraction. Making the usual allowance for loss, more than 200,000,000 tons of coal should be extracted from this single bed.

As the outcrop of these beds follows with remarkable uniformity the deep indentations of the foothills of the Raton range, under which the coal dips, the geographical conditions afford every facility for opening new mines. Up to the present six mines have been opened on the outcrop of this single vein, the output of four of which is screened and loaded from a single tippie. A separate tippie serves the fifth and sixth mines, situated two miles distant from the first, up the Vermejo cañon.

The present mines opened are equipped for a total capacity of about 120,000 tons of coal a month. The output at the present time is about 90,000 tons per month. This is an increase over the output in January, 1908, when only about 65,000 tons were mined, and in February, when the output was only 41,688 tons. Of the present production about 50,000 tons, screened from the run-of-mine coal, passes to the washery and thence to the coke ovens. Of the total coking plant of 550 ovens, 100 ovens are of the old-fashioned beehive type, and 450 are of underflue design, from all of which the waste gases can be recovered for the generation of power. The gases from only 200 of the ovens generate steam enough to run the washery, the pumping plant and the electrical underground transportation. The tipples and crushing plant, as well as the washery, are built of steel, every piece of machinery, even the jigs, being incombustible. As a precaution against explosions, electric firing is practised in all the mines.

The expenditure on the steel buildings constituting the surface plant has been great, but danger of delay from destruction by fire is eliminated, and the expense of insurance is reduced.

The capacity of the coke ovens is 27,000 tons a month. The present output is 25,000 tons. The quality of the coke is from actual tests equal in efficiency to within 7 per cent. of the best eastern coke. The railroad connecting the coal mines with the copper mines has provided a supply of coke rack cars and of steel coal cars suf-

ficient to handle the product, and, therefore, the shortage and irregular supply of fuel to the copper mines which has hampered smelting operations in the past, will, it is hoped and believed, be avoided.

The operations of the company during the fiscal year ending June 30, 1908, which was a year of deep industrial depression, with only a part of the new ovens in operation, were as follows: tons of coal mined, 846,473; tons of coke made, 177,043.

The gross earnings were \$1,518,809.69; and the total net earnings, \$283,942.61.

The present increased output, which it is hoped to bring in prosperous times up to the full capacity of the mine, namely, 120,000 tons of coal per month, has resulted in a correspondingly increased net profit.

The company has built for its miners comfortable houses, provided a hospital with an efficient staff of doctors and nurses and a large amusement hall with reading and billiard room. A general store is run by the Southwestern Mercantile Company, of which the stock is owned by the Stag Cañon Fuel Company. The actual cost of the permanent improvements on the property since the present owners came into possession has been \$2,452,388, but the mines are now so well equipped, and the plants so nearly completed, that but little further expenditure on construction will have to be made in the near future.

The valuation of the company's property as of Nov. 1, 1908, exclusive of the mines, is as follows:

Invested in plant .....	\$3,226,488.42
Other Assets .....	\$1,749,272.00
Total Liabilities .....	\$2,388,492.96

## A California Mine Complication

SPECIAL CORRESPONDENCE

The now famous Tightner quartz mine at Alleghany, Sierra county, California, owned by H. L. Johnson, is in trouble, as happens to so many mines after they are proved to be rich. The Dead River Gold Mining Company has begun suit against Mr. Johnson, claiming that that portion of the ground from which the rich ore of the Tightner came, is covered by the placer location of the company. The property in dispute was originally owned by the Alleghany Mining Company which finally dwindled down to two stockholders after considerable unsuccessful work had been done. These two stockholders held on to the claims which were originally placer claims and did the assessment work each year to prevent the property from being jumped. To better protect their interests, after they had discovered that quartz veins existed in the property, they made two quartz locations, thinking that the placer locations would not protect

them in holding the quartz veins. The locations were called Contact and Contact Extension. Later the placer properties passed into other hands. Capt. J. W. Morrell got control of the placer locations and sold them to the Dead River Gold Mining Company, which is composed of prominent Scranton, Penn., capitalists. This property has been extensively worked. The quartz locations passed into the hands of H. J. Johnson, who now owns them. Johnson got the property for \$10,000 and has taken out large quantities of gold from the vein at small expense.

Mr. Johnson has been working the Tightner for seven or eight years, and at one time bonded it to other parties, who failed to make payments, so the mine reverted to him. Finally he came upon phenomenally rich ore, which has since continued and this has made him a wealthy man. Moreover, the fame of the Tightner brought numbers of mining men to the locality where it is situated, who have since invested in other properties, so that last year the mining region around Alleghany was probably the most active in the State.

## Low-Phosphorus High-Silicon Pig Iron

According to Colne & Co., New York, high-silicon pig iron very low in sulphur and phosphorus is used in making steel with the surface-blown converter, and analyzes as follows: Silicon, 2.25 to 3.50 per cent.; manganese, 0.50 to 0.90 per cent.; carbon, 3 to 4.50 per cent.; sulphur, 0.03 to 0.04 per cent.; phosphorus, 0.03 to 0.04 per cent. Iron so low in phosphorus is very scarce in the United States, the production small, the price high, and is confined principally in the hands of one house.

The surface-blown converter has been introduced with much advantage as an adjunct to cast-iron foundries, malleable-iron works and open-hearth steel foundries. It fills a field not reached by the open-hearth process for making small and medium perfectly sound castings of high tensile strength, free from blow holes. Steel is rapidly being substituted for cast or malleable iron. There is much demand for good castings from the machinery trade, steam fitting, electrical business, etc. The surface-blown converter being now free, the patent having expired, it is to be expected that its use will be largely extended.

Diamond drilling on the Rand, according to an editorial in the *South African Mining Journal*, Oct. 10, 1908, apart from strengthening the knowledge that the Main Reef does go down, has not obtained adequate return for the vast sums that have been expended in such prospecting.



# Mine Labor and Supplies in Mexico

Quality of Native Labor in Mexico. Cheap Labor and Machinery.  
Trade in Mining Supplies; Sources from Which Materials Are Drawn

B Y M A R K R. L A M B \*

Labor conditions in Mexico differ so widely and radically from those across the border in the United States, that some notes and illustrations of how work is done there seem to be of interest and service to engineers and investors.

## METHODS OF MEXICAN LABORERS

Labor in Mexico is a problem which has to be solved every day. A mill is built, but from the first hatful of dirt

credible to one not acquainted with local conditions. Note that with car tracks laid to the face of the cut it is cheaper to carry the dirt in baskets to the edge of the fill than to fill cars and tram them. The task on this piece of work, for each man, was 300 well-filled baskets per day. Mr. Empson, the manager, explained that account should be taken in such work of the graft between the timekeeper and the laborer, and about 50 baskets should be

15c. gold, so the laborer has little trouble getting one. The sight of these men trotting back and forth with their loads, really doing much work considering their limited diet of corn and beans, much resembles an excited ant heap. They are famous for their ability to carry loads which would put an American out of business. They are really only undersized boys in build and to see a group of four load a motor weighing 470 lb. on



EXCAVATING FOR PINGUICO MILL, GUANAJUATO

moved troubles are experienced. Not real troubles like American troubles, where a laborer is free to work or to quit—and is free to allow his neighbor to work or to prevent him. Here there is none of that. Labor is docile and willing when it is labor, and when treated properly, but pulque, high wages (comparatively) and church-feast days conspire against the employer to reduce the supply. The illustrations of the excavations for the Pinguico mill show a condition which seems in-

\*Mining engineer, Mexico, D. F., Mexico.

deducted. The basket holds slightly over a cubic foot and for 300 baskets (less graft) the peon is paid 50 centavos, or 25c. gold. The men are much better satisfied at the rate of 300 baskets than if actual count was kept and they were paid the same amount for 250, since at the higher rate they beat the company. These baskets are a great improvement over the old method of using hats for carrying, and the improvement was only possible after the American began paying such high wages—25c. gold per day. The baskets cost

the back of a fifth man gives one curious sensations. It became necessary to take a 10-in. I-beam 16 ft. long from one part of the town to another, so it was loaded upon the bent necks and shoulders of two men and four went along to take the beam down when it was time to rest. These four could barely lift one end down at a time and were not expected to help carry—nor did they!

## SKILLED LABOR

After such a mill-site is graded the

skilled laborers—such as carpenters, masons and machinists—have their chance and here the influence of the foreigner begins to show. There is a Mexican proverb which says, "Beware of the *gringo* who wears a Mexican hat and of the Mexican who smokes a pipe!" The first part of this is all right, but a pipe is a long step above the cigarette for a Mexican and he should be given credit for it. It is a time-saving change for his employer.

The Mexican of the higher class is instinctively and hereditarily opposed to manual labor, so that though the mining school in Mexico City is excellent, one rarely sees one of its graduates in a modern mill or plant working with his

ductors. And the latter consider the gentlemen perfectly right! One of the most hopeful signs is the sight of bright, eager young fellows in overalls, caps and shoes who seem proud of the dirt from the shops. They have discarded the broad straw hat and white cotton pants, and it is this class which is making it more and more difficult for the *gringo* handy-man to find a place in Mexico.

#### LABOR AND MACHINERY

The usual line of talk of the machinery salesman in Mexico is that labor is so uncertain that, even though it costs more to do the work by machinery, this would be better than to depend upon such a vari-

low a cost to include in finals per ton. This very cheapness of labor has its disadvantages. A metallurgist used to intelligent laborers of other countries will design a mill along good lines for those countries and those laborers, utterly ignoring the men who must run his mill. The latest refinements in concentrators, Huntington mills, high-speed Chile mills, separately driven stamp batteries, grinding pans, classifiers, etc., should be looked at with a prophetic eye in an endeavor to see what they will resemble after being turned over to the tender mercies of helpers who do not know a left-handed saw from a round square and can hardly speak Spanish, many being full-blooded Indians.



EXCAVATING FOR PINGUICO MILL, GUANAJUATO

hands getting the details of experience. This feeling is slowly passing, but for a long time mill-men, mechanics and shift-men must be drawn from the United States or England. It is not fair to the native, but as yet the native does not appreciate his opportunities and advantages. Caste feeling is very strong; it would, and does often, interfere, as a machinist may be of the peon class and be obliged to give orders to a gentleman, a thing which could not be tolerated for a moment. It is even difficult for some men in the City of Mexico who have the outward appearances of gentlemen to pay fares to such low creatures as are the con-

able factor. To a large extent this is true, but one should always bear in mind the extremely low cost of labor. Where else can dirt be moved at the cost given for grading for Pinguico mill? They are not even doing it at Panama! A comparison recently made by a manager using Blaisdell machinery clearly showed that this system saved both time and money and that a very few stoppages due to lack of labor for discharging tanks would pay for the equipment. The margin must indeed be close when 100 tons of sand can be shoveled to conveyers from tanks for \$2.50 gold. Compared with similar work in Nevada and California it is simply too

Sr. Narvaez at Hacienda La Union at Pachuca is running Chile mills and says, "You Americans and English have had the results attained by these slow, heavy Chile mills before you for centuries, and have known that they are particularly strong on reducing coarse ore to slime for the patio. Now that sliming is again in order for the new cyaniding, how long will it take you to discover the Chile mill?" He says that there are only two conditions under which the Chile does not work well. One is when it is too well fed and the other when it is not fed at all. The commonest of peon labor can remedy these conditions and get good re-

sults, which can be said of no other machine for reducing ores. He proves what he says in the results attained in his plant. To be sure, it seems a pity not to buy the latest ore-reducing machinery, but with this labor which costs so little and is so unmechanical and with no staying qualities—where the entire plant crew changes from month to month—the designer should frankly make the best of it. Use more labor if necessary, but make the mill as near repair-proof as possible. If good American mechanics at \$5 gold per day allow mortars to become loose on concrete blocks, can more be expected of Indian helpers at nothing per day? Unfortunate examples of such conditions can be discovered throughout Mexico.

#### HOLIDAYS

During Holy Week foreigners go on working as usual, but it is a frantic scramble to get men enough on the job to keep the mill going. Even though there may not be enough in the larder

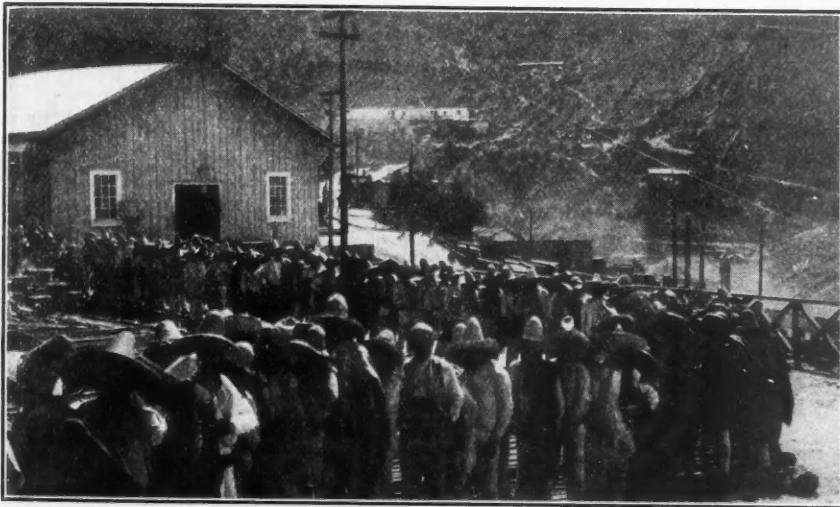
ernment certainly fosters the mining business sedulously and impartially, and it is exactly this treatment which has given miners such confidence. Money will continue to come to Mexico for mining investments, while the evidence is all one way as to the treatment received. Railroad rates to Mexican camps are much lower than similar hauls in the States. The same applies to passenger fares, and with even greater force to telegraph tolls. The latter service double-discounts Western Union, in cost, expedition and accuracy, to say nothing of the fact that complaints receive attention and proper adjustment. All these differences are due to government control, the latter having as much to do with low freight rates, perhaps, as the competing water hauls. A consul went through this central mesa of Mexico some 70 years ago on horseback, and casually said that though the country had great agricultural possibilities, the fact that the central mesa was so surrounded by mountains would prevent

credited with but one plant in Mexico. All cyanide comes from Germany and during prosperous times most structural and railroad steel comes from there. Steel buildings complete can be obtained to better advantage in the United States, as foreign houses require the customer to supply complete plans and specifications down to the last rivet hole, while American companies will design and construct your building; even if you desire, choose the paint for it. Even the famous house of Krupp has furnished little machinery outside of ball and pebble mills. The business opportunities of the country do not seem to be appreciated abroad as much as in the United States.

#### FORMER CUSTOMS

In the old days supplies consisted principally of fodder for the mules and corn for the laborers and the owner of the *hacienda de beneficio* was also owner of a ranch, being thus his own jobber. He paid both silver and corn, so that even when resting the miner generally had corn in the house. The patron also loaned money to his men and was allowed by law to hold them until the debt was paid. This gave him a fairly constant and dependable labor supply, as the officers would bring back delinquents for him. Pay was in the form of retort silver at the rate of eight pesos per *marco* of eight ounces. This silver the laborer took to the mint and sold.

The men liked this method, but later it was changed as high-grading existed in all treatment plants and mines. The old, old men of the community tell how they would buy the right to concentrate the treated *torta* as it issued from the patio on its way to the river. They would pay a percentage, perhaps, but more frequently money up to about 50 pesos. The purchaser of this privilege would arrange his *planillas*, or inclined concentrating floors, and would carefully work over the tailings. The concentrates were roasted in tiny reverberatories, re-ground by hand and worked into a miniature *torta* from which much amalgam would be extracted. The retorting was done by filling a narrow-mouthed clay *olla* with pieces of hard amalgam. After the mouth of this vessel was choked with fragments of broken clay pots it was inverted over the mouth of another similar one which was half full of water. The two were luted tightly with clay and buried in the ground, room being left around the upper amalgam *olla* for fire. The fumes went down to the water and were condensed and collected. "These days," an old man complained to me, "If we do find concentrates in the tailings from the big mills, the managers buy the *planilla* privileges from the city and prevent us from working in the river. Why do they not want us to work in the river?"



PAY-DAY AT DOS ESTRELLAS

to last over the week, all want to see the festivals—a veritable week of passion play ending with fun, jollifications, firecrackers and the burning of thousands of Judases. After this is all done there is no trouble keeping the mill going until some special saint is to be crowned or some noted bull-fighter is to appear, or until the first rains, when all must plant corn.

#### COST OF SUPPLIES

Mill machinery, supplies and materials are cheaper in Mexico almost without exception than in the States. One of the exceptions is Standard Oil products. Manufacturers in the States allow a special export discount of from 5 to 10 per cent. from their lowest prices for home consumption. There is a slight duty on machinery for mines, but when proper representation is made to the Department, even these small duties are refunded when new plants are built. The Mexican gov-

wagon roads being built into it, and that consequently it could never amount to much. He was like most prophets.

#### SOURCES OF SUPPLIES

Most machinery which comes to Mexico is American, though ordinarily steel plate is cheaper and has better delivery from Scotland or Germany. At the time of writing the American prices and deliveries are best even in these items, though as soon as the market is better in the States the Mexican market will be abandoned. English machinery is rarely seen here, and this seems strange as Englishmen were first to appreciate the mines of Mexico. Even English-owned mines are supplied with American machinery. There seem to be no strong English houses represented here. The noted Cyanide Supply Company, of London, which has built so many plants in other parts of the world and which should easily underbid less experienced manufacturers in the States, is

# The Operation of a Coal Washery in Colorado

Previous Experience Showed That the Coal Must Be Delivered to the Ovens Finely Pulverized, and in as Dry a Condition as Possible

B Y W. F. M U R R A Y\*

The constantly increasing demand for coke and the universal desire to eliminate waste and improve the product from the ovens, is operating to make the use of coal washeries more general; a recent estimate by one thoroughly acquainted with the industry shows that at the present time the daily capacity of the coal washeries in the United States is approximately 110,000 tons.

washer, Campbell bumping table and a large variety of jigs, of which those most commonly used are the Forester, Luhrig and Stewart. Nearly all of these different machines have at one time or other been used in Colorado.

In the eastern coking coalfields of Pennsylvania and West Virginia, the coals which do not need washing before coking are becoming more and more scarce, and

used for the better grades of coke is first washed.

THE FIRST WASHERY IN COLORADO WAS BUILT ABOUT 25 YEARS AGO.

The first washery built in the State of Colorado was erected at the El Moro mine by the Colorado Coal and Iron Company, now the Colorado Fuel and Iron Company, in the early 80's. The jigs used were of the

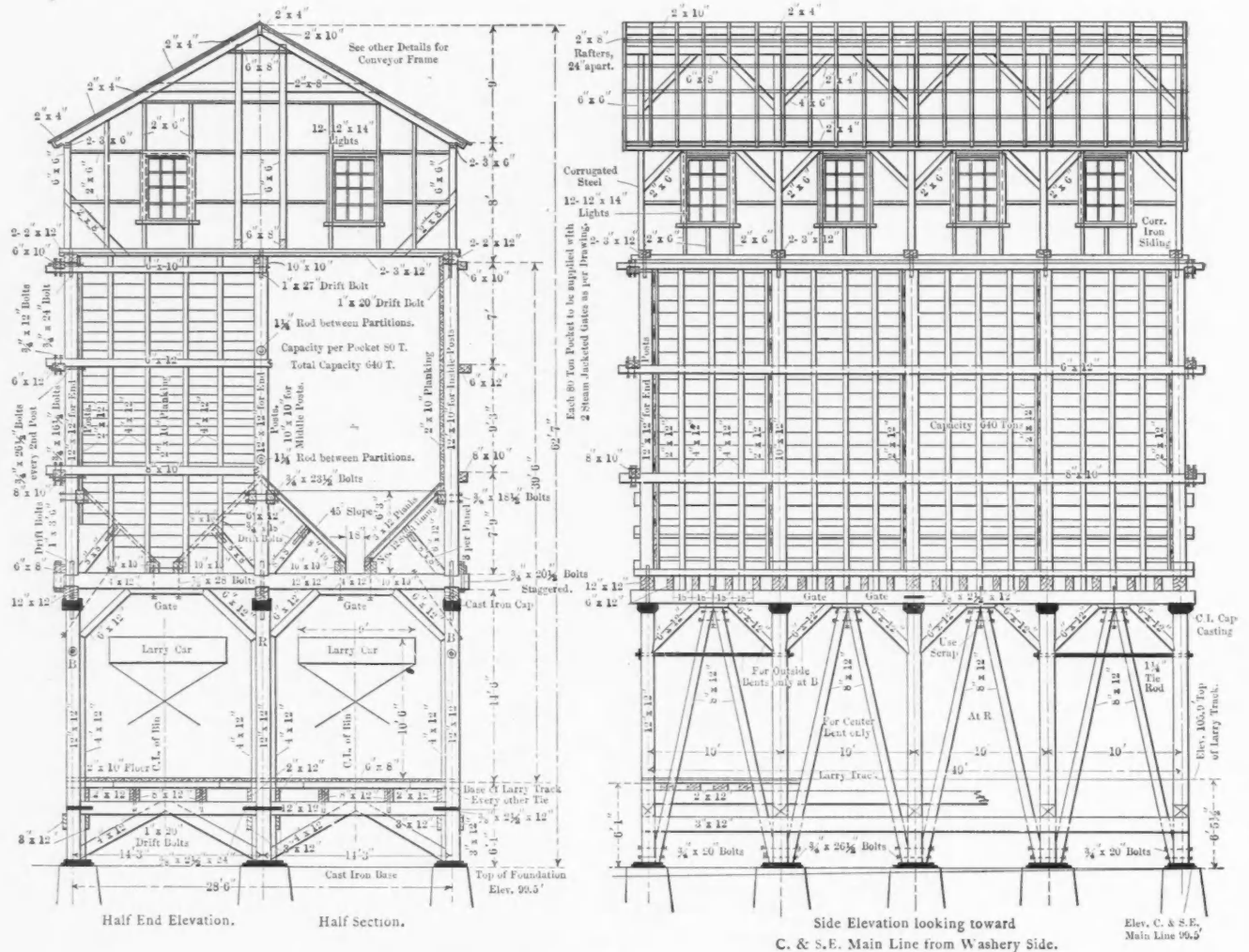


FIG. I. DETAILS OF END AND NORTH ELEVATION OF WASHERY BUILDING

Engineers have given the subject considerable study, and many devices have been brought out, some of them new, while other systems have been copied from European practice. Among the devices most prominently used in this country are the Robinson coal washer, Scaire trough

\*Engineer with Victor Fuel Company, Denver, Colo.

washeries are being extensively introduced. In the southern or Birmingham coking coal district, no coal is made into coke that is not first washed. In Colorado there are many coals which make excellent coke, but practically all of them contain such a large amount of foreign matter in the way of slate, bone-coal, etc., that all of the coal which is

common Hertz type, and the coal was supplied by the Engleville mine, as it is today.

In 1888 a washery was built at Hastings, Colo., in which the Forester jigs were used. This mine is located in the southern part of the State of Colorado, about 19 miles from Trinidad, on the line of the Colorado and Southeastern, which

is a feeder to the Atchison, Topeka and Santa Fe, Denver and Rio Grande, and the Colorado and Southern railways. This plant is now owned and operated by the Victor Fuel Company of Denver.

OLD METHODS WERE DISCARDED.

In 1906 it was found desirable to build a new and modern washery at this mine, as the old washery was getting in bad condition, and it was thought that with more modern appliances better results might be obtained. In the operation of the old plant, the particular needs of this coal and the best methods of preparing it for the ovens were well understood, so that

ground was available on the opposite side, it was decided to build the new plant entirely independent of the old plant so that building operations might be conducted without interfering in any way with the operation of the mine and of the old washery. This plan was successfully carried out; the washery was built and the final connections to the new washery were made, putting it into commission and throwing the old washery out of commission without losing a single day's output of the mine.

The previous experience with the For-ester washery demonstrated that in order to get the best coking results the washed

decided to wash the coal in a relatively coarse condition; that is, from 1 in. square mesh down and then crush again after washing. Since there was a fairly good demand for a nut coal, a sizing screen for the unwashed coal was installed so that an unwashed nut coal might be made, and only that coal which had passed through a 1-in. square mesh would be sent to the washery.

CONSTRUCTION OF THE BUILDINGS

There are two buildings comprising the washery; the washery proper, which contains the engines, jigs, elevators, etc., and the larry or storage bin, which contains

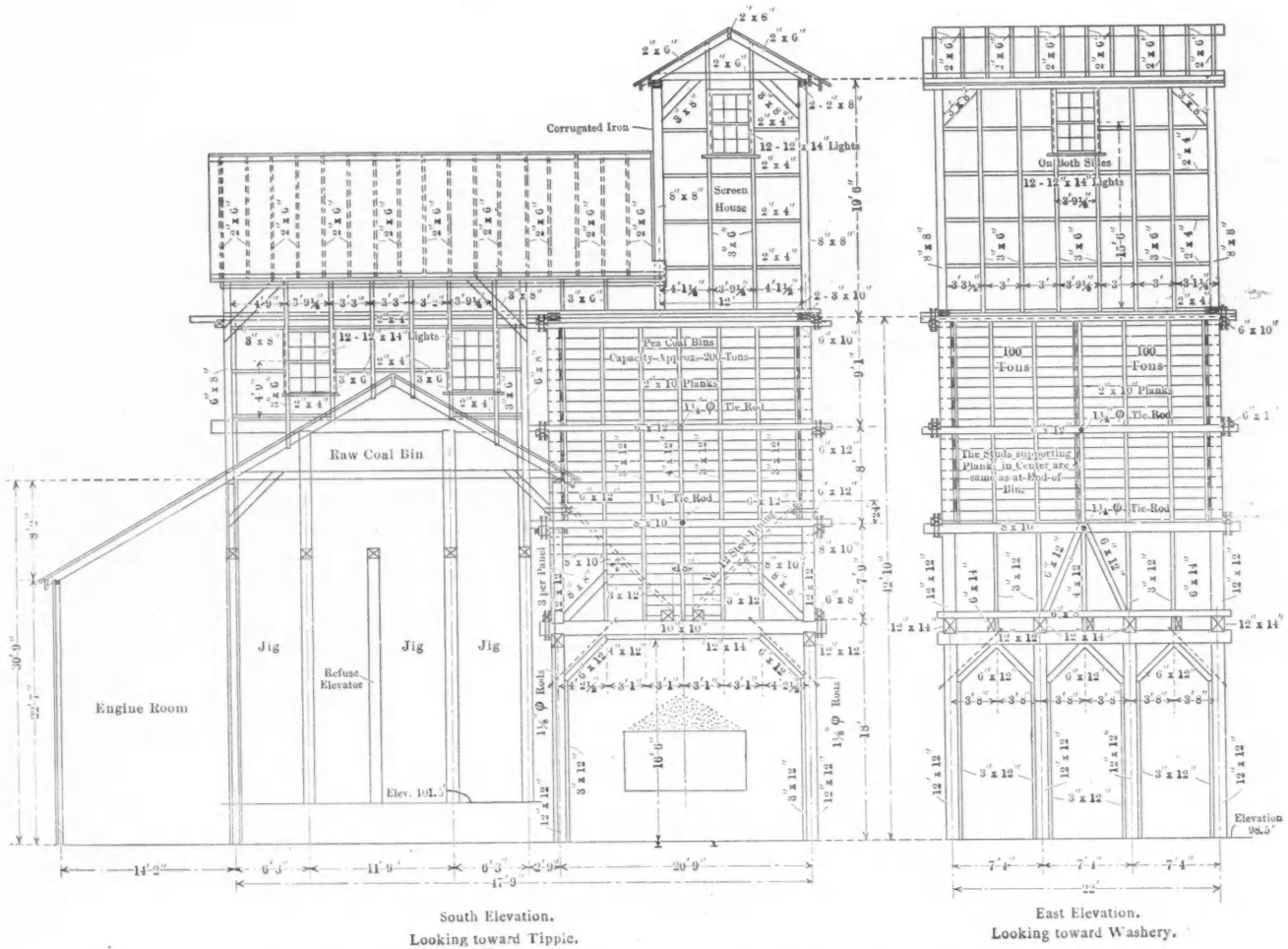


FIG. 2. SOUTH AND EAST ELEVATIONS OF WASHERY, SHOWING ENGINE ROOM AND RAW COAL BIN

when the new plant was decided upon, it was known just what the plant should be expected to accomplish. After a careful investigation into the various types of washeries in use in various parts of the country, it was decided to adopt Stewart jigs in this new plant, and the Roberts & Schaefer Company, of Chicago, Ill., was given the contract to build the new washery complete.

The new plant had to be so built as not to interfere with the regular operation of the mine. Since the old washery was built entirely on one side of the tippie and

coal must be delivered to the ovens in as finely a pulverized condition as possible, and in addition it must be delivered to the ovens in as dry a state as possible. It was, therefore, demanded that the washed coal be delivered into the washed-coal bin finely pulverized and as free as possible from water. How these conditions were met will best appear in the description that follows:

In order to prevent the losses of coal in the refuse, which hitherto had seemed unavoidable when the coal was ground to a fine state before washing, it was de-

the washed coal. All foundations are concrete, composed of one part cement, three parts sand, and six parts broken stone. The depth of the foundations is 8 ft. below ground level. The lumber entering into the construction of the buildings is fir, pine and native woods. The sides and roof are covered with corrugated steel.

METHOD OF OPERATION.

The run-of-mine coal is discharged over screen bars at the tippie, which are three-fourths of an inch apart. That which goes through the bars is discharged into a

62½-ft. elevator, which consists of a No. 126 roller chain fitted with 24x10x11-in. No. 10 continuous buckets. This elevates the coal to a three-size product revolving screen, 6 ft. in diameter and 12 ft. long, fitted with wire cloth. This screen

the washed coal is elevated to a storage bin of 640 tons capacity, where it is distributed into the bin by means of a conveyer placed over the bin, consisting of ¼x8x24-in. steel flights mounted on a steel roller chain. The washed-coal bins

the jigs to a conveyer which delivers it to a refuse bin from which there is an aerial wire-rope tramway 2450 ft. long, which carries the refuse to a remote point where it is dumped. This tramway is capable of transporting 15 short tons per hour; the waste material weighs 120 lb. per cu.ft. This tramway was erected by A. Leschen & Sons Rope Company, of St. Louis. It works satisfactorily and removes the waste cheaply and quickly.

The raw-coal machinery and crusher is driven by an Atlas four-valve engine, size 16x22 in., generating 140 h.p. The washed-coal machinery is driven by an Atlas four-valve engine, size 15x20 in., generating 115 h.p. The water from the sludge-recovery tank is pumped to a reservoir back of the jigs by an 8-in. centrifugal pump. All bins are lined on their bottoms with No. 10 gage steel. Sluiceways are lined on bottoms with No. 12 and partly on the sides with No. 14 steel.

The washed coal has been brought down to a point where the percentage of ash is less than when the old washery was operated. The refuse shows only a trace of coal. The fine crushing has been satisfactorily accomplished by the Stedman

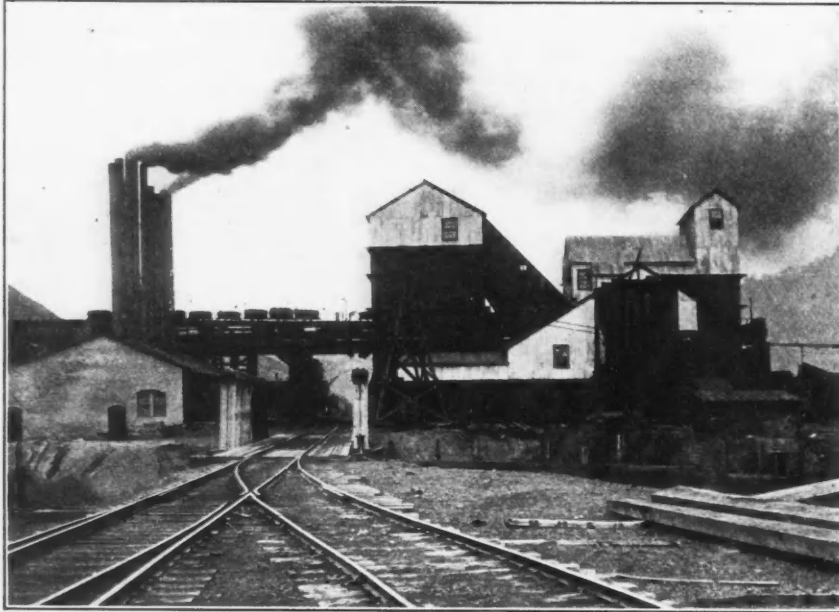


FIG. 3. GENERAL VIEW OF POWER HOUSE AND NEW WASHERY BUILDING AT HASTINGS, COLORADO

rests on the nut and pea bins over the railroad track, and is for the purpose of taking from the slack, the pea and nut coal when it is desired to market the same.

The coal which is to be washed is delivered to a conveyer, which consists of double-strand No. 126 roller chain, fitted every 30 in. with ¼x8x24-in. steel flights. This conveyer delivers the coal to a 120-ton raw-coal bin, from which it is spouted direct to three Stewart jigs, where it is washed. The washed coal is then sluiced to a revolving draining screen which is 5 ft. in diameter and 20 ft. long, covered with ⅛-in. mesh wire cloth. This screen removes from the washed coal the bulk of the water and fine coal which drops to a primary settling tank underneath, from which the fine coal is elevated to a horizontal drag conveyer operating over perforated plates, whence it is delivered to the washed-coal elevator.

The water from this settling tank overflows into a sludge-recovery tank 12 ft. 4 in. wide by 75 ft. long, which serves to clarify the water and removes therefrom the fine float coal where it is elevated to the horizontal drag conveyer previously mentioned, by a special washed coal elevator fitted with 30x12-in. No. 12 steel perforated buckets.

The coarse coal from the jigs, which passes through the revolving draining screen, is spouted to a Stedman disintegrator, where it is crushed and delivered to the washed-coal elevator. All of

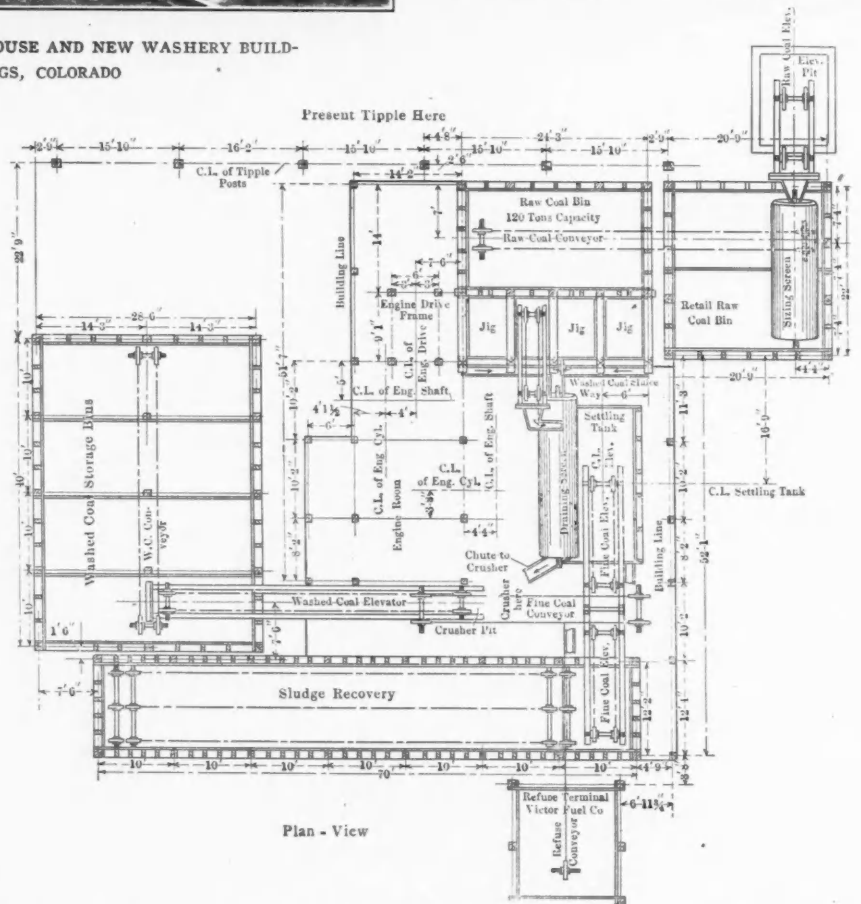


FIG. 4. GENERAL VIEW SHOWING ARRANGEMENT OF THE VARIOUS SCREENS AND BINS

are provided with steam-jacketed gates to prevent freezing in cold weather.

**AN AERIAL TRAMWAY IS USED TO DISPOSE OF WASTE**

The bone, slate, etc., is elevated from

mill and this fine crushing, together with the extraordinarily dry condition of the washed coal, has permitted the making of a better grade of coke than had been possible before the building of the new plant.

## Coal Mining on the Retreating System

BY HARVEY J. NELMS\*

This method insures the operator a greater amount of coal than when the seam is worked advancing on the room-and-pillar system. Since mining men in the United States now recognize that our supply of fuel is exhaustible, it certainly behooves all operators to mine every ton of coal possible.

In this retreating system, the main entries are driven 50-ft. centers with crosscuts every 100 ft. The middle entry, in the three-entry system, is used for the haulage road, being also a main intake airway. After turning a pair of butt entries off the main, the second crosscut, 200 ft. from the last butt entry, should be a 45-deg. chute for motor haulage.

The dotted lines on the main entry at the bottom of the butts show the position of the "parting." The motor, hauling twenty-five 1½-ton cars comes in the middle main entry, swinging its trip of empties in the chute, the motor running up the straight where the drivers have stocked their loaded coal. The motor can then pull its loaded trip outside and the drivers proceed to distribute their cars, two drivers going in each butt entry. The drivers make two trips, while the motor makes one.

### FACE ENTRIES ARE 1400 FT. APART

The butt entries are driven on a 90-deg. angle from the main entries, and at a distance of 1400 ft., they intersect a set of three-face entries running parallel to the main entries. The butts are driven 50-ft. centers, with crosscuts every 100 ft. This system of turning butts off the mains is an ideal one for haulage and ventilation. Instead of driving rooms off the butts beginning near the main entry, the rooms are started from the face-entry side and all coal is worked toward the main entries.

Usually 60 ft. of solid coal is left to protect the face entries, and 60 ft. to also protect the mains. The rooms are started four at a time, and as soon as the first four have been driven 50 ft., the next four are started on both butts. The rooms are all driven on sights 90 deg. off the butt entry and driven 25 ft. wide for a distance of 240 ft., there being a 15-ft. pillar left in each room. The crosscuts in the rooms are from 80 to 100 ft. apart, and should be "staggered" across the different rooms so as not to make a weak place in the roof as would occur if the breaks were all opposite.

### FOUR PAIRS OF BUTT ENTRIES WILL PRODUCE 1200 TONS OF COAL DAILY

After driving the rooms the full distance, they should be cut over to the next

room by the mining machine, the cut being 20 ft. wide. The great advantage to be gained in this system is the method of not having work scattered all over a mining territory. Four pairs of butt entries mined, according to this method and in the condition shown in this plan will produce 1200 cars of coal each working day.

In the plan shown, there are 32 "machine" rooms working on the pair of butts, and requiring 32 men (loaders), two men having two rooms and working

wages, as pick coal costs about twice as much as machine coal. The chain pillar and stump will produce 12 cars per day, four men working these. The two butts produce 234 cars per day.

### THE METHOD OF VENTILATION IS SIMPLE

The engineer can advance the work in such a standard way that his machine coal will always total to the proper amount. A mine foreman should find this an easy way to keep his men standardized, the machine loaders always having machine places and the pick men pick places, thereby increasing the safety factor of his mine as his machine men would never have to do pick work.

The ventilation shown by the arrow heads is the most practical to use; the splits are shown and also the overcast at the bottom of the butt entry, there being a regulator in this overcast. The motor road is clear of doors on the main entries. The arrangement of chutes on the left side would be slightly different.

## The Rich Coalfields in New Mexico

About two years ago all the public land in New Mexico supposed to contain coal was withdrawn from entry by the President pending an investigation and classification now being carried on by the United States Geological Survey. During the past few months the valuable coal beds in the vicinity of Raton have been investigated. The deposits here located have an area 15 miles wide, extending from Johnson's Mesa westward to the mountains.

Careful investigations, carried on by the United States Geological Survey, have shown that most of the coal contained in this field is a high-grade bituminous and of coking quality.

### GEOLOGY OF THE FIELD

The field work done shows that the oldest geologic formation exposed at the surface near Raton is the dark-colored rock on which the town is built, a formation known to geologists as the Pierre shale. The dark color of this shale has led some people to search for coal in it, but it contains no coal, though there are local indications that it may contain oil. Above the Pierre shale is a white, cliff-making sandstone, the rock may be seen in the cliff at Goat Hill, Raton. This is known as the Trinidad sandstone, and though in some places it includes layers of carbonaceous shale with thin beds of coal, it is not to be regarded as a coal-bearing formation. To the coal prospector, however, it is of the greatest value as a reference horizon, as it immediately underlies the real coal-bearing formation throughout the Raton field. Its white color and the characteristic markings

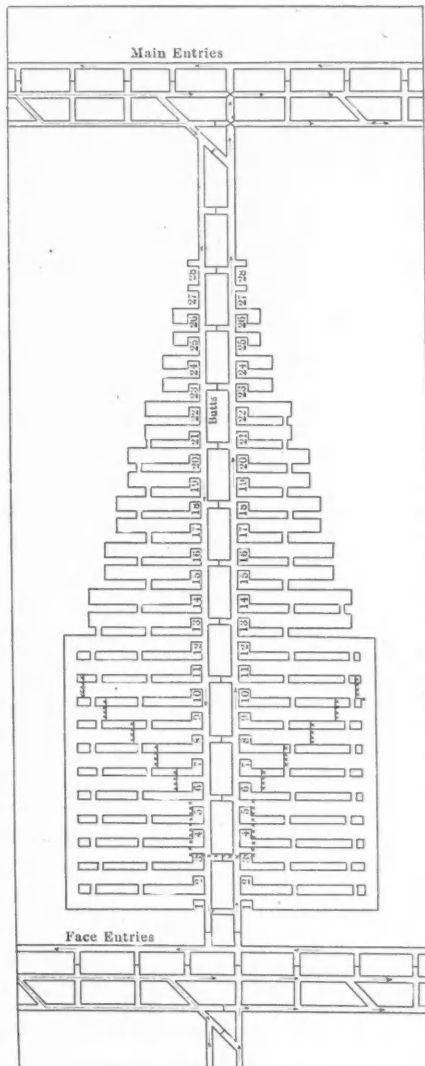


FIG. 1. GENERAL SYSTEM OF WORKING ON THE RETREATING ROOM-AND-PILLAR PLAN

them together. It is the general practice to clean up one room at a time and so always have coal to load in one room or the other. Each machine loader receives six cars, thereby producing 192 cars per day.

There are 10 pillars being robbed, and these produce 30 cars of coal, as the pillars are worked by one man. In some places, two men work the pillars. The "turn" in coal mines is such that a machine loader receives two cars to the pick miner's one, thereby equalling each other's

\*Mining engineer, Bentleyville, Penn.

locally known as "petrified corncocks" make it easily recognizable. The "corncocks" are supposed to be impressions of seaweeds.

#### COAL-BEARING ROCKS

Above the Trinidad sandstone is a coal-bearing formation, which varies considerably in thickness in different parts of the field. Near the mountains it is 150 to 250 ft. thick and includes several beds of coal. In the vicinity of Raton it may be 20 to 50 ft. thick in some places and contains the Raton coal—the most important coal bed in the field; in other places, however, it has been eroded away, allowing the younger geologic formations to rest upon the Trinidad sandstone. In other words, after the sediments that contain the Raton coal were deposited, they were exposed to erosion and in some places were entirely removed. This may be seen near the Van Houten mine, where conglomerate rests directly upon 13 ft. of coal, while a quarter of a mile to the south, this conglomerate rests directly upon the Trinidad sandstone. The recognition of this interval of erosion is of great importance to the coal miner, for it explains why the coal is absent in certain places where it might naturally be expected to occur.

In many places along the outcrop of the coal-bearing formation is a deposit of conglomeratic sandstone or "pudding stone" that varies in thickness from a few feet to several hundred feet. The lower part of this conglomerate, including pebbles 5 in. in diameter, grades upward into finer material and finally to shales and sandstones that contain beds of coal scarcely less valuable than the lower or Raton coal.

#### COAL CHANGED TO COKE AND GRAPHITE

During some period of volcanic activity after the coal beds had been formed, igneous rock was intruded into the beds. In some places this took the form of dikes, such as the "stone wall" at Raton; in other places it formed intrusive sheets thrust in between the beds. Where a comparatively small amount of this melted rock came in contact with the coal it changed the coal to coke, but where a large amount was injected, the greater heat transformed the coal into graphite. This transformation was effected over an area of several hundred acres in Red River Valley.

During the coming winter analyses of the coal of the Raton region will be made, the fossils collected will be examined, the notes and other data will be studied, and a preliminary report will be issued, probably in the spring of 1909, which will be obtainable free of charge from the Director of the United States Geological Survey. Later, when the survey of the field has been finished, a final and exhaustive report will be published.

### Colliery Notes

Whenever it is practicable, the abandoned portions of a mine should be ventilated by a separate current of air, returning directly to the main return airway; this system prevents any accumulated gases being carried on into the workings.

Natural air-bridges, that is, those built directly in the overlying or underlying strata, although costing more, are not so likely to be injured in the case of an explosion. Natural undercasts are even safer than overcasts, but they have the disadvantage of being so easily stopped up either by water or accumulated debris.

Much care should be observed in entering a room or other working place where a body of gas has accumulated. The explosive condition of the firedamp is usually more dangerous at the intake side than on the return side, where the diffusion is more complete. For this reason it is often better to examine the air on the return side of the chamber, or brattice.

For securing the top and sides in a mine, the batter of the legs in a timber frame should be about 2 in. per ft. of height. When the bottom is soft and wet the timber frames should be set upon sills running either longitudinally or across the entry. To prevent the track slipping down the slope in a steep seam, it is advisable to use occasional long track ties lodged in hitches cut in the ribs.

In sinking a shaft, a good light is necessary for the proper performance of the work; it is well to employ an electric light capable of being raised or lowered from the surface, and hung sufficiently high for safety. In addition to this light, it is advisable to have several good safety lamps hung near the men to test the atmosphere for gases, which may at any time be given off from faults, or on approaching a coal seam.

All of the recent coal commissions appointed by the different foreign governments to investigate the depth at which coal can be mined, have agreed in their reports that the workable limit of a coal seam is 4000 ft. from the surface. At a depth of about 4000 ft., a temperature of nearly 98 deg., or blood heat, would be encountered. It is, of course, possible that the price of coal in future ages will be such as to justify the use of methods at present considered impracticable, so that coal beds lying below the present 4000-ft. limit will be successfully mined.

Engineers in England are at present devoting much time and study to a solution of the coal-dust problem. For some time past, it was the general belief in England, that the only remedy against coal-dust explosions was to spray the rooms and entries with water; there is at present a great difference in opinion concerning this plan, and as a consequence, attention

has been directed toward the discovery of an alternative remedy, which many engineers believe they have found in the use of stone dust. All experiments along this line so far have demonstrated that the effect of coal-dust explosions may be neutralized by using this stone dust.

It is safe to assume that for domestic purposes, such as heating, cooking, etc., we consume in the United States about 100,000,000 tons of coal per year. When we consider that 1 lb. of coal burned in a well-constructed steam-engine boiler will evaporate 1 gal. of water, and when we compare this result with the insignificant quantity of water which can be evaporated by a pound of coal consumed in an ordinary kitchen stove, we will be able to better appreciate the enormous waste which takes place when coal is burned for culinary purposes alone. In warming our houses, more than 80 per cent. of the fuel value of each pound of coal is wasted; it is true, therefore, that our fuel supplies are not only unnecessarily lost in poorly devised systems of mining, but in burning the fuel after it reaches the market.

There are at present several types of mining machines which are giving excellent service. Each style of machine has its particular advocate. One English engineer who has given the subject much thought makes the statement that the "bar machine" is the coal cutter of the future. In his argument he gives the advantages of this machine as follows: (1) The spiral bar and reciprocating motion bring out all the cuttings. (2) The bar works its own way into the coal and needs no assistance by hand cutting. (3) It is not likely to be buried by coal as it will work its way out. (4) The coal can be spragged up to a few inches from the solid. (5) It will cut on either side of the machine. (6) The motor is gas-tight, therefore less liable to fire CH<sub>4</sub>. (7) It is claimed to require less power to drive it than other machines.

During recent years, a number of coal mines have been started on the coöperative plan. Now comes the report from France that the largest coöperative mine in that country has proved a failure. The mine was started in 1890 and a grand fête marked the inauguration ceremony. Three years later the managers of the mine quarreled and after considerable litigation, several of the founders were evicted from their positions; the remaining stockholders terminated their connection with the Miners' Union, which had coöperated in starting the mine. Up to the present time, mining has been carried on by shareholders and workmen, who were described as auxiliaries. At present there is no money to carry on the work and no further financial assistance can be obtained. The miners were informed that they would be responsible for finding their own wages.



# The New Steel Corporation Plant at Gary

The Largest Steel Plant in the World. Handling Material from Iron Ore to Finished Steel on the Latest and Most Approved Lines

## SPECIAL CORRESPONDENCE

The new plant at Gary, Ind., to which reference has frequently been made in the *JOURNAL*, will be, when completed, the largest steel plant in the world, and will be equipped throughout in accordance with the latest and most approved machinery of every kind. It is built by the United States Steel Corporation, through a subsidiary concern known as the Indiana Steel Company, and is intended to furnish material largely for the trade of the central West and Northwest; as the Carnegie Works at Pittsburg are the production center for the trade of the East.

The Gary Works are peculiar, in that they are not the outgrowth or enlargement of older plants, as most of our great steel plants are; and therefore they could be planned on entirely new lines, including the latest practice, and generally arranged to secure the best and most economical handling of raw and finished material.

### SITUATION OF THE WORKS

The site selected is near the southern end of Lake Michigan, 23 miles southeast of Chicago, where a new town has been built, called Gary. The land owned by the company includes 9000 acres, with a water front of 1½ miles, having deep water enough to permit the docking and unloading of the largest Lake vessels. Iron ore, coal and other material can be delivered by water directly to the storage and distributing yards. The Grand Calumet river, which empties into the lake at this point, has been converted into a canal, or harbor, 250 ft. wide and bordered with docks built of cement, which have a total length of nearly a mile. At the end of this harbor is a turning basin 750 ft. in diameter.

### HANDLING ORE

The plant for handling ore from the vessels consists of five Hulett unloaders and Hoover & Mason bridges of sufficient capacity to furnish material for the eight blast furnaces already built, each of which will deliver 500 tons of pig iron daily, and the eight additional furnaces yet to be constructed. The bridge dumps the ore into large concrete ore pockets at the rear. From the pockets, which have walls 5 ft. to 8 ft. thick, with concrete bottom 5 ft. above lake level, the ore is taken, as required, by grab buckets operating on bridges 498 ft. long, which are the largest ever constructed, rising to a height of 85 ft. above the floor of the pockets. Each is

equipped with clam-shells, carrying 14 tons at a trip. By means of the bridges ore is conveyed to hoisting bins, divided by concrete walls spaced 87 ft. apart, which are built or laid out for nearly a mile parallel to the dock, and, with the pockets at the water line, have a present capacity of over 1,000,000 tons, sufficient to supply the furnaces during five months or more of closed navigation. With the completion of the bins this storage volume will be about doubled. By means of auxiliary track facilities, provided for handling ore in and out of cars, the entire system is rendered mobile. From the bins the ore is taken by electrically operated larries and hoisted on skips to the tops of the blast furnaces.

The ore bins and auxiliary apparatus were constructed by the Brown Hoisting Machinery Company of Cleveland, Ohio except the electric hoists operating the skips to the blast-furnace tops, which are of the Otis Elevator Company's standard design for this service.

### STORAGE OF COKE AND LIMESTONE

Storage of coke, coal and limestone will be provided for just west of the site of the mills at a point on the lake shore known as Stockton. These yards, which are shared with the Illinois Steel Company, will be the largest of their kind in the West. Material is mechanically handled here by means of unloaders of an improved revolving-conveyer type, having each a capacity of about 50 cars for a nine-hour day. These were built by the Hamilton Manufacturing Company, Columbus, Ohio.

### SHIPMENTS OF FINISHED MATERIAL

Shipments from the works to almost any point can be readily made. The Baltimore & Ohio and the Lake Shore & Michigan Southern are the railroads directly passing the works; while the Chicago, Lake Shore & Eastern, a belt line owned by the Steel Corporation, provides connection with all the other railroads entering Chicago. When the site at Gary was selected, it was found that the main line of the Baltimore & Ohio and Indiana Harbor railways would run through the center of where the great mills are now located. It was therefore necessary, in order to build the plant at this particular place, to change the location of these two roads, and also, in carrying out the general scheme of the Steel Corporation, to alter the route of the Lake Shore

& Michigan Southern Railway. A new line was built for the Lake Shore and is now in operation by that road for a distance of about 14 miles, the old tracks having been taken up. A new double track road was also constructed for the Baltimore & Ohio from Indiana Harbor to Millers, Ind., a distance of 12 miles, and one of seven miles for the Indiana Harbor road to take the place of its old line. These newly constructed lines have all been elevated through the city of Gary.

The Chicago, Lake Shore & Eastern, which, as previously mentioned, is a subsidiary company of the Steel Corporation, has arranged to serve the steel plant without undue delays, by elevating its tracks over those of all of the other roads.

### TERMINAL YARDS

The location of the plant, with direct access to all railroads, through the United States Steel Corporation's own lines, required classification yards. These are laid out on the plan known as the Kirk yards. They are designed to accommodate 15,000 cars and interchange yards being built by connecting lines will hold fully 10,000 more. In them the freight handled in and out of Gary will be made up into outgoing trains or classified for switching to various parts of the steel plant. They are laid out on the unit system and up to the present time about one-half of the work has been completed. In addition to its trackage the yard now contains a locomotive round house, car repair shops, sand houses, coal bunkers and fire pits for cleaning the engines. All of the rolling stock of the Chicago, Lake Shore & Eastern will be cared for here.

### INTER-WORKS TRANSPORTATION

Within the plant itself no feature has had more careful thought bestowed upon it than that of inter-works transportation. The lines from the railroads enter the mills at the southwest corner, through the Kirk yards, over nine main tracks crossing on a viaduct. These, upon entering the grounds, branch out to the shops, rail mills, open-hearth furnaces and finally to the blast furnaces. To reach the furnace there is a long trestle carrying tracks at a considerable elevation, also trestles to the gas producers of the soaking pit buildings, for the coal-handling system above described. Around the open-hearth buildings there is a perfect network of tracks, crossing and recrossing, and on the charging floor of each three standard-gage

tracks come in on a long embankment from the north. The chief end sought was to secure direct access to every part of the plant by the most available route, with no chance of blockades.

On the dock and walls of the ore pockets are laid tracks upon which the ore unloaders and bridges travel, giving them a working range of nearly a mile along the blast-furnace fronts, and parallel with these run four switch lines, enabling ore or other material to be unloaded from vessels directly into cars when shipment is to be made elsewhere. Along the ore-bins tracks also extend their full length, so that, when it is not desirable to move the great bridges, the ore can be unloaded directly into cars, moved to any section required, shot into the elevator boots and hoisted to the tops of the furnaces.

The railroad system of the mills alone has a trackage of about 100 miles, and the Kirk yards have 125 miles, making 225 miles in all. Besides the large number of standard locomotives of the Chicago, Lake Shore & Eastern, there are required to handle the inter-yard traffic 40 light locomotives of the type built by H. K. Porter & Company of Pittsburg.

In the transportation and handling system of the plant large traveling cranes, up to 125 tons capacity, as well as jib cranes, are prominent. These were supplied by the Morgan Engineering Company, the Whiting Foundry Equipment Company and the Alliance Machine Company. They are supplemented by a number of locomotive cranes built by the Industrial Works, Bay City, Michigan.

#### GENERAL DESIGN OF THE PLANT

The works will include blast furnaces, open-hearth steel furnaces, rolling mills and all necessary subsidiary machinery for repairs. They are designed on the unit plan, so that any future additions can be made without interfering with the constructions already in use. The arrangement of each unit is such that material can be passed from one department to the next entirely by machinery, and labor is reduced to a minimum.

#### THE BLAST FURNACES

There will be 16 blast furnaces, eight of which are already erected. These require no special description, except to say that they are of the latest approved type. The methods of supplying them with ore, coke and flux have been already indicated. The main work of these furnaces will be to supply the open-hearth steel furnaces. The molten metal will be conveyed in 40-ton ladles, on special trucks, to the mixers, two of which, of 300 tons capacity each, are placed in each of the open-hearth buildings.

The blast-furnace plant is also provided with five pig-casting machines installed by

Heyl & Patterson of Pittsburg. These are for making pig iron and loading it directly on cars, if for any reason the open-hearth plants are unable to take care of the product of the blast furnaces, when the mills are not in operation, or if it is desired to send the pig to any other plant of the Steel Corporation.

#### THE OPEN-HEARTH STEEL PLANT

An important feature of this plant is that there will be no bessemer converters. All the steel will be made in open-hearth furnaces. There will be 84 of these furnaces, arranged in groups, or units of 14 each. Two of these groups are now completed, and two more are under construction. Each unit is in a separate building, all of the same construction. Each building, lying upon monolithic concrete foundations, is 1200 ft. long and built in three spans, giving a total width of 193 ft., with a height of 104 ft. above the floor line. The charging floors are of steel. Instead of being at right angles to the rest of the plant, the open-hearth buildings run northeast and southwest at an angle of 35 deg. This is an innovation intended to lessen the sharp curve of the railroad tracks which run through the buildings. At the north end of each building is a structure for the mixers, previously referred to, which is 120x86 ft. This also contains a pit for relining ladles. Parallel to the furnaces is a wing 24 ft. wide and running the entire length of the building, where the gas producers for the furnaces are located. Beyond the gas producers is a stock yard, 72 ft. wide, every point of which is reached by overhead cranes. Between each pair of open-hearth buildings is a scrap house and skull cracker.

The open-hearth buildings are equipped with electrically operated cranes, both traveling and fixed. There is one with a capacity of 125 tons in the casting department and another with a capacity of 125 tons on the charging side. The ladles handled in pouring off are of 80 tons capacity each.

With the four open-hearth buildings, now completed or under construction, in operation, the Gary plant will have a capacity of over 12,000 tons of steel per day, or 2,500,000 tons per year. With all six buildings in use, the total capacity of the plant, as planned by the United States Steel Corporation, will be upward of 4,000,000 tons per year.

The furnaces are 40 ft. long by 16 ft. wide. In the construction of each 800,000 brick was required. Each furnace will be supplied with gas from a producer built by the Morgan Construction Company.

As it takes about eight hours for a heat and the furnaces will never be allowed to cool except for repairs, the daily capacity of each of the 70-ton furnaces will be

about 210 tons, giving, with one furnace down for repairs, a total of 3360 tons for each group daily.

#### TREND OF DEMAND IS TOWARD OPEN-HEARTH STEEL

The fact that the works at Gary is to be purely an open-hearth plant, emphasizes the trend of the industry away from the bessemer to the open-hearth process, due to the greater reliability of the latter, at least in the making of steel rails. A conference of railroad officials, held in New York some months ago, showed very plainly how strong is the preference shown by the steam roads for rails made by the open-hearth process, and the same change of sentiment is apparent in structural circles.

#### THE RAIL MILL

In the rail mill 4000 tons of steel rails can be produced daily; and in normal operation the mill is expected to turn out 100,000 tons per month. The group of rail-mill buildings is about 900 ft. from the lines of the open-hearth furnaces. The main structure is 1800 ft. long, and at right angles to it is another building 600 ft. long, with a width in a single span of 85 ft. This contains 12 soaking pits or furnaces, each of which is supplied with gas from an independent Hughes mechanical gas producer. The arrangement here is such that ingots enter from the open-hearth furnace buildings along the entire length of one side of the pit building, the other side being reserved for the electrically operated ingot buggies which transfer the heated ingots through the first stand of rolls. Each of the 12 pits has four holes 6x6 ft., and is provided with the usual equipment of hydraulic cylinder covers and reversing air and gas valves of the Dyblie type. The ingots used are 20x24 in. and 6 ft. long, weighing 8500 lb. each. For the operation of the two ingot buggies, the Cutler-Hammer Company, of Milwaukee, has developed an ingenious system of control to guard against the possibility of the operator becoming confused and bringing both ingot buggies to the mill at the same time, which would result in a collision. The special controlling system provides guards against this contingency, at the same time enabling the operator to stop the ingot buggy at any of the pits. There are two master levers for the control of the two buggies. Each of these levers can be set in any of eight positions, one corresponding to the rail mill itself, six to the six soaking pits, which each buggy serves, and one off position. A suitable interlock between the two controlling levers is provided which renders it impossible for the operator to throw both levers to the mill position at the same time, thus insuring a clear track for each buggy.

The arrangement for receiving and

handling coal through the gas producers consists of an elevated track upon which the coal is received and conveyed to overhead storage bins; thence it is distributed to the various producers by means of a five-ton crane equipped with automatic scales.

The rail mill is equipped with 12 sets of roll trains, all operated at varying speeds by General Electric alternating-current motors. These are housed in a separate bay running parallel with the rolls. The motors are 20 ft. in diameter and have a speed of 83 revolutions per minute. All of the motors are connected directly to the roll trains by regular mill couplings. The aggregate driving capacity is 24,000 h.p. Although the motors are provided with flywheels and operate in one direction, provision is made for reversing in case of necessity. The control system has been worked out with the greatest nicety, all operations being under the instant control of the operator by means of a master controller.

The first group of rolls consists of four stands of continuous 40-in. mills, each two of which are driven by a 2000-h.p. motor. They are arranged in tandem, requiring no manipulation from stand to stand. Here, as elsewhere through the plant, sufficient distance is left between successive sets of rolls to enable a quarter turn of the ingot or bloom to be made, so that it is worked equally on all sides. The first two mills are at present equipped with 42-in. rolls, enabling 20x24-in. ingots to be used. After passing these four mills the ingot is sent to a 40-in. three-high blooming mill equipped with lifting tables and arranged with a combined hydraulic and pneumatic balancing device. This mill, which is operated by a 6000-h.p. motor, gives the ingot five passes. After being bloomed the ingot is sheared in a 10x10-in. horizontal blooming shear, and the crop ends or butts are taken outside of the mill by a butt conveyer. Each bloom then goes through a 28-in. roughing mill, which is three-high and equipped with tilting tables. This mill has actually three stands of rolls. The roughing stand, however, is the only one that is three-high, the other two stands being two-high. The mill is driven by a 6000-h.p. motor and gives the bloom three passes. After leaving the roughing mill the bloom goes through a two-high 28-in. forming mill driven by a 2000-h.p. motor, receiving but one pass. Then it is sent to finishing mills, which consist of five stands of 28-in. mills driven by two 6000-h.p. motors. After the dummy pass, the bloom is transferred to the first edging, which is in this same mill but the second stand, and turns back on an elevated table to the second edging, which is in line with the 28-in. roughing mill. It then travels by chain transfer to the lower tables and on the leading pass goes through a stand

which is also in line with the roughing mill and driven by the same motor and continues on to the third stand of the 28-in. finishing mill, this being the eighteenth and last pass. After the finishing pass the rail travels through to the saws, of which there are five provided, thus cutting four rails to length. These four-rail lengths consist of half the ingot. As the capacity of this mill is 4000 gross tons per 24 hours it will be seen that there must be a four-rail length sawed about every half minute. The saws are 42-in. blades, arranged to be raised and lowered in unison by one controller from the hot-saw operator. After leaving the hot-saw run the rolls pass over the usual cambering machine and are run on hot beds 100 ft. long, of which four are at present installed, with provision made for an additional two, if necessary. These hot beds extend to the south of the mill proper. In the finishing-mill section they are of unusual design, being made of structural material and placed 8 ft. above the floor, allowing for an extraordinarily large air space to facilitate the rapid cooling of the rails. The finishing building is 1383 ft. long, central with the hot beds, and provided with live rolls extending the entire length. The roller tables are equipped with stops and kick-offs to transfer the rails to the straightening presses, of which there are 16, built by the Hilles & Jones Company, of Wilmington, Del., these being of the usual type and motor driven. From the straighteners the rolls are transferred by the usual skids to three-spindle vertical drill presses furnished by Wm. Sellers & Company, of Philadelphia, which are also motor driven. These complete the rails for use. From the drill presses the rolls are transferred to a roller table, which extends the full length of the building and from which the rolls may be skidded to the loading beds immediately outside of the building.

The principal machinery was built and installed by the United Engineering and Foundry Company, with the exception of the finishing department, which was erected by the Morgan Engineering Company. For the lifting tables and transfers Westinghouse motors are used.

The loading yard is provided with the usual inspection beds and two tracks, each about 1400 ft. long, connected with the track system of the plant at both ends, thus avoiding any unnecessary shifting. The yard is also served by an 80-ft. traveling crane for the entire length of the finishing department and by means of this the rails are placed directly on flat cars.

All of the butts and scrap from the rail mill are loaded into cars from the conveyer above mentioned and carried back to the open-hearth furnaces.

#### THE BILLET MILL

The billet mill consists of four con-

tinuous stands of 40-in. blooming mills, each two of which are driven by a 2000-h.p. motor. After leaving these the ingot is turned end for end on a turntable and passes through a five-stand 32-in. continuous mill, the entire mechanism of which is driven by one 6000-h.p. motor. At the end of this mill is placed a 12x12-in. horizontal blooming shear and also a 10x10-in. vertical blooming shear, from either of which shears either sale blooms or blooms for the 24-in. mill immediately following may be sheared. The sale blooms are run out on hot beds on the other side of the building, where there is a loading yard equipped with overhead traveling cranes. Blooms intended to be further reduced after being sheared are sent through the 24-in. continuous mill, which consists of six stands driven by a 6000-h.p. motor, reducing the blooms to 4 or 5 in. square. At the end of the 24-in. mill is placed a roller table. The billets may be transferred to an 18-in. continuous mill to be further reduced or, if for sale, to a shear and from thence to overhead billet pockets from which they may be loaded directly into cars.

For the further reduction of billets taken from the above-mentioned transfer skids, the billets are run through an 18-in. six-stand continuous mill, driven by a 6000-h.p. motor and equipped with flying shears, so that billets reduced in this mill (1¾ and 2 in.) may be run out on covered hot beds extending at right angles to the general direction of the mill into an extension of the same billet loading yard as that provided for the 10-in. and 12-in. sale blooms. Provision has also been made for the installation of an additional continuous mill for reducing 4-in. and 5-in. blooms to such small sections as the trade may require. This mill will be on the opposite side of the mill building from the 18-in. mill, thus providing additional capacity to take care of the enormous tonnage from the blooming mill proper. All of the machinery is electrically driven. The ingots for this billet mill are heated in 12 soaking pit furnaces of approved design, arranged similarly to those adjoining the rail mill. Each of the pits in both buildings is supplied with gas from one independent Hughes mechanical gas producer built by the Wellman-Seaver-Morgan Company.

An interesting feature of the billet mill is the handling of the scale. Usually in a mill of this size the problem is a serious one, but here means have been provided by which all of the scale from the various mills is collected in a large pit extending for some distance along the side of the building, whence the scale can be removed at any time without interfering with the operation of the mills.

#### ADDITIONAL MILLS

The additional mills to be built are a

60-in. universal plate mill, which will be the largest of its kind in the world, and a 44x160-in. sheared plate mill. These two mills will each be served by a 32-in. slabbing mill. Further extensions to the Gary works include an axle mill, structural mill and 18-in., 14-in., 10-in. and 8-in. merchant mills.

The mill buildings are steel frame with brick sides and corrugated-iron roofings. The open-hearth, stripper and soaking-pit buildings have steel frames with corrugated sides and roofings. The structural steel here and elsewhere in the plant was furnished by the American Bridge Company, supplemented by the Illinois Steel Company.

#### OTHER SHOPS AND BUILDINGS

In connection with the furnaces and mills of the steel plant proper there have been erected a group of buildings of general utility, consisting of a machine shop, foundry, boiler shop, blacksmith shop, pattern and carpenter shop, pattern storage building, roll shop, electrical repair shop, brick storage house and a well equipped general storehouse. These shops are of steel frame construction with brick walls and concrete tile roofing. There has also been provided a yard locomotive house, which is rectangular in shape, with tracks running through on an angle from one side to another, thus avoiding the use of a turntable.

Of these buildings probably the most interesting is the foundry, a structure 400 ft. long by 136 ft. in width, divided into three spans, 60, 40 and 36 ft. wide. It has two cupolas for iron castings and two 25-ton open-hearth furnaces for steel castings, and is served by eight cranes of capacities ranging from five to 50 tons.

The blacksmith shop is also noteworthy for the improved appliances which it contains. It houses boilers to generate steam for operating the steam hammers and heating the shops in this group.

#### UTILIZATION OF GAS FOR POWER

Two important and remarkable features of this plant are the use of electric power throughout; and the generation of this power, in large part, by the utilization of the gases from the blast furnaces. This power plant is much the largest of this type ever erected, and a description of it is reserved for a future article.

#### CAPACITY OF THE PLANT

With the furnaces already completed or nearly finished, the Gary plant will be able to turn out 2,700,000 tons of finished steel yearly. With the additions planned this capacity will be increased to 4,000,000 tons. This will be an addition

of nearly 20 per cent. to existing capacity.

#### PROVISION FOR FUTURE GROWTH

As previously mentioned, the plant has been designed upon the unit system, thus providing for a healthy growth, without tearing down and rebuilding. Future blast-furnace installations will be made on land redeemed from the shallows adjacent to the harbor, as a certain amount of filling in can profitably be done with the noncombustible material other than slag. The slag will not be available for this purpose, but is to be granulated and shipped to Buffington, a few miles west, for making into portland cement by the Universal Portland Cement Company.

#### THE TOWN OF GARY

Adjacent to the works the company has laid out a town for the accommodation of its employees. This is to be a model town, carefully planned and well provided with all necessary public utilities, such as water, gas, electric lights and trolley lines. The plans are on such a scale that the town will eventually be able to house 25,000 people. Owing to the situation of the plant, it was necessary for the company to undertake this work.

### Monel Meta

Attention has been called to this alloy recently by its use in the sheet form in the roof of the new Pennsylvania railroad station in New York. This roof is covered with sheets of Monel metal, which was adopted after many tests in preference to copper or other metal. It is laid in the same manner as copper sheets would be, and the sheets are bent, corrugated and joined without difficulty. The sheets are fastened with nails made of the same alloy, which have been found best adapted for the purpose.

Monel metal is an alloy containing about 70 per cent. nickel and 30 per cent. copper. It is a natural alloy, being smelted and refined directly from nickel-copper matte produced from ores of the Sudbury district in Canada. The metal is made at the Orford Copper Company's works at Bayonne, N. J., and is introduced by the International Nickel Company, of which the Orford company is a subsidiary. The furnacing and refining of the matte involves only the removal of impurities and the reduction of the iron which is contained in the matte to a very small proportion, 1.5 per cent. being the maximum.

Monel metal has a high tensile strength, the tests showing much higher results than those given by nickel steel. The accompanying table gives the results of a number of tests, the figures being in pounds per square inch.

#### TESTS OF MONEL METAL.

	Rolled.	Rolled and Annealed.	Rolled, Annealed and Cold Drawn.
Tensile strength, lb.	108,750	109,500	107,000
Elastic limit, lb.	80,000	82,500	98,000
Elong. in 2 in., %	27.0	28.5	20.0
Contraction of area, %	51.1	53.3	51.4

	CASTINGS.		
	Grade B.	Grade C.	Grade D.
Tensile strength, lb.	85,000	65,000	70,000
Elastic limit, lb.	40,000	25,000	30,000
Elong. in 2 in., %	10.0	30.0	20.0
Contraction of area, %	14.0	35.0	25.0

The sheets used in the roof above referred to were rolled in the Vandergrift mill of the American Sheet and Tin Plate Company. Owing to the hardness of the metal, it was found more difficult to roll Monel than steel sheets. More power was required, and generally more passes to bring them down to gage. It is probable that a special mill will be required for this purpose.

Experience so far with Monel metal shows that it possesses many good qualities. It resists corrosion, takes a fine polish, and possesses in a high degree the qualities of metallic nickel. It is applied to many purposes. Among others, perforated sheets for mining screens have been tried, some 60 or 70 tons having been furnished up to date. These have been found to wear much better than any other metal yet used for the purpose. Other uses will doubtless be suggested. Experiments in drawing and using wire are now being made.

Notwithstanding the high nickel content, the metal is placed on the market at about 2c. per lb. above the current price of copper. This can be done because the process of separating the nickel from the copper is not required; the alloy, as above stated, being made directly from the nickel-copper matte. There seem to be many purposes to which Monel metal can be advantageously applied.

### Production of Diamonds

When its new plant is running, says a recent issue of *The South African Mining Review*, there is every prospect that the Premier company will be producing diamonds at the rate of 3,000,000 carats a year, an output of 7,000,000 loads of ground in excess of the quantity actually treated by the De Beers company in 1907. The estimate of working costs is about \$1.50 per carat, as against the Kimberley and De Beers expense of about \$5.

As the future of this industry depends upon high prices for diamonds, any attempt on the part of this company, says the *Review*, to popularize diamonds would effectively remove the general hope that with the return of prosperity in America, the output of De Beers and other companies would again sell at the old high prices, and the inevitable result would be the "vulgarization" of diamonds.

# Examining and Fitting up a Hydraulic Mine—I

Methods of Examination and the Placing of Pipe-Lines, Receiving Reservoirs, Drain Tunnels and Sluices Are Discussed in This Instalment

B Y H. A. B R I G H A M \*

In this article I will present a brief review of the methods of hydraulic mining that were so successfully applied for many years in California, where these methods originated because they solved a problem. Hydraulic mining is so simple a process that its utilization in mining will always remain an alluring expedient, and where the requirements for its successful operation exist, it seems almost a calamity to the commonwealth that it should have ceased to be the great industry that once it was. Indeed it is not unreasonable to assert that with an intelligent study of the physical surroundings it should be possible now, under certain conditions, of course, to make practical use of hydraulic mining on a large scale in California.

While I do not intend to enter into any of the arguments and discussions that have been made so often, both before and since the time that hydraulic mining was enjoined in the most promising part of California, it does seem to me as though our technical men, our engineers and scientists should not give up all hope of an ultimate solution of this problem of rehabilitation, a problem so worthy and deserving of the keenest study.

## EXAMINING A HYDRAULIC MINE

Hydraulic mining consists of excavating and washing gravel by water under pressure through sluiceways provided with riffles for catching and saving the gold. To make profitable use of this method it is essential to have a large volume of gravel containing sufficient gold, an adequate grade to utilize the sluices properly, dumping facilities for the disposal of the tailings, ample water under effective pressure for breaking down and washing off the material, and a supply of timber for building sluices for other purposes.

In making an examination of a hydraulic mining property a general view of its situation, conditions and capabilities should be taken from the more elevated points in its vicinity. If the view from these higher elevations is not too much obstructed it should be possible, with an aneroid and with a hand and slope level, to ascertain the general conditions and adaptability of the locality for the purpose. This means an approximate determination of height, length, width and amount of the

deposit to be handled, and its general trend; the elevation of the bedrock of the channel or bottom of gravel deposit to be worked; the outlets and dumps for tailings, their relations to the height of the channel and the distance therefrom; the conditions and facilities for disposing of the tailings; the elevation, length, grade, required size, etc., of the sluices; the amount of water available, and the facilities for bringing it to the mine for economical and effective use; practical reservoir sites, both for storage, if necessary, and for receiving and distributing the water; available timber for building sluices and for general use; facilities for transporting the necessary material and supplies needed; labor conditions, climate, etc.

## DETAILED EXAMINATION

If the view from these elevated positions should be too much obstructed to obtain the general outlook needed to form an opinion, and if no impossible conditions have been previously encountered, then more elaborate surveys may be necessary for obtaining this required information.

If this preliminary work shows no insurmountable obstacle and all features appear reasonably good, then a more extensive and detailed examination should be started; commencing first with the title to the property. If this is found perfect, a very careful and exhaustive test of the deposits as to their value, extent, location, character, etc., and as to the elevation, formation, position and nature of the bedrock of the channel, or the bottom of the deposit to be worked should be made. The preliminary examination will have indicated whether the deposit should be tested by means of shafts, bore-holes, tunnel or cuts.

Many and numerous samples should be carefully selected from all sections, or, at least, from a sufficient area, in order to enable one to arrive at a general average value; the extent of the entire deposit and the elevation of the bottom of such deposit should also be taken into account. A diagram should be made showing the point from which each sample was obtained. All the samples should be marked and carefully weighed; they should be washed by pan or by rocker, and the amount of the gold found, after being tabulated, should be finally entered upon the plan at the proper position.

If water in sufficient quantities can be obtained for the purpose, and conditions are favorable, an excellent method is to work off a measured section of the deposit by piping, or ground sluicing through, or by shoveling it into small sluiceboxes prepared for this test. This, however, while giving a larger and consequently a better general average value than the pan or rocker test, may not be so reliable, owing to the greater difficulty in preventing a falsification of the natural conditions of the deposits, and this may call for an additional check.

The thoroughness, care and caution observed in determining the extent and richness of the deposit, and in ascertaining the position of the channel, bedrock or bottom of the deposit, are of the utmost importance, for the success of the whole undertaking is centered in and dependent almost entirely upon the reliability of these tests; all the future examinations will be governed by and related to them.

When the results of this investigation have been satisfactorily verified, sufficient information as to the bedrock conditions should have been obtained to enable one to establish the elevation of the upper end of the sluice.

If all these preliminaries prove satisfactory, the next step should be to investigate the available outlet or outlets, the dumpage facilities, and the character of the bedrock or other ground through which the sluice will pass, whether by cut or tunnel. All these details must be thoroughly examined.

The elevation, the grade and the pavement of the sluices are of paramount importance, for the steeper the grade and the smoother the pavement, the greater the volume of fine material, and the larger the quantity and the sizes of stones and boulders that can be run off with a given amount of water. Most large hydraulic mines do not have fall enough, and are compelled, by their conditions, to be worked on inadequate grades. The determination of the elevation and grade of the sluice will depend upon the elevation and general condition of the available dump for the tailings, and also upon the relative positions of dump and deposit as to height and distance between them, as well as upon the amount of material to be deposited in the dump.

If the tailings can be discharged into either a torrential stream of sufficient size and current to run them away immediately and effectually, or a ravine or channel

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NOTE—An abstract of a paper read before the Technical Society of the Pacific Coast, and published in the *Journal of the Association of Engineering Societies*, October, 1908.

of ample grade or fall to carry them off in their own water; or, if they can be discharged over a precipitous place where they will never accumulate high enough to back up into the sluices, the disposition may be considered ideal, and the elevation of the lower end of the sluice may be established at once.

But if the tailings must be discharged into a place where they will accumulate detrimentally, it will be necessary to place the sluice high enough to prevent the tailings from backing up into the sluice, choking it and rendering it unfit for further operations on that grade.

To establish the proper elevation for the lower end of the sluice under such unfavorable conditions of dump, surveys are necessary to determine the storage space available below the grade of the sluice and to obtain an estimate of the amount of material to be washed off and the proportion that will remain in the dump. If the ordinary conditions make the slope or grade too small, it may be possible to place the dump end of the sluice at a lower level and to utilize a giant near the outlet to elevate or stack up the tailings on one or both sides of the line of the sluice, to be extended as the dump becomes filled; or, the upper end may be placed at a higher level with the installation of a hydraulic elevator to lift the water and gravel into the head of the main sluice. Either one of these arrangements—giant at the dump end or hydraulic elevator at upper end of the sluice—will provide a steeper grade.

#### THE HYDRAULIC GIANT

A hydraulic giant or monitor is a device attached to the end of the mine pipe-line, by which the stream may be controlled in direction. It consists of a metal tube so fixed to the pipe by flexible joints as to be moved readily in both planes. The tapering nozzle end varies in diameter from 4 to 9 in. and has a deflector attached at its extremity for the purpose of directing the stream readily to the proper point of attack. The hydraulic giant is the main implement of the hydraulic miner, and its successful development has made the process of hydraulicking what it finally became. It places a powerful stream of water, a confined force of great magnitude, at the immediate disposal of the operator, who utilizes this force by directing it, according to his judgment, to the point of attack.

The width and the proportions of the sluice are governed principally by the volume of water to be used, and, to a small extent, by the character of the material to be washed, sand and fine gravel requiring a wider sluice, while large boulders should have a narrower one for a given quantity of water. For washing fine material and sand the following widths for sluices under varying

amounts of water will answer: For a 3-ft. sluice, 200 to 600 miner's inches; for a 4-ft. sluice, 400 to 1,200 miner's inches; for a 5-ft. sluice, 1000 to 2500 miner's inches; for a 6-ft. sluice, 2000 to 4000 miner's inches; for an 8-ft. sluice, 3000 to 5000 miner's inches; for a 10-ft. sluice, 4000 to 7000 miner's inches of water. If the deposit contains many large boulders, the above proportions of water should be increased 10 per cent., or perhaps more. The "miner's inch" varies greatly in different localities and is here assumed as equivalent to  $1\frac{1}{2}$  cu.ft. per minute.

Most hydraulic mines contain more or less fine gold which cannot be saved with the ordinary sluices, no matter how well the sluice is paved or how carefully it is manipulated. Under such circumstances, if conditions make it possible, one or more undercurrents should be used. The undercurrents should be placed near and below the lower end of the main sluice, for the reason that by placing them midway fully 5 ft. of the available grade will be sacrificed in order to lead the water and tailings from the under-current back into the main sluice again.

An undercurrent is an enlarged portion of the sluice; its construction is described later in this article. It is used for the purpose of receiving the finer material, containing the fine gold which would escape without this precautionary measure, together with a certain quantity of water. Since in the undercurrent the water is spread over a greater surface, its speed of flow is diminished; this slower current allows the smaller particles of the gold to settle in the riffles more readily.

#### WATER SUPPLY

The supply of water available for working the property should be thoroughly investigated. The total quantity of water, the amount of the regular and constant supply, the height at which it may be delivered at the mine, the length and the proper grade of the ditch necessary to convey the water, the character of the ground over which the ditch line or lines will pass; the necessity for flumes, the supply of timber for building them as well as for other purposes; the necessity of using pipe-lines for crossing ravines or depressions and their length, size, pressure, etc., are features that require detailed inquiry.

If the supply of water is limited during the dry season, a survey of the drainage area and the available sites for storage reservoirs will probably be necessary. The conditions of the drainage area and the ability of the soil to retain water should be investigated, as well as the annual rainfall and how this is distributed through the different seasons of the year, so as to see during what months in the year water will be available for working the deposit.

The grade of the ditch should be as steep as permissible, taking into con-

sideration the height at which the water is required at the mine and the nature of the ground traversed by the ditch. In order to avoid the cutting or eroding action of too swift a current, the grade should be accommodated to the nature of the material through which the ditch passes.

#### RECEIVING RESERVOIRS

One or more receiving or distributing reservoirs are very essential; their capacity will depend upon the character of the deposit to be worked and the facilities for handling it.

If there is a wide face to the mine, so that washing can be carried on at several different points independently, or if there is little pipe clay and few boulders to handle, and the material is easily broken down and washed; if there are no hard bedrock cuts to excavate, and if the main line ditch is short and there is ample storage above the ditch line, then a small receiving reservoir will answer. But if the face is narrow and contracted, and there is much pipe clay to be broken, or many boulders or stumps that require blasting and removal; or if there is much hard bedrock to be shot away, and there are no storage facilities above the ditch, then receiving reservoirs of large capacity should be provided to prevent waste during the interim of cleaning up, shifting the giants, removing boulders, etc., or while doing other work around the mine. One of the receiving reservoirs should be near the head of the mine pipe-line, so that the water may be quickly regulated for the giants or turned off without waste in case of accidents or other causes.

#### PIPES FOR THE MINE

The pipes that lead the water to the giants at the mine should be of ample capacity for carrying, without undue friction, the entire quantity to be used; seldom, if ever, is it good practice to run a portion of the water for the sluice over the bank. The pressure should be such as to allow the giants to be operated at a safe distance from the face, so as to prevent them from being injured or buried by the falling bank, and yet to exert sufficient force to undermine the bank rapidly enough to insure an ample supply of gravel for the sluices.

It frequently happens that the lower portions of the bank are so compact or so cemented that sufficient stream pressure cannot be obtained to cut it speedily enough to supply the sluice; other methods will then have to be used. In such an event, it may be possible to get an ample supply of material for the sluice by piping above the hard gravel into a softer stratum, and far enough ahead to insure the safety of the giant from caves; the giant may then be brought closer to the bank, where it can exert

sufficient force to remove the remaining hard portion. While it may not be possible to cut this stratum fast enough to supply the full capacity of the sluice, possibly one giant can be working on this hard part of the bank while another giant furnishes the remainder of the gravel supply from a softer or caved portion of the bank.

Sometimes this hard material has to be loosened by blasting. This can be done by working the loose top off first and then blasting the remaining portion by means of drill holes, shafts or drifts; or it may be preferable to blast the entire face by running powder drifts into the bank at the bottom, with cross drifts at right angles at their inner ends. In this case the powder is placed in the cross drifts and the main drift tamped solidly with dirt before exploding.

The latter method of blasting the entire bank, while frequently resorted to in the earlier days of hydraulic mining, when small streams of water were used, is now seldom necessary, for the large streams of water under high pressure now used are generally able to overcome the difficulty.

#### DETAILS OF INSTALLING THE PLANT

In discussing the preliminary examination enough has been said to point to the fact that the arrangement of the sluice becomes one of the most important elements in the fitting up of the mine, for no problem requires better judgment and more careful thought than the establishment of the grade, which is determined by the beginning and end elevations of the sluice and the distance between these two points.

Generally the principal difficulty in hydraulic mining is to provide an efficient carrier to convey the tailings to the locality of disposition—a conveyer that will always perform its many important functions with the least interruption and loss of time.

It will be instructive, therefore, to discuss the practical installation of a sluice with more detail, referring to the preceding statements for a knowledge of the general principles that must guide one in determining the practical and economical possibilities, and also in studying the topography for the selection of the line.

#### THE SLUICE.

Practically the sluice is nothing more or less than a flume of special design, built for the purpose of conveying water, which is, again, the conveyer of gravel containing a valuable metal that must be segregated from the mass and saved by making use of its greater specific weight.

The available cross-section may have a width of from 2 to 12 ft. or even more, and a height of from 2 to 4 ft., ac-

ording to the volume of water used; it is made up of the sill, the posts and the side braces, the lining of floor and sides, and the walking plank on each side. There are no cross caps. The sluice contains the floor device for catching the precious metal, which, although almost primitive in its mechanical simplicity, is very effective and has been in use in one form or another from the earliest time in the history of gold washing. It consists of a pavement (which may be of wood, or of stone, or even of iron; in fact, of any suitable material), so placed and arranged that the greatest amount of gravel may be effectually conveyed over its surface; at the same time, since it must afford the gold an opportunity to leave the gravel and sand with which it is moving, numerous pockets, or receptacles, for catching the gold must be provided between the blocks.

In constructing the sluice, great care must be taken that the grade be uniform throughout its length; a short section of lighter grade will govern the transporting power of the material for the entire length of the sluice, while a section on a steeper gradient will cause a more rapid wear of the pavement, and this may necessitate a change or renewal of the pavement on the steeper grade before it is really required on the rest.

A straight sluice is an ideal one, but this is not always practicable. In making turns or bends in a sluice, great care should be taken not to make angles so sharp that the flow of water is thereby retarded or the surface of the water unduly disturbed, for that will cause a stoppage of the material, thereby choking up the sluice. Where an abrupt bend is unavoidable, it must be so constructed that the current will adapt itself to the turn and retain its velocity and smooth water surface. This can be accomplished by cutting the sluice boxes into such lengths that a short turn may be effected by small deflections at several joints.

Where the proposed turn cannot be made with the full length (12 ft.) of the boxes, by giving each box a 5-in. turn, the boxes may be made in shorter lengths, say 6 ft., each having a 4-in. turn; if necessary to make a still shorter curve, the boxes may be made 4 ft. long, each with a 3½-in. turn; even shorter lengths may be used if necessity requires it. At both ends of a curve the turn should be eased.

The outer curve, or that of the longer radius, should be raised a little above the inner one, say ⅛ to possibly as much as ¾ of an inch per foot of sluice width, at the same time increasing the grade a little to overcome the check. Around a very short turn the gradient should be increased as much as 15 per cent., or possibly a little more than that. With this precaution few instances are likely to oc-

cur where a turn cannot be successfully made without sacrificing more than a few inches of the available grade.

The height of the sides of the sluice will depend upon the height and condition of the ground through which it passes. If the sluice is to be in a deep cut, in hard ground, high sides will be unnecessary, and 30 in. may be enough. This will not only save lumber, but it will also prevent a heavy strain on the sluice bottom, and, in the case of cleaning up and changing the pavement, it will afford a handier opportunity for piling the loose blocks on the top, which is so much easier to reach.

If a sluice placed in a deep cut through hard material should fill to overflowing because the gravel is run into it too quickly, or if it be obstructed in any way so as to cause an overflow, the water will return to the sluice without aid as soon as the flow of the gravel is reduced or the obstruction removed. On the other hand, if the ground of the outer cut is soft and liable to be eroded by the created current, or if it lie lower than the top of the sluice, care must be taken that the sides are high enough to prevent any overflow during an obstruction, for if this should occur in a case like this, even to a slight extent, while the sluice is fully charged with material, it would cause a congestion, and unless the flow of gravel from the mine be checked immediately, the entire head of water will overflow the sides, and it cannot be brought into the sluice again until the gravel is removed, which will cause a long and expensive delay.

#### PREPARING THE BED FOR THE SLUICE

Where the sluice is to be laid in a deep open cut through ground loose enough to be hydraulicked, if the necessary quantity of water is at hand under adequate pressure, it will prove economical both as to time and cost to utilize a giant in preparing the bed for the sluice. If water is available, but without pressure, recourse may be had to ground sluicing. The bed may be prepared in this way by getting it almost down to the proper grade and finishing it by hand labor subsequently. Where there is a large amount of material to be removed in this manner in order to prepare the bed for the sluice, a section may be hydraulicked or washed off and the sluices built therein and paved; it may then be possible and practicable to work off another section of the ground through the sluice already completed. In this way the sluices may be extended and continued until the field of operation is reached.

#### TUNNEL

In opening up a mine, a drain tunnel for the sluice is sometimes necessary, with a shaft at its head for the purpose

of washing the material through it into the sluice in the tunnel.

The tunnel should be of sufficient width to afford room to place the loose pavement upon the top of the sluice while cleaning up and changing it. While it is possible to place the loose pavement on the bottom of the sluice during the clean-up, this makes the work awkward for the blocks must be shifted several times before completing the clean-up. If the head of a sluice tunnel is in deep bedrock, or if a shaft is used for any length of time in running material through it, the portion that is subjected to continuous wear and tear for long periods should be securely timbered and lined to prevent its ultimate destruction. Should the bottom of the shaft be in soft ground, liable to be eroded by falling water and material, it must be securely timbered to prevent undermining at its lower end. If the bedrock be very soft, it may be necessary to extend the timbering of the shaft downward a few feet below the bottom of the sluice. The bottom needs no protection other than to prevent the sides from caving.

In order to prevent a choking of the tunnel from an over-supply of gravel, at the shaft the tunnel should be 3 to 4 ft. higher than the ordinary height, and from there should taper to the normal height of the main tunnel in about 50 ft. If the tunnel is to be continued past the shaft, it will prove expedient to place the shaft to one side of the tunnel and far enough from it so that the shaft may be utilized for washing the material, or for running waste water through it without endangering the sluice after its extension ahead and beyond the shaft. This can be done by running a short drift from the main tunnel and placing the shaft at the head of this branch.

The main tunnel should be extended ahead at opportune times and another shaft constructed to be in readiness for continuing the washing without delay when the cuts from the former shaft lose their grade, become too deep in the bedrock or too long to justify their farther extension.

If, in placing the sluice in the tunnel, there should not be sufficient room to allow the loose pavement to be placed on either side while cleaning up, the sluice should be placed close to one side, so as to leave all the space on the other side.

#### DRAINS

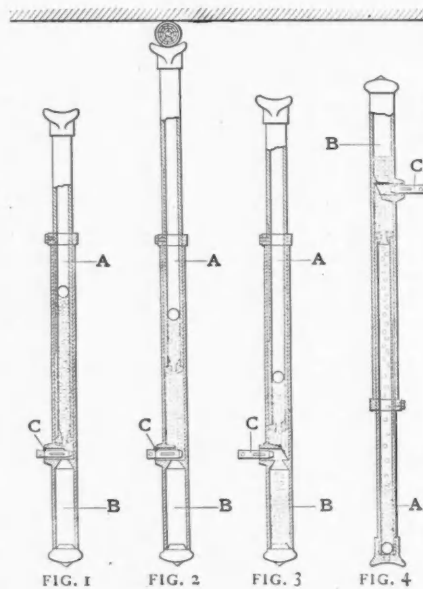
If there be a large quantity of seepage water from the mine, it sometimes is well to construct a drainage box for conveying this water during the time that the pavement is replaced. This drain may be located on the outside of the sluice, its upper elevation even with the top of it. While this will require a high temporary dam to raise the water into the drain at the upper end of the section to be cleaned up, it has the advantage of clearing eas-

ily, while clearing would be difficult with a closed drain placed on a level with the bottom of the sluice, as is sometimes done. Unless there is a large amount of seepage water to handle, the drain may be dispensed with, for the miners soon become accustomed to paving the sluice with considerable water running in it.

Before turning on the water, some means of signaling should be provided near the upper end of the tunnel, a short distance below the shaft, so that in case the sluice begins to fill with an overload of material, or from some other cause, the mine can be signaled to let clear water run until the sluice frees itself.

### Adjustable Mine Support

The *Comptes Rendus* of a recent meeting of the Société de l'Industrie Minérale contain a description of a metallic prop, adjustable in length, and suitable for temporary use in the timbering of drifts and



ADJUSTABLE MINE SUPPORT

tunnels. It is called the Mounier prop, and is made by Crozet & Co., of Chambon.

The prop consists of two telescoping steel tubes containing a lot of small steel balls. The lower tube, B, is divided into two compartments, the orifice between which is closed by the movable plug C, which can be withdrawn so as to permit the balls to drop into the lower compartment. The bottom end of the upper tube is armed with an annular steel plug, having an opening just large enough to permit the balls to drop through freely.

When all the balls are in the upper tube, the prop is ready for use. It is placed in position by simply lifting the upper tube until its top presses against the timber it is desired to support; when this has been done, some of the balls fall through the conical opening into the lower chamber

and then resist the pressure from the upper tube. Fig. 2 shows the prop in this position.

When it is desired to remove the prop, the plug C is withdrawn, allowing some of the balls to fall into the lowest chamber, and releasing the upward pressure on A. This is shown in Fig. 3. To prepare the prop for use again, it is turned upside down and after the balls have fallen back into A, Fig. 4, the plug C is inserted to its original position.

A prop 2m. long weighs, when loaded, only 48 kg. and can be carried around and operated with ease by one man.

The resistance of one of these props was tested in a hydraulic press and was found to withstand all deformation under a pressure of 35,000 kg. With this weight upon it, the upper end was forced into the lower for a distance of 10m., due partly to the contraction of the free spaces among the balls and partly to the elasticity of the tubes.

While under a pressure of 35 metric tons, not the slightest difficulty was experienced in withdrawing the escape plug, nor in removing the prop from its position. The bottom bearing of the prop is ingeniously shaped so as to take its load gradually and to settle into position without danger of producing lateral stresses which might break or distort the tubes.

### Coal and Iron in Austria

Official reports for the full year give the production of coal in Austria for the full years named below, in metric tons:

	1906.	1907.	Changes.
Coal.....	13,473,307	13,850,420	I. 377,113
Brown coal.....	24,167,714	26,262,110	I. 2,094,396
Total.....	37,641,021	40,112,530	I. 2,471,509
Coke made.....	1,677,646	1,855,376	I. 177,730

In 1907 there were 2,602,372 tons of coal used in making coke, showing an average of 1.403 tons of coal to the ton of coke.

The iron ore and iron production are reported as follows, in metric tons:

	1906.	1907.	Changes.
Pig iron made.....	1,222,230	1,383,524	I. 161,294
Iron ore mined.....	2,253,662	2,540,118	I. 286,456
Iron ore imported.....	720,242	799,890	I. 79,648
Total ore.....	2,973,904	3,340,008	I. 366,104
Manganese ore m'd.....	13,402	16,756	I. 3,354
" imported.....	44,100	43,418	D. 682
Total.....	57,502	60,174	I. 2,672

The average of ore to one ton of pig iron in 1907 was 2.41 tons. There were 42 blast furnaces active during the year, showing an average make of 32,941 tons to the furnace. The fuel used in making iron in 1907 included 1,485,272 tons coke, 793 tons raw coal and 33,281 tons charcoal. The larger part of the iron ore imported was from Hungary.

By-products reported in 1907 from coke making included 13,028 tons ammonium sulphate and 1073 tons coal tar.



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## The Anaconda Smoke Question Again

In speaking about the proposed Bureau of Mines, we have several times referred to the mischief which such an organization might do to the mining industry unless its abilities be carefully restricted by the organic law. Our warnings were perhaps regarded at first as pertaining to a danger that might exist in an overwrought imagination, but would be unlikely to develop in practice. However, when we called attention to the vexatious, unwarranted and blundering interference with the mining industry by immature officers of the Forest Service, mining interests in the West received an object lesson in the meddling of a bureaucracy, and became more thoughtful about inviting a new one to take part in their affairs.

Another illustration comes to our mind. Suppose that some person in a Western metallurgical district, suffering from the perennial smelter-smoke dispute, should go to Washington and beseech a sincere, but impetuous, President to issue an injunction against the offending smelter on the ground that its smoke was destroying the adjacent forests, Government property. Suppose this President be a man who is thoroughly convinced, not only as to the fidelity, but also as to the omniscience of his executive organization, including the scientific bureaus, and be naturally disposed to act upon their advice rather than upon that of the outside engineering profession. Suppose this President calls upon his bureau of forestry, bureau of chemistry, bureau of mines, or whatever he thinks of, for advice as to action in this smoke question. Suppose he be told, "The solution is simple. Let this smelter—in Alaska, we'll say—make sulphuric acid! That ought to be done anyway, because sulphuric acid is a valuable commodity. It can be done because the Tennessee Copper Company, at Copperhill, has proved it. If this smelter in Alaska should make sulphuric acid out of its smoke, the forests would not be injured." Of what avail would it be for the managers of the smeltery in question to argue that while the concern in Tennessee, near the phosphate field and a large market for acid, can profitably recover that by-product, the smelter in Alaska would make nearly as much acid in a year as the whole country produces, would be unable to sell it, and in short would not know what to

do with it if it were made? The expert of the bureau, a few years out of school, who knows no more about the market for sulphuric acid than he does about the syntax of the Chinese language, has said that sulphuric acid can be made and ought to be made. With the President this advice goes.

This article is not intended to be humorous. It is simply our conception of the train of reasoning in connection with the new Anaconda smoke case, in which the Federal Government has taken a part. We understand that the President is considering the matter with a view to causing an injunction to be issued against the company. An expert from some bureau has been to Tennessee, and he knows now that a copper smelter can make sulphuric acid.

We hope that the Government will in this matter go outside of its bureaucracy and secure the advice of a chemical engineer who knows about sulphuric acid. The more quickly it does this, the more quickly will the great industrial company be saved from pestering and from expense in defending itself.

We are firmly convinced that a bureau of mines will find a great many things to do, and the bill now pending before the Senate will not restrict it. As we have said before, there would be no danger under Doctor Holmes, but what might happen under his successor?

## The Tariff Hearings

The tariff hearings began as a joke. The feeling was strong that the tariff would be revised, but upward rather than downward. To lend some color of seriousness to the operation, Messrs. Payne, Dalzell & Co., caused an "investigation" of the cost of production abroad to be made by our consuls and other luminaries. The hearings began with demands by rapacious producers for an increase in duties of 5 to 500 per cent. Suddenly there was a change, brought about by general disgust at the nature of the hearings, by Carnegie's statement that the steel makers needed no protection, and finally by Mr. Taft's announcement that a real revision would be made.

Since then the hearings before the Ways and Means Committee have been of quite a different color. The hoggish manufacturer has disappeared and his place

has been taken by big captains of industry, who have gone to Washington under subpoenas. This manifests a desire on the part of the committee to learn facts. The men whom they have invited to instruct them are not theorists and doctrinaires. They know things, but are not always anxious to tell. The present problem of the committee is to extract information from them. The operation has been amusing, more so perhaps to their conferees in business than to the committee itself.

We can picture the jovial Mr. Schwab on the stand, ingenuously explaining that when he was president of the Carnegie Steel Company, nine years ago, he was still so young and inexperienced that he deceived himself as to the cost of producing pig iron and steel; and that he was then expressing an opinion to help Mr. Frick and Mr. Morgan crack up their goods, while in Washington the other day he was animated by a different purpose. With this fickle explanation, the committee must have felt that Mr. Schwab was a reliable adviser. For our own part we feel real sorrow that the poor iron miner of the Mesaba has been unable, even with all of the modern improvements, to prevent the cost of digging iron ore from doubling or trebling during the last 10 years.

Then there was Mr. Brush, of the American Smelting and Refining Company. The Japanese acrobat who performs on the tight wire at the Hippodrome has an easy task compared with his. The consumers claim that he jacks up the price of lead; the miners think that he jacks it down. He himself produces a lot of lead in the United States. Also he produces a lot in Mexico, which he brings into this country for refining in bond, scooping incidentally a certain amount of exempt lead, which is profitable. Then there is the matter of the National Lead Company that is to some extent interested in having cheap lead, in which the Guggenheims were once important factors. According to the last report of the National Lead Company they are so no longer, but they still have a representation upon the board of directors which seems to confuse the Ways and Means Committee. Mr. Brush was a perfect witness. Champ Clark might as well have tried to pick up a greased ball. We fear that the committee did not learn very much about the inwardness of the smelting business from Mr. Brush. However,

he was generous in admitting that the duty on lead might be reduced a little without hurting the smelters very much.

### Copper Producers' Association

A meeting of copper-producing interests was held at the office of Phelps, Dodge & Company, Dec. 18, to consider the revival of the former association for statistical purposes. Upward of 90 per cent. of the copper production of the United States was represented at this meeting and the sentiment appeared to be generally favorable to the proposal. A committee was appointed to frame a set of by-laws and another committee to consider the appointment of a statistician. A second meeting of the producers will be held early in January.

The prospect that this organization will be effected for the purpose stated is gratifying. We have repeatedly argued that what the copper industry needs more than anything is the publication of prompt and frequent statistics. This can be done only by such an association as is now contemplated.

The plan under consideration does not in any way contemplate an understanding for the regulation of production and price, except insofar as individual producers may act by the guidance of the statistical information that will be obtained. That is, of course, one of the purposes for which statistics are collected in any industry. There need be no fear of an "understanding" in the selling of copper. In spite of all wishes to control the price of this metal and the attempts to do so in the past, the market has remained open and competitive. It will continue to remain so.

### The Geological Survey Suffers from Fire

The Geological Survey, on Dec. 16, had a fire in its headquarters at Washington, whereby many maps, photographs and other records of value were destroyed. About three years ago, the JOURNAL forecasted that this would happen sooner or later, the building rented for the Geological Survey being a dangerous fire-trap. We urged then that Congress should provide the Geological Survey with a suitable headquarters. The failure to do this is another evidence of the incompetence

of Congress. That body provides itself extravagantly with sumptuous office buildings, and absurdly builds stone post-offices in many hamlets by a log-rolling understanding to provide fat for constituents. But just as our embassies abroad are neglected, so has been the Geological Survey—one of the national institutions of which the country should be proud. We hope that the recent experience will prove a blessing in disguise by inspiring a slothful Congress to put aside its promotion of special interests sufficiently to provide the Geological Survey—which is an interest of all the people—with an adequate building. If Congress can be driven to do that, it might also be led to see the advisability of providing the Geological Survey with an endowment, or arrange that it should have a fixed annual appropriation that would relieve the director of this great scientific organization from the necessity of teasing and tickling members of Congress in order to secure the funds necessary to carry it on, which results in appropriations for miscellaneous, non-geological work of no particular value to anybody, to the exclusion of the work that is the main function of the organization.

### The Stock of Copper

A good deal has been said lately about the stock of unsold copper in this country. We believe that there is such a stock, but, whether it is more or less than the stock at the beginning of the year (which was 120,000,000 lb. of refined) no one can say, because no one knows yet what the production and consumption have been. Statistical estimates are apt to be misleading unless they be compiled intelligently and upon a uniform basis.

There are three ways of computing the production, namely, (1) on the basis of the mine output, (2) on the basis of the smelters' output, and (3) on the basis of the refiners' output. For any given year the three figures may be nearly the same, or they may be wide apart. The year just closing is one in which they are likely to be wide apart.

Under no circumstances do we place any reliance upon statistics of the mine production, because we know the insuperable difficulties of collecting them accurately. The figures of the smelters and refiners can be collected accurately, but they represent materially different periods of time, because the product of the smelt-

ers is upward of two months in transit and process of refining before it appears upon the market. Consequently in a year like 1908 which began with the refiners operating at reduced capacity and several important smelters like Washoe and Cananea closed down, resuming operations later in the year, the respective totals are likely to show a good deal of difference. Obviously the estimate of the stock of refined copper can only be combined properly with reported production of refined copper.

Errors arising from the above particulars probably account for the present difference of opinion as to the amount of unsold refined copper. The selling agencies say that they have not got any to speak of, but the refiners do not say how much they may have in storage for speculators and other outside persons. As we said in the first place, we have no doubt that there is an unsold stock, but the amount of it will continue to remain a matter of uncertainty for some time to come.

### Smelting Competition

When the American Smelting and Refining Company and the Utah Consolidated Mining Company fell out over a difference in the matter of a smelting contract, and the mining company made plans to build its own smeltery, the Smelting company probably did not think that this was going to lead to a general competition in the smelting business. At the worst it promised competition only in the Salt Lake market, which had previously been a competitive point owing to the operations of the United States Smelting Company. Now it has been announced that the syndicate headed by Cole and Ryan, which is going to build the smeltery where the Utah Consolidated ore will be treated, has more comprehensive plans; nothing less, indeed, than a general competition in the custom smelting business, involving the erection of plants at all points where there is a satisfactory prospect of profit.

Competition in the general smelting business has long been threatened. The United States Smelting Company has indeed embarked in it on an extensive scale, but its operations have been limited to comparatively few centers, having spread but little outside of the radius naturally commanded by Salt Lake. Its plans have not been formulated on a systematic ex-

ploitation of all the important ore-producing districts. Such schemes of that character as have been discussed have one after another come to naught, wherefore talk of competition in the smelting business has been considered like the cry of "wolf." We are led to believe that the present plans mean the real thing.

What those plans are has not yet been disclosed. However, it is indicated that they are far-reaching, and Messrs. Cole and Ryan are known to be ambitious. The weakness in the stock of the American Smelting and Refining Company indicates knowledge of what is impending. It would be interesting to discover to what extent the new scheme will be financed from the proceeds of bear operations in the stock market.

### Mr. Carnegie Speaks

The Laird of Skibo had the day of his life with the Ways and Means Committee, Dec. 21. He was no witness to be heckled; rather did he heckle the committee. A retired ironmaster who has converted his brains and knowledge of the business into a hundred millions or more is not a man who can be flouted as an ignoramus. The committee-room became a class-room, with Mr. Carnegie the teacher and the committee the pupils, who were often dense. We can spare space for only a few of Mr. Carnegie's gems.

He laughed at the elaborate statements of cost submitted by Messrs. Schwab, Gary and Felton. "There are more ways of figuring cost than of killing a cat," said he. "These men who come here are trying to tell you, the truth, but they speak in a language that you do not understand." (This to a committee that is going to equalize manufacturing cost the world over!)

Those minutely itemized statements of Mr. Schwab and Judge Gary, which had been mulled over in two long sessions, continued to trouble the committee. They wanted Mr. Carnegie to explain them, but he insisted that he was unable to make an analysis of the items.

"How, then, do you figure out the production cost of the United States Steel Corporation?" demanded Mr. Dalzell, with some asperity.

"Well," returned Mr. Carnegie, "the last report of that company showed profits of \$158,000,000 on 10,000,000 tons of steel.

That is, roughly, \$15.50 a ton. Does that enter your brain? Can you get at it in any other way?"

Mr. Carnegie is something of a "pawky chiel" himself. He smiled triumphantly while the committee remained silent.

Incidentally Mr. Carnegie punctured the vagary of Judge Gary that the trusts may defy the law of supply and demand, which has been defended by a university professor, as our readers will recollect. Mr. Cockran asked if a reduction of the price of steel products would not stimulate consumption. Replying in the affirmative, Mr. Carnegie took advantage of the opportunity to give the committee a lecture on what manufacturing companies should do when a panic comes on. It is a great mistake to try to hold up prices in time of panic, he said. If he had been at the head of the Steel Corporation during the recent panic his policy would have been to reduce prices enormously. The result of such a policy would be that a man in New York who was contemplating the construction of a skyscraper would say: "Here's a bargain. I'll buy my steel and start work at once." This would be followed in other parts of the country and business would begin to pick up.

This is good economics and sound sense. It was by the practice of such a policy that the Carnegie Steel Company became so extraordinarily successful and Mr. Carnegie earned his millions.

WE LEARN FROM the secretary of the American Institute of Mining Engineers that the next meeting of the Institute for the reading and discussion of papers will be held at New Haven, Conn., beginning Tuesday evening, Feb. 26, 1909. Leading topics for consideration at this meeting will be the conservation of natural resources; professional education; and the Panama canal. The full program will be sent to members by circular in January.

THE CORONER'S JURY appointed to take testimony in the case of the Marianna explosion, held a two days' session at Washington, Penn., and on Dec. 18, rendered a verdict finding that the 154 deaths were due to a blown-out shot. The jury was composed of five farmers and one machinist; the inquest was a bigger farce than is usually the case. We expect to review the evidence in detail next week.

# Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and  
Debatable Points Suggested by Articles in the Journal

## CORRESPONDENCE AND DISCUSSION

### Alumina in Copper Blast Furnace Slags

The contribution on this subject, by Harley E. Hooper, Nelson, New Zealand, published in the JOURNAL of Dec. 5, and written with the intention of throwing further light on the subject insofar as my article in the JOURNAL of Aug. 8, 1908, dealt with Carl Henrich's experiences at the works of the Champion Copper Mining Company, of New Zealand, and as published by him in the JOURNAL of July 17, 1886, is interesting at least even though it might be considered disappointing. If his conclusions are correct, this incident only serves as another "instance to prove that unless all the conditions under which a furnace plant is operating are known or stated, that a few figures such as a slag analysis may sometimes be more misleading than instructive," a remark which may be found in my article of Aug. 8, 1908.

It is extremely disappointing to learn of any possible chances for criticism in Mr. Henrich's analyses. I never had the pleasure of his acquaintance and know nothing further about his New Zealand experiences than the information published by himself. However, the same article from which I extracted the few notes published as a part of my contribution of Aug. 8, 1908, also deals with his (Mr. Henrich's) previous experiences at Morenci, Arizona, and the analyses he cites in connection therewith show substantially the same slags as those that are being made there today; his analyses of the Copper Queen slag, with 15.4 per cent. alumina is also unquestionable, as it has been duplicated many times since George B. Lee, who superintended the last year's operations at the old Bisbee plant of the Copper Queen, and who is at present in charge of the large Douglas works, has frequently mentioned making slags at Bisbee containing as high as 20 per cent. alumina. That he made them, there is no doubt; but that an analysis of the dump will show that amount, there is also no question for doubt. It will not. The slags described were exceptions rather than the rule.

It is always the exceptions that attract attention, and when they indicate desirable possibilities they call forth study and an endeavor to make the exception the rule, and so on *ad infinitum* until perfection shall have been reached. The evolution of our copper-matting blast furnaces

from the 36-in. circular type to Mr. Mathewson's furnaces 120 ft. long is a most striking instance of the value of noting exceptional features, all combined being the result of a study of slags, mattes, their tonnage ratio to each other, air volume, tuyere area, hearth area, labor efficiency, wall accretions, settler capacities, etc.

#### HEINRICH'S DATA

In Mr. Henrich's article stress is laid on the importance of correctly determining alumina as a separate constituent, mentioning some of the causes for error in its determination, which 20 years ago might have been more confusing than now. That Mr. Henrich was a student and kept himself informed as to the proceedings in metallurgy at that time is evidenced by his quotations from and references to the writings of others. Dr. M. W. Iles, from whose writings he quotes, was one of the pioneers of our present day chilled slag analytical methods, with which, we are entitled to infer that Mr. Henrich was familiar.

Mr. Henrich's description of the Nelson ores 22 years ago does not differ greatly from Mr. Hooper's present information, except that Mr. Hooper calls the gangue serpentine, and Mr. Henrich says that it is "locally called serpentine," and that:

"The country 'serpentine' in which the lodes are situated is a monosilicate of alumina and magnesia of approximately the following composition:  $3 MgO, Al_2O_3, 3 SiO_2$ . The 'serpentine' of the lode itself, occurring with the ore, has lost some of the magnesia and silica, removed probably by the action of the sulphatized waters engendered by the decomposition of the pyrites of the lode. This 'serpentine' is on an average of the composition:  $MgO, Al_2O_3, 2 SiO_2$ . These formulas are based on the analysis of samples of large quantities of rock, and they represent the average constitution of the rock and not any of the rare crystals of the minerals contained in the rock.

"The lode serpentine sometimes contains more silica than is given in the above formulas, but frequently also less, and then more."

#### HIS DEDUCTIONS CONCERNING ALUMINA

Mr. Henrich dates his article at Nelson, New Zealand, May 17, 1886, and supplements it with another under date of July 16, 1886, published in the JOURNAL of Aug. 21, 1886, in which he mentions that

he is satisfied with his opinion as to the acidic action of alumina in his blast-furnace slags by a further smelting of 140 tons of material, but does not state that he attempted slags with such high alumina contents. A deduction would be, that in view of the prevailing opinion at that time as to the basic action of alumina, he commenced operations on that supposition, the incorrectness of which he endeavors to prove in his first article, which cites the high alumina slags, and which evidently were subsequently abandoned for the more fusible combinations as given by Mr. Hooper and from which he selected his sample from 100 tons of the slag.

If Mr. Henrich gave us *ultra* or *infra* results as compared with his regular practice, it was with the idea of elucidating the then obscured action of alumina, and we owe him for it. While I consider Mr. Hooper's results as authentic, I do not think that they impair the authenticity of Mr. Henrich's. That Bisbee made 20 per cent. and higher alumina slags is unquestionable, but to find them there today would be as tedious as searching a haystack for a needle.

In reply to Mr. Hooper's inquiry if I have ever run a 31-per cent. alumina slag, I answer no. I gave Mr. Henrich's as the most extraordinary slags, in this respect, that I had what I considered an authentic account of, and even Mr. Henrich associates them with freeze-ups.

In reply to his inquiry as to, "What is the highest alumina content allowable for economic working under 'favorable' conditions," I should say that it all depends on what "favorable" implies. It generally simmers down to financially successful operations, regardless of conditions, and the answer would necessarily be vague. The highest I have ever been called upon to run approximates 16 per cent. alumina. But I should say, that with a proper furnace, either blast or reverberatory, and a fuel capable of intense heat, that the limit would be far above that point.

#### MAGNETIC OXIDE IN SLAGS

In reply to Mr. Hooper's inquiry with reference to the formation of magnetic oxide of iron in his reverberatory furnace, I may say that it is a very difficult question to answer, when a person is unfamiliar with all the conditions that may govern the case. Magnetic oxide of iron is generally the result of an incorrect balance between reduction and oxidation,

and even though we realize this, sometimes it seems almost impossible to correct the difficulty. It seems rather queer, however, that a magnetic oxide of iron should settle on top of his furnace charges, from which we deduce that it floats on the slag. Its proper location in the reverberatory furnace would be between the slag and the matte. I have experienced troubles of this kind in connection with copper-matting blast furnaces, wherein this magnetic oxide of iron would appear as a "mush" in the settlers between the slag and the matte, and its origin is rather puzzling.

I have entertained the belief that its formation in the instances that I have in mind (in settlers into which the slag and matte were delivered by blast furnaces through a water-jacketed, copper, boiler-plate spout, kept heated on top by means of a coal fire), was due to the burning away and disintegration of this coal and particles of coke, some of considerable size, formed by this coal fire, and which would be washed into the settler and hover near the entering stream of slag until entangled and carried below the surface. In this case it might be reasonable to believe that the particles of coal and coke would cause a reduction of some of the iron in the slag, a condition which would be appreciable only after an accumulation had taken place during a substantial period of time.

Now how this metallic iron could be reoxidized to magnetic oxide I cannot explain, nor am I ready to state that it is magnetic oxide. It may possibly be largely composed of elemental iron. On account of its location in the settler and its intermixture with slag and matte, it was practically impossible to secure an uncontaminated sample. What I have done is to take a ladle with a vertical handle, lower it into the settler below this "mush" and bring up some slag greatly enriched with this substance. All I can say is that the samples assayed abnormally high in iron, and were attracted by a magnet. Sometimes this material may disappear after a change in slag composition; but if not, my remedy has been to take the tap plates off the settler and to wash it out with all possible speed, assisting the operation after the settler was drained out by flushing it with hot converter slag.

#### PRESENT PRACTICE AT CANANEA

Since the resumption of operations at Cananea, with probably unequalled facilities for mixing furnace charges on a large scale and obtaining uniform results, we have been making slags continuously that previously involved serious troubles. For the month of October, 1908, the average analyses of about 30,000 tons of slag from the blast furnace was: Silica, 39.5 per cent.; alumina, 10.3 per cent.; iron oxide, 30.8 per cent.; lime, 15.7 per

cent., representing an oxygen ratio of acids to bases of 2.27 to 1, this with satisfactory furnace speed, or 4.52 tons per day per sq.ft. hearth area, with a charge containing so much fine material that 52.4 per cent. would pass through a ¼-in. square opening.

The highest silica-alumina slag we have obtained continuously from the blast furnaces gave the following analysis: Silica, 41.1 per cent.; alumina, 11.8 per cent.; iron oxide, 27.8 per cent.; lime, 16.1 per cent., representing an oxygen ratio of acids to bases of 2.53 to 1, and a hearth activity of 3.6 tons. This represents the smelting of a bed containing 4500 tons of material, and was the slowest furnace speed we have had. The fastest bed contained 5500 tons and delivered a slag containing: Silica, 37.7 per cent.; alumina, 10 per cent.; iron oxide, 33.9 per cent.; lime, 14.8 per cent., with oxygen ratios of acids to bases of 2.09 to 1, and a hearth activity of 6.1 tons. In all these slags we do not daily consider any other elements than those mentioned, whereas we appreciate and are aware of the existence of manganese oxide, magnesia and zinc oxide in small quantities, as well as copper and sulphur.

Our oil-fired reverberatory for the month of October, 1908, delivered a slag containing: Silica, 41.3 per cent.; alumina, 10.8 per cent.; iron oxide, 36.4 per cent.; lime, 3.7 per cent., with oxygen ratios of acids to bases of 2.91 to 1. There was also much more zinc oxide in this slag, and the furnace smelted a lower tonnage and with more fuel per ton than has since been the customary practice with a much more basic slag.

The accompanying table gives a week's exceptional results during the month of October, 1908, when we were introducing continuous fettling by dropping the silicious material along the side and bridge-walls of our reverberatory furnace through holes in the roof.

REVERBERATORY SLAGS PRODUCED DURING AN EXCEPTIONAL WEEK.

Treated Tons Per Day.	Silica.	Alumina.	Iron Oxide.	Lime.	Oxygen Ratio Acids to Bases.
192	40.5	10.6	40.5	2.8	2.69
192	41.4	9.7	38.4	4.3	2.71
154	41.0	8.7	39.2	4.8	2.56
201	41.2	10.2	38.4	3.4	2.80
190	42.2	10.6	35.0	3.2	3.14
169	45.0	11.3	32.0	3.9	3.54
167	49.1	10.0	28.8	4.0	4.07
1265	42.9	10.2	36.0	3.8	3.03

These latter results are not advised nor to be emulated. The slags were all clean as far as copper is concerned, but the fuel percentage was far too high and the normal capacity of the furnace should have been about 250 tons per day. The

increased silica in the slag came from the fettling material that would float away before we succeeded in getting it to "bed" down properly. The following week was substantially the same, but in inverse order. The higher silicas cannot even be considered slags, as they were entirely too viscous to run and were only pulled out of the furnace with extreme difficulty.

CHAS. F. SHELBY.

Cananea, Sonora, Mexico, Dec. 7, 1908.

## The Conservation Commission in Washington

SPECIAL CORRESPONDENCE

Senator Flint, of California, who at the recent meeting of the National Conservation Commission in Washington, presented the report of the mineral section of the commission has issued a statement in which he estimates that the waste of mineral products in the United States amounts to \$1,000,000 per day. The waste of natural gas amounts to 1,000,000,000 cu.ft. per day.

"The waste in coal mining is equivalent to about one-half of the total product mined, or for the year 1907 about 240,000,000 tons," says Senator Flint. "With an entire waste of all mineral products approximating \$1,000,000 per day, and with the mineral production of the United States during the past year amounting to \$2,000,000,000, this waste is equivalent to more than one-sixth the value of the total production."

During the past year in coal mines more than 5000 men were killed and more than 7000 injured. The number of men killed in the United States for each 1000 men employed in the mines is estimated as from two to four times as great as it is in other coal-mining countries.

Senator Flint presents expert estimates showing that the coal supplies of the United States contain about 1,400,000,000 tons of coal available for mining under existing conditions.

Iron-ore estimates, based upon data gathered from every available source, indicate that of the high-grade ores we have in sight available for use under present economic conditions 3,840,000,000 tons, of which nearly two-thirds are located in the Lake Superior district. In addition to this, the final estimate of low-grade iron ores, those not available for use under existing conditions, shows that there are about 59,000,000,000 tons distributed throughout the iron-producing districts. At the present increasing rate of consumption it is stated that the high-grade iron ores will have been largely consumed by the middle of the present century; while the supplies of high-grade coal may

be extended to near the middle of the next century.

The chief waste in oil is alleged to be its excessive use for fuel purposes—more than 18,000,000 bbl. having been used during the past year for locomotive fuel.

As to copper, lead, zinc and the precious metals, it is estimated that without discovery of other deposits, at the present increasing rate of consumption, the known supplies of these materials will not last beyond the present century, and the probability of discovery of new supplies is diminishing with each year. The losses in the mining and treatment of these metals are greater than with iron. With lead, zinc and iron ores the chief source of loss is through rust, electrolytic action, etc. Senator Flint urges that success in the effort to conserve resources will largely depend upon the State Governments rather than on legislation by Congress.

### A Statement by Daniel Guggenheim

Daniel Guggenheim made the following statement to the press, Dec. 17:

Quite some years ago the speculating public were kept in a ferment by the cry of "wolf!" in connection with sugar refining stocks due to competition between the Havemeyers and the Arbuckles. It is now the Smelting Company with other large financial interests. It seems that the people must be fed upon something of this kind. As the American Sugar Refining stocks are now so largely absorbed and put away in the boxes, the American Smelting and Refining Company's common stock is being speculated with in its stead. This will continue until it is absorbed and put away in the boxes, unless some other security shall in the meanwhile become more popular with the speculators. There is nothing new that I can see or any change of policy in the so-called Ryan-Cole development of the copper-smelting business.

The group of gentlemen known as the Ryan-Cole and their following have been for many years in the copper mining and copper smelting business. They are great believers undoubtedly in copper as a metal. So am I. They can see that a great deal of money can be made in this business—as can be when intelligently prosecuted. They have interests in copper smelters and copper mines in various parts of the United States and properties in various parts of the world. It is a business they have gone into, and whether or not they have now formed a large company for the purpose of taking in other interests or for the purpose of building new smelters and buying new mines it is nothing new, nor is it anything that the American Smelting and Refining Company's shareholders need look upon with any concern whatsoever,

because the American Smelting and Refining Company has not a single exclusive copper smelter in the United States. It has a few copper furnaces at some of its plants which are simply used as auxiliary furnaces to provide for by-products and such ores as are contiguous to their locality.

The American Smelters Securities Company has only one exclusive copper smelter in the United States. Neither of these companies is likely to have in the near future any more exclusive copper commission smelters because they look upon copper smelting as an extremely annoying business, and if one is fond of litigation and likes it as a steady diet I strongly recommend building a copper smelter in a farming locality. The American Smelting and Refining Company is largely interested in copper refining. I personally am very fond of and believe in copper mining as a highly profitable business, and copper refining as a very satisfactory business, but I would not personally go into the copper commission smelting business or advise any companies with which I am connected to go into the copper smelting business unless to smelt the copper ores from their own mines. By that I mean I do not believe that the smelting of copper ores on commission for others is a business that at the present time, at least, is desirable. If one has copper mines and a smelter located away from the farming district to treat the ores of those mines this is an entirely different affair.

As regards the lead smelting business of the American Smelting and Refining Company fully 90 per cent. of all the lead ores of the United States and in the Republic of Mexico are now controlled by ownership of mines and by long-time contracts. These ores are either controlled by the American Smelting and Refining Company or by its present competitors. And I wish to state further that the earnings of the Smelting Company at the present time, as well as of the Securities Company, are considerably in excess of the dividends that are being paid.

### The Caddo Oil Field

The Secretary of the Interior has withdrawn from entry, by the President's order, all the public lands in the petroleum and natural gas field in northwestern Louisiana, known as the Caddo oil field, and embracing about 6500 acres. This action is taken pending a careful geologic investigation by the U. S. Geological Survey, with a view to preventing the great waste of natural gas now chargeable to the Caddo field.

Representatives of the Survey recently visited the Caddo district and report a waste of natural gas which is beyond all precedent. This field as a large oil producer has only lately come into promi-

nence; but several years ago one of its natural gas wells began to leak badly as a result of poor work in packing the well above the gas-bearing sand. The leakage increased and the well "blew out;" the pipe, derrick and entire apparatus were engulfed in the hole and submerged by water which blew out with the gas.

Three additional similar cases are reported, due to indifferent work, the gas blowing out under tremendous pressure, and a fifth eruption is expected soon. In one well the waste has been going on for four years, an incredible amount of gas having been dissipated.

In another well a crater about 300 ft. in diameter has been formed, containing water and some petroleum, and in the center the gas boils up in the form of a large mud volcano. This well has been wasting gas about two years at a rate, variously estimated by persons familiar with gas wells, of 15,000,000 cu. ft. every 24 hours. In another well the discharge is constantly burning a gigantic torch, flaming night and day from 75 to 100 ft. high.

The total waste in the Caddo field, an only partially developed region, is estimated by the chief geologist of the Geological Survey at 75,000,000 cu. ft. of gas daily, or more than one-twentieth of the total amount of natural gas usefully consumed in the entire United States.

The work of drilling and packing many of the wells in the field is described as most careless and faulty, and it is this which is causing such deplorable waste of a great natural resource which should make prosperous the entire section. The object of the withdrawal of all the public lands in the vicinity is to insure the Government's retaining title to the land, pending necessary legislation as well as action by the State officials.

Remedial engineering work is also necessary to stop the wasteful flow of gas which is now depleting the common supply under the Government as well as under other private lands. No attempt is being made to stop the flow since the oil men have the fanciful belief that after the gas has exhausted itself the production of oil will be improved, an idea for which there is no geological justification, as this rapid escape of gas rather injures the oil chances of the field by permitting an influx of salt water as the gas pressure is removed. Up to the present time nothing whatever has been done to check this waste of hundreds of thousands of dollars, but it is probable that some effective measures will follow the action of the Secretary.

During 1907 there were 369 blast furnaces operating in the United Kingdom. These smelted 25,123,759 tons of iron ore and produced 10,114,281 tons of pig iron. The coal consumed by these furnaces was 21,119,547 tons.

## Charles M. Schwab on the Tariff

The evidence of Charles M. Schwab before the Committee of Ways and Means in Washington was expected with some interest, as it was thought that he would be able to contribute valuable information, owing to his long and intimate connection with the Carnegie Steel Company and the United States Steel Corporation. Mr. Schwab did give some information as to costs, and his opinions may be accepted as those of a man thoroughly posted on the details of steel manufacture and still actively engaged in it; but they can hardly be said to have thrown much light on the general discussion.

### COST OF STEEL RAILS IN 1899

The first part of Mr. Schwab's evidence was largely taken up in explaining a letter written by him in 1899, which was published some time ago. In that letter he estimated a good profit for the Carnegie company on steel rails at \$17.50, and even \$16.50 per ton, and said:

"As to the future, even on low prices, I am not sanguine. I know positively that England cannot produce pig iron at actual cost for less than \$11.50 per ton, even allowing no profit on raw materials, and cannot put pig iron into a rail, with their most efficient works, for less than \$7.50 per ton. This would make rails a net cost to them of \$19. We can sell at this price and ship abroad so as to net us \$16 at works for foreign business, nearly as good as home business has been. What is true of rails is equally true of other steel products. As a result of this, we are going to control the steel business of the world.

"You know we can make rails for less than \$12 per ton, leaving a nice margin on foreign business. Besides this, foreign costs are going to increase year by year, because they have not the raw materials, while ours are going to decrease. The result of all this is that we will be able to sell our surplus abroad, run our works full all the time and get the best practice and costs in this way."

Mr. Schwab admitted that he had been carried away to some extent by "youthful enthusiasm and optimism," but stated that his figures were substantially correct at that time. He put the cost of 58 per cent. Mesabi ore at Pittsburg at \$4.50 per ton of pig iron. This cost was made up of 15c. royalty per ton of ore; 25c. for mining; 65c. freight to Lake Superior; 60c. lake freight, and 70c. freight from Lake Erie port to Pittsburg. The cost of the coke used in making a ton of pig he put at \$1.75, and of limestone at 35c. The cost of labor he put at \$1.65, making a total of \$8.25 per ton of pig iron. Adding \$3.75 per ton for converting pig iron into rails made the total cost of rails \$12 per ton, as stated in his letter. He explained, however, that this included the

materials and labor only with no allowance for general expenses, for depreciation of plant, for charges on capital, or for profits. He stated also that in that year the wages paid were very low, as a result of the surplus of labor available. For the same reason the cost of labor at the mines was low. The mining costs were also put very low, as the work on the Mesabi at that time was mainly on the surface and the ores could be cheaply handled.

### PRESENT COST OF MAKING RAILS

At the present time, Mr. Schwab said, the cost of Mesabi ore in the ground—or royalty—has risen to \$1 per ton of ore; freight to Lake Superior to 85c.; lake freight to 70c.; unloading and railroad freight to Pittsburg to \$1. Moreover, the average grade of the ore has fallen from 58 to 50 per cent., so that, with allowance for loss, the cost of ore per ton of pig iron is \$8.50. Coke is higher, costing about \$2.60; limestone 75c. These items, with labor, would bring the cost of pig to \$13.15; or with general expenses added, to \$14 per ton. The labor cost has not increased, because the extensive use of machinery in handling material had reduced the number of men employed at a furnace. The cost of converting pig iron into rails has practically doubled, amounting now to \$7.50 per ton. The last-named increase is mainly due to the higher cost of ferromanganese and other materials, to the greater care taken in making steel, the larger rejection on ingots, and other charges. This would make the cost of bessemer rails now about \$21.50 per ton, and of open-hearth rails a little higher.

### COST OF RAILS ABROAD

When questioned as to the cost of making rails abroad, Mr. Schwab was rather less definite in his statements. The difference in cost between the United States and Germany, he thought, was mainly in the cost of pig iron. The conversion of pig iron into steel and the rolling of the rails would cost about the same in both countries. In making pig iron the Germans had an advantage of \$2 to \$2.50 per ton, because there is less to pay for transportation and their methods are more economical. The cost of steel resolves itself into two elements, materials and labor. The steel can be made in the United States as cheaply as anywhere in the world if the cost of these items is kept down. With regard to conditions in Germany especially he said:

"The Germans have made the greatest advance in economic metallurgy of any nation in this world during the last five years. They have utilized their by-products to a greater extent than any other manufacturing nation. Not only that, but they have developed their mechanical appliances with reference to manufacturing to an extent that no other nation has, and they have developed their quality to a greater extent than any other

nation during these past five years. In other words, manufacturing in Germany five years ago seems to have had a complete renaissance, and they have advanced very much more rapidly than any other nation, for the reasons I have given. For two reasons: the first, the very excellent technical education of their metallurgical engineers in Germany; the second, the most important, the labor conditions in Germany as compared with the conditions in England. I think the labor conditions in England are the worst of any of the great manufacturing countries of the world. \* \* \* Germany is rapidly adopting the same methods and blast-furnace practices that we are, with reference to economies in handling the material, but they have gone much further than we have in the introduction of the use of their waste gases. Germany was the first country to use waste gases for the development of power, which makes a very large saving in the cost of pig iron. We are rapidly adopting it, but, to tell the truth, we are following Germany in that respect."

### PRICES OF RAILS

With regard to prices he said that in 1896 the price of steel rails was \$28 at mill, the same as now. In 1899 there was competition among the steelmakers which brought down the price to a low point. Since the organization of the Steel Corporation the price has been uniformly \$28 per ton.

With regard to finished steel other than rails, many questions were asked; but the following answer to one of them gives the substance of all: "The cost of plates and the cost of all steel structural shapes—that is, rolled products—in round figures is about \$3 a ton above the cost of rails. There is a great variety of specifications and qualifications with reference to these special grades of steel that make their cost very considerable, but I am taking the common standard shapes. I mean by that columns for buildings, girders for buildings, or plates for ships, or any similar line, and you can reckon that as a general thing the cost is about \$3 to \$4 a ton above that of rails."

### PROFITS IN THE STEEL TRADE

Mr. Schwab's ideas as to profits in the steel business are decided, and can be summed up in the following answers:

"I believe that in the manufacture of steel, unless a man can see a profit of 20 or 25 per cent. a year, he had better keep out, for the reason that changes in the methods have necessitated such frequent and radical changes in plants that the charge-off each year for changes and depreciation is very much greater than people not in the business possibly dream of. I could state to you many illustrations of that. During my superintendence of the Braddock Works, in five years I rebuilt the converting department three times.

Therefore, the ordinary charge of 5 per cent. for depreciation will not nearly cover the investment. I think that in any manufacturing, you ought to have at least 25 per cent. I think where you consider steel from the ore down, where you mine the ore and manufacture the coke, and do all those things incidental to the manufacture of steel, 25 per cent. is not a sufficient profit.

"I will give you an illustration of that: The latest plant built in the United States I have just built at Bethlehem. We produce only 500 tons of rails a day, and about 1000 tons of structural steel in this plant. That is a total production of 1500 tons of steel a day. The cost of the bare plant—that is not the blast furnace, but from the pig iron to the finished product—was about \$15,500,000. That included no working capital. We have spent on that plant, in working capital and plant, approximately, \$21,000,000. Let us take the cost of that plant at \$21,000,000. Twenty-five per cent. of the cost of that plant is approximately \$4,000,000. If you divide that by about 500,000 tons a year of steel output, which is about the output of that plant in rails and structural steel, it amounts to \$8 a ton."

#### LABOR COSTS

The witness said that the labor cost per ton in the United States differed little from that abroad. Wages here are on a higher scale, but there is more use of machinery here and consequently fewer men employed. Another result of this condition, however, is that the original investment in plant is much greater per ton of product here than abroad.

#### EXPORT PRICES

With regard to prices of rails sold for export, substantially no new information was obtained. Mr. Schwab was, apparently, quite satisfied that the policy of making lower prices for export would be a judicious one under many conditions.

Not only for rails, but for structural steel and other finished material, he believed that consumers generally were better satisfied to have prices maintained at a nearly uniform level than to see constant variations. For this reason he believed that present conditions should be maintained.

#### BESSEMER AND OPEN-HEARTH STEEL

An opinion expressed by the witness, though not directly bearing on the tariff question, is of interest. He said: "I make this prediction, that in five years from now there will not be a single bessemer converting works for making steel in the United States. That means that every man who has his money invested in bessemer works for making steel rails will have to throw it away as useless and of no value before five years. The change is rapidly taking place now. If you will look at

statistics you will see all the steel rails are getting to be the open-hearth. Bessemer will be of no use. The result is all these changes will have to be made at tremendous cost. The same is true of structural steel. The new mills which I have built at Bethlehem have made a radical change in the character of structural steel, so that most of the structural-steel plants of the United States will have to be changed within the next five years, and that has been the history of the steel business since I have been connected with it."

#### CONCLUSION

Mr. Schwab's views on the tariff, though diffused throughout his testimony, can best be summed up in the following: "My view in this: You can take the tariff off altogether if you want to, and we will be able to compete anywhere, but we have to put the conditions in a similar form. We have to put labor on a similar basis. If you will go into the detailed amount of labor entering into the cost of making steel, you will find it is practically everything but the cost of the raw material in the ground. Reduce those labor items along the line—I mean the labor of all the people who furnish firebricks and refractories and supplies and waste and oil and coal and everything that goes into the steel—and you will be able to put us on a basis with our natural resources, putting them in at the same price as anybody's else, to compete with the world free, and it will make a very radical and decided change in everything pertaining to the manufacture in America."

### The Bureau of Mines Bill

#### SPECIAL CORRESPONDENCE

The adjournment of Congress for the holidays without action regarding the Bureau of Mines bill has thrown the measure over to the latter part of the session, but with an understanding that it will be called up in the Senate. It is now on the calendar under rule IX which implies that it cannot be advanced for discussion without unanimous consent. Some opposition to the measure apart from that attaching to every bill which proposes to enlarge the number of governmental bureaus, seems to be based upon the claim put forward by certain senators that they dislike the measure owing to its limitations. They assert that they would prefer to wait longer and then secure the passage of a bill creating a department of mines rather than to accept the bureau bill. The judgment of several of the friends of the measure is that it will be passed at the current session notwithstanding the concealed antagonism to it.

### The Tariff Hearings in Washington

#### SPECIAL CORRESPONDENCE

At a hearing on Dec. 15 Walter Wood, of Philadelphia, representing R. D. Wood & Co., considered the cast-iron pipe situation and suggested a duty of not over \$3 per ton differential over pig iron in lieu of the present duty, which is equivalent to about \$8.96 per ton, or nearly \$5 above pig-iron duties.

At hearings on Dec. 19 Charles Searle, Boston, Mass., in behalf of various users of high-speed steel asked that high-speed and crucible steel valued above 13 and not above 16c. per lb. be dutiable at 2c. per lb., instead of 25c., with similar products worth over 16c., 3.5c. instead of 4.7 cents.

#### LEAD ORE AND LEAD

At a hearing on Dec. 16 Edward Brush, representing the American Smelting and Refining Company, discussed the conditions of competition and cost of production of lead ore and lead. Mr. Brush said that the tariff might be cut to 1¼c. on pig lead instead of the present 2½c. The duty on lead bullion might be made 1¾c. instead of the present 2½c. The duty on lead ore should not be cut below 1½c., the present rate.

#### MISCELLANEOUS PRODUCTS

Winthrop C. Neilson, Philadelphia, for the Republic Mining and Manufacturing Company, Philadelphia, has filed argument in support of a duty of \$2 per ton on bauxite. The Marion Fluorspar and Lead Company, Marion, Ill., requests "a good, stiff duty on foreign stuff." Charles R. Brayton, Providence, R. I., requests the removal of the duty on imported gypsum rock and is supported by several New York and Connecticut concerns. George D. Miles, Newdale, N. C., requests an increase of duties on mica.

The H. M. Franklin Manufacturing Company, Syracuse, N. Y., requests the removal of the present duty of 8c. per lb. on aluminum. J. F. Frantz, for the Dentists' Supply Company, protests against the proposal to impose a duty on all platinum products except ingots 5/16x2x4 inches.

Abendroth Brothers, Port Chester, N. Y., urge that the duties on pig iron and cast scrap be reduced or abolished. The National Cotton Association, Atlanta, urges removal of the duties on cotton ties. F. W. Hickle, Hartford, Conn., for the Capital Foundry Company requests reclassification with incidental increase of duties on engine-cylinder castings. The C. F. Patterson Company requests reduction of the present duty of 40 per cent. ad valorem plus 1c. per lb. on wire rope.

The Kentucky Barytes Company, Nicholasville, Ky., by G. A. Roy, president,



asks that the duty on crude barytes be advanced to \$5 per ton. Mr. H. Schall, New York, for Gabriel & Schall, importers, has filed a reply to charges made by W. D. Gilman, of the W. D. Gilman Company, Sweetwater, Tenn., regarding alleged undervaluation of imported carbonate of baryta.

**DRAWBACK ON CORUNDUM**

The Treasury Department's regulations of September 29, 1905, providing for the allowance of drawback on wheels and other articles manufactured in part with the use of imported corundum, have been extended, so far as applicable, to cover the exportation of wheels manufactured by the Massasoit Abrasive Products Company, of Chester, Mass. In liquidation, the quantity of imported corundum which may be taken as the basis for the allowance of drawback may equal that declared in the drawback entry, after official verification of exported quantities, but in no case shall it exceed 75 per cent. of the net weight of the exported wheels.

**MANGANESE ORES**

In response to the resolutions of the House of Representatives, introduced by Mr. Cook, of Colorado, and dated April 20, 1908, requesting information as to the authority for the admission of manganese ore free of duty at certain ports of entry, Secretary Cortelyou has just sent to Congress a letter in which he says that no manganiferous iron ores were admitted during the last fiscal year free of duty as manganese ore. Secretary Cortelyou says further that ores containing less than 10 per cent. of iron and from 40 to 50 per cent. of manganese, or over, are commercially known as manganese ores, valuable only for the manganese contained therein, and are, therefore, free of duty under paragraph 607 of the tariff of 1897. It further appears that the percentages of iron and manganese, respectively, in such importations have been determined by analyses whenever necessary, and that the analyses have never shown over 10 per cent. of iron, and, at New York, in but two instances, over 4 per cent.

**THE COST OF STEEL RAILS**

At a tariff hearing before the Ways and Means Committee on Dec. 15 C. M. Schwab, of the Bethlehem Steel Company discussed the cost of producing iron and steel and said that while he would prefer no change "a moderate change is not going to seriously hurt" but "a radical change will make a very great difference." At the same hearing Robert Gilchrist for the Western Foundry Supply Company asked that the duty of \$4 per ton on ferro-manganese be maintained. Prof. F. W. Taussig, Cambridge, Mass., suggested that iron ore, pig iron, steel rails, and ingots be transferred to the free list.

At a hearing on Dec. 18 Judge E. H. Gary, of the United States Steel Corporation analyzed the cost of production of pig

iron and steel and took general ground in favor of maintaining the tariff on those articles with the addition of a maximum and minimum tariff provision.

On Dec. 21 Andrew Carnegie reviewed the iron and steel situation and supported the position taken in his recent article to the effect that no tariff duties whatever are needed by the iron and steel business. Mr. Carnegie maintained that protection has resulted in developing the industry to a point where the stronger concerns are independent of duties while others may properly be disregarded.

The interesting feature of the Schwab-Gary-Carnegie hearings is considered to be the widely varying opinions advanced with reference to costs of production. In this connection too it is worthy of note that Chairman Payne has made public with the consent of Judge Gary, given on the witness stand, the detailed figures prepared by the Bureau of Corporations with respect to iron and steel costs. These figures represent the labor of a substantial corps of men during the past two or three years under the direction of a practical steel manufacturer. Mr. Schwab in his public testimony makes the cost of pig iron as follows: Ore in the iron \$8.76 per ton, coke \$2.62, limestone 75c. conversion cost \$1.30, general charges 65c., or \$14 in all. The cost of conversion into rails he sets at about \$7.50, a total cost for steel rails of \$21.50. Judge Gary estimates the costs as follows: Ore \$8.62 per ton of iron, coke \$3.93, limestone 49c., scrap 16c., cinder and scale 11c., cost of labor material and expense of operating \$1.37, depreciation 40c. or in all \$15.30—this being the average cost at all the plants of the U. S. Steel Corporation. From pig iron to rails the cost, says Judge Gary, is as follows: Pig iron and scrap exclusive of depreciation \$15.06, conversion pig iron to ingots \$2.88, ingots to rails conversion cost \$3.22, depreciation &c., total cost \$22.81. Mr. Carnegie regards the items of cost furnished by both Judge Gary and Mr. Schwab as fallacious and purely a matter of "bookkeeping," differing with them especially on the way in which ore costs are properly to be figured.

The figures of the Bureau of Corporations taken from the books of the iron and steel-producing companies are given as follows in a letter from the Commissioner of Corporations to Chairman Payne.

**COST AND PRICE OF STANDARD RAILS.**

	Cost per Ton.	Price.	Profit per Ton.
1902.....	\$22.32	\$27.65	\$5.34
1903.....	23.78	28.07	4.32
1904.....	21.57	25.70	4.17
1905.....	21.30	27.13	5.88
1906.....	22.77	27.61	4.85
Five years.....	\$22.39	\$27.34	\$4.97

The cost items of rails produced for five years, 1902-1906, are given in detail, tons produced being 14,020,303. The cost

items in the statement are: Bessemer pig iron, \$14.52; waste, 1.95; total pig iron in rails, 16.47; labor, 1.98; manganese, etc., 0.99; fuel, 0.35; steam, 0.62; molds, 0.15; rolls, 0.17; materials in repairs and maintenance, 0.42; supplies and tools, 0.27; miscellaneous and general works expense, 0.51; general expense, 0.14; depreciation, 0.16; total cost, \$22.23. Cost of conversion from pig iron, \$7.71 per ton.

The lowest cost reported by any company in one year was \$19.33; for five years, \$20.74. The highest costs were \$31.27 and \$26.01, respectively.

The cost of bessemer pig iron, being an average for the years 1902-1906, is given at \$14.01 per ton.

The average cost of all bessemer and open-hearth steel billets 1902-1906 is given as below:

Year.	Cost per Ton.	Price per Ton.
1902.....	\$21.73	\$26.33
1903.....	23.01	28.55
1904.....	19.34	20.59
1905.....	19.19	21.95
1906.....	20.93	25.68
Total.....	\$20.60	\$24.30

The cost of making bessemer and open-hearth billets, 1902-1906, is given as follows:

Final Commercial Cost.	Bessemer.	Basic Open-Hearth.
Pig iron and scrap.....	\$14.34	\$13.78
Waste.....	1.95	1.64
Cost of pig and scrap..	\$16.29	\$15.42
Variation in cost ingots..	0.36	0.06
Labor.....	1.08	1.58
Manganese and fluxes..	0.37	0.59
Fuel.....	0.37	0.94
Steam.....	0.49	0.37
Molds.....	0.16	0.17
Rolls.....	0.03	0.04
Materials in Repair and Maintenance.....	0.27	0.47
Supplies and tools.....	0.17	0.36
Miscellaneous and general works expense.....	0.29	0.39
General expense.....	0.10	0.13
Open-hearth rebuilding..		0.24
Depreciation.....	0.10	0.11
Total cost.....	\$20.18	\$20.87

The cost sheets obtained for bessemer ingots cover practically all, and of open-hearth ingots more than 75 per cent. of the production of the country for the period. The reports include billets made for conversion into other forms in the various works, as well as those made for commercial sale as billets.

Four electrically operated stamp mills are now running on the Rand, South Africa. These are the Angelo, Cason, Jupiter-Simmers Deep and Cinderella Deep mills. The Angelo and Cason batteries have been electrically driven for a year or two, all the stamps being run from one main line shaft. The others are being driven in separate units, a separate motor being used for each unit. At the Cinderella Deep there will be 20 stamps to a unit; at the Simmer Deep and Jupiter 10 in a unit.

# Patents Relating To Mining and Metallurgy

A Selected and Classified List of New Inventions Described during the Past Month in the Publications of the Patent Offices

## UNITED STATES AND BRITISH PATENTS

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

### ALUMINUM

**SMELTING**—Process of Smelting Aluminum Ores. Frank J. Tone, Niagara Falls, N. Y., assignor to the Carborundum Company, Niagara Falls, N. Y., a corporation of Pennsylvania. (U. S. No. 906,172; Dec. 8, 1908.)

**WELDING**—Improvements in Welding Aluminum. Max U. Schoop, Garenne-Colombes, France. (Brit. No. 24,096 of 1907.)

### CEMENT

**SLAG CEMENT**—Improvements in the Manufacture of Cement from Blast Furnace Slag and the Like. Wilhelm Lessing, Troisdorf, Rheinland, Germany. (Brit. No. 19,070 of 1908.)

### COAL AND COKE

**COAL-CUTTING MACHINE**. Georges Leichnam, Denain, France. (U. S. No. 904,623; November 24, 1908.)

**COAL-WASHING APPARATUS**. William A. Knoyer, Masontown, Penn., assignor to Pittsburg Coal Washer Company, Pittsburg, Penn., a Corporation of Pennsylvania. (U. S. No. 906,239; Dec. 8, 1908.)

**COKING**—Improvements in Distilling and Coking Coal. Samuel B. Sheldon, Buffalo, N. Y. (Brit. No. 138 of 1908.)

**COKING-OVEN**. Edmond Ledoux, Sheffield, England, assignor to Simon-Carves Bye-Product Coke-Oven Construction and Working Company, Limited, Manchester, England. (U. S. No. 904,268; November 17, 1908.)

**SEPARATOR for Coal**. John H. Walker, Scranton, Penn. (U. S. No. 904,738; November 24, 1908.)

**SEPARATOR for Coal, Slate, etc.** David E. Phillips, Mahanoy City, Penn. (U. S. No. 906,280; Dec. 8, 1908.)

### COPPER

**ELECTROLYTIC COPPER**—Process for the Precipitation of Electrolytic Copper and Other Metals in the Form of Sheets or Cylinders, with Soluble Iron or Other Metal Anodes. Marie J. L. Wanger, Paris. (Brit. No. 3504 of 1908.)

**TITANIUM ADDED TO COPPER**—Copper and Process for Purifying, Casting and Alloying the Same. Auguste J. Rossi, New York, N. Y., assignor to the Titanium Alloy Manufacturing Company, New York, N. Y., a Corporation of Maine. (U. S. No. 905,232; Dec. 1, 1908.)

### GOLD AND SILVER

**EXTRACTION**—Apparatus for the Extraction of Gold From Crushed Ores. Thomas E. Beaumont, London, England. (U. S. No. 905,048; November 24, 1908.)

### IRON AND STEEL

**BLAST-FURNACE CHARGING APPARATUS**—Improvements in and Relating to Blast Furnace Charging Apparatus. David I. Miller, Sheffield, Ala. (Brit. No. 10,872 of 1908.)

**CHARGING APPARATUS for Blast-Furnaces**. Homer D. Williams and William Ahlen, Duquesne, Penn. (U. S. No. 903,423; November 10, 1908.)

**CHARGING BLAST-FURNACES**—Method of Charging Blast-Furnaces. Homer D. Williams, William Ahlen and Ambrose N. Diehl, Duquesne, Penn. (U. S. No. 905,125; November 24, 1908.)

**LADLE FOR SLAG**—Ladle for Carrying and Tipping Blast-Furnace Slag. John H. Dewhurst, Sheffield, England. (U. S. No. 906,117; Dec. 8, 1908.)

### MANGANESE

**PROCESS OF MAKING MANGANESE and Ferromanganese**. Anson G. Betts, Troy, N. Y. (U. S. No. 905,281; Dec. 1, 1908.)

### MICA

**TREATMENT**—Method of Treating Mica.

John P. W. Beckman, Parnassus, Penn. (U. S. No. 903,949; November 17, 1908)

### SILICON

**REDUCTION PROCESS**—Process of Producing Silicon. Frank J. Tone, Niagara Falls, N. Y., assignor to the Carborundum Company, Niagara Falls, N. Y., a Corporation of Pennsylvania. (U. S. No. 906,338; Dec. 8, 1908.)

### TIN

**DETINNING**—Improvements in Detinning Processes. Elmer A. Sperry, New York City. (Brit. No. 25,496 of 1907.)

### ZINC

**EXTRACTION**—Process of Extracting Zinc. Edward H. Shortman, Bloxwich, England, assignor of one-half to New Delaville Spelter Company, Limited, Spring Hill, England. (U. S. No. 905,753; Dec. 1, 1908.)

**PIGMENTS**—Improvements in or Relating to the Production of Zinc Pigments or Mixtures Containing Zinc Sulphide. Henry W. de Stucklé, Dieuze, Alsace-Lothringen, Germany. (Brit. No. 575 of 1908.)

**ZINC OXIDES**—Reduction of Zinc Oxides. Pierre-Armand Brangier, Agnew, and John J. Faulkner, Berkeley, Cal. (U. S. No. 906,191; Dec. 8, 1908.)

### ORE DRESSING

**AGITATING AND AERATING APPARATUS**. Lamartine C. Trent, East Auburn, Cal. (U. S. No. 905,025; November 24, 1908.)

**CLASSIFICATION**—Improvements in Apparatus for the Volumetric Classification of Ores. Jean C. Demaret, Paris. (Brit. No. 11,971 of 1908.)

**CONCENTRATING APPARATUS**. Wilton E. Darrow, Sutter Creek, Cal. (U. S. No. 906,205; Dec. 8, 1908.)

**FILTER-PRESS**—Continuous Filter-Press. Alexander J. Arbuclie, Johannesburg, Transvaal. (U. S. No. 905,129; Dec. 1, 1908.)

**GRINDING-MILL**. William R. Cunningham, Bucyrus, Ohio, assignor to the American Clay Machinery Company, Bucyrus, Ohio, a Corporation. (U. S. No. 904,686; November 24, 1908.)

**MAGNETIC SEPARATION**—Apparatus for Magnetic Separation. Clarence Q. Payne, Stamford, Conn., assignor to the International Separator Company, a Corporation of New Jersey. (U. S. No. 901,368; October 20, 1908.)

**MAGNETIC SEPARATOR**. Marcus Ruthenberg, Lockport, N. Y. (U. S. No. 904,280; November 17, 1908.)

**MAGNETIC SEPARATION**—Apparatus for the Magnetic Separation of Ore. Gustaf Gröndal, Djursholm, Sweden. (U. S. No. 905,815; Dec. 11, 1908.)

**ORE-CONCENTRATING TABLE**. Claude Sherwood, Black Bear, Idaho, assignor of one-half to Israel Walker, Taft, Mont. (U. S. No. 906,464; Dec. 8, 1908.)

**ORE-DISCHARGE FOR JIG-TANKS**. Charles W. Whitman, Elk Grove, and Thomas S. Baldwin, Benton township, Lafayette county, Wis.; said Whitman assignor to said Baldwin, Cuba, Wis. (U. S. No. 906,480; Dec. 8, 1908.)

**PRESSURE-FILTER**. Charles W. Merrill, Lead, S. D. (U. S. No. 905,341; Dec. 1, 1908.)

**REDUCTION PROCESS**—Method of Reducing Ores. George F. Rendall, New York, N. Y., assignor to American Reduction Company, a Corporation of New Jersey. (U. S. No. 903,318; November 10, 1908.)

**REDUCTION PROCESS**—Process of Reducing Metallic Substances by Volatilization and Precipitation. George F. Rendall, New York, N. Y., assignor to American Reduction Company, a Corporation of New Jersey. (U. S. No. 903,317; November 10, 1908.)

### METALLURGY—GENERAL

**ELECTROMETALLURGY**—Process of Obtaining Metals From Their Ores. Karl Kaiser, Berlin, Germany. (U. S. No. 904,263; November 17, 1908.)

**ORE TREATMENT**—Process of Treating Metalliferous Ores. Franklin R. Carpenter, Denver, Colo., assignor to the American Iron and Steel Alloys Company, Denver, Colo., a

Corporation of Colorado. (U. S. No. 904,838; November 24, 1908.)

**RECOVERY OF METALS FROM SLAG**—Metallurgical Process. Anson G. Betts, Troy, N. Y. (U. S. No. 905,280; Dec. 1, 1908.)

### MINING MACHINERY AND APPARATUS

**COMPRESSED-AIR WATER-ELEVATOR**. Robert M. Downie, Beaver Falls, Penn., assignor to Keystone Driller Co., Beaver Falls, Penn., a Corporation of Pennsylvania. (U. S. No. 906,395; Dec. 8, 1908.)

**DRILLING MACHINE**—Coal or Rock Drilling Machine. Albert Ball, Claremont, N. H., assignor, by mesne assignments, to Sullivan Machinery Company, Claremont, N. H., a Corporation of Maine. (U. S. No. 905,490; Dec. 1, 1908.)

**MINE-DOOR**. Joseph L. Dinwiddie and Albert F. Braun, Carlisle, Ill. (U. S. No. 903,846; November 17, 1908.)

**MINE-ROOF SUPPORT**. Frederick C. Kelghley, Uniontown, Penn. (U. S. No. 904,878; November 24, 1908.)

**PUMP for Mine-Shafts**. Richard Heidecke and Otto Lellau, Neuhof, near Fulda, Germany. (U. S. No. 904,870; November 24, 1908.)

**ROCK-DRILLS**—Improvements in and Relating to the Valve Gear of Rock Drills and Other Tools Worked by Compressed Air. Communicated from Arnold Freiherr von Schmidt, Beuthen, Germany. (Brit. No. 24,533 of 1907.)

**ROCK-DRILL**. John R. Wilson and Frederick R. Thackrath, Benoni, Transvaal. (U. S. No. 903,936; November 17, 1908.)

**ROCK-DRILLING MACHINES**—Improved Method and Apparatus for the Distribution of Motive Fluid in Rock-Drilling Machines or Other Compressed-Air Machines Having Reciprocating Pistons. Arnold Baron von Schmidt, Charlottenburg, Germany. (Brit. No. 5965 of 1908.)

**ROCK-DRILLING MACHINE CHUCK**. Lewis C. Bayles, Johannesburg, Transvaal. (U. S. No. 903,948; November 17, 1908.)

**ROCK-DRILLING MACHINES**—Improvements in Fluid-Actuated Rock-Drilling and Other Percussive Machines. Wilhelm Mauss, Brakpan, Transvaal. (Brit. No. 13,759 of 1908.)

**ROCK-DRILLING MACHINES**—Improvements in Rock-Drilling Machines. Thomas Rasmussen, Johannesburg, Transvaal. (Brit. No. 22,100 of 1907.)

**SAFETY-BRAKE for Elevators and Mine-Cages**. Auguste Barblieux, Mecca, Ind. (U. S. No. 901,314; October 20, 1908.)

**SAFETY BRAKE MECHANISM for Mine-Cages and the Like**. Henry A. Walker, Johannesburg, Transvaal, assignor of one-half to Walter George Compton, Johannesburg, Transvaal. (U. S. No. 902,703; November 3, 1908.)

**SAFETY DEVICE for Mine Skips, Cages, etc.** James Spry, East Rand, Transvaal. (U. S. No. 902,694; November 3, 1908.)

**SAFETY DEVICES FOR WINDING**—Improvements in Safety Devices for Preventing Overspeed and Overwinding in Hoisting Apparatus. Fraser & Chalmers, Ltd., London, E. C. (Brit. No. 7664 of 1908.)

**SAFETY LAMPS**—Improvements in or Connected with Miners' Safety Lamps. Thomas J. Thomas, Porth, Glamorganshire, Wales. (Brit. No. 671 of 1908.)

**SAFETY LAMPS**—Improvements in and Relating to Miners' Safety Lamps. Otto M. Müller, Gelsenkirchen, Germany. (Brit. No. 16,296 of 1908.)

**SAFETY MECHANISM for Mine-Cages and the Like**. Kurt W. O. Schweder, Johannesburg, Transvaal. (U. S. No. 902,690; November 3, 1908.)

**TRAMWAY-BUCKET GRIP**. Charles A. Case, New York, N. Y., assignor to Case Tunnel and Engineering Company, New York, N. Y., a Corporation of Arizona. (U. S. No. 904,178; November 17, 1908.)

### METALLURGICAL MACHINERY AND APPARATUS

**ELECTRIC FURNACES**—Improvements in or Relating to Electric Furnaces. Hans Nathusius and The Westdeutsche Thomas-phosphatwerke, Berlin. (Brit. No. 7188 of 1908.)

## Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

There will shortly be a vacancy on the editorial staff of the JOURNAL, open to a young engineer, who must be a graduate of a technical school and must have had several years of practical experience.

Pope Yeatman has returned to New York from the West.

Henry S. Washington, of Washington & Lewis, New York, has returned from Brazil.

E. W. Walker has returned to Tombstone, Ariz., after examining some mines in Sonora, Mexico.

C. W. Purington is in Brookline, Mass., for the Christmas holidays, and will return to London early in January.

H. W. Turner, San Francisco, has been examining a mine on the Mother Lode in Calaveras county, California.

George A. Flagg, secretary and treasurer of the Calumet & Hecla company, has been a visitor at the property.

Sydney J. Jennings has been appointed consulting engineer for the Boston Consolidated Mining Company, Utah.

Prof. Regis Chauvenet, of Denver, has been examining mines in Gilpin county, Colo., in the interest of Eastern capitalists.

H. V. Winchell, of St. Paul, Minn., has been visiting New York. He has resigned his position with the Great Northern railway.

W. S. Keith, of Seattle, Wash., has been appointed consulting metallurgist to the Gold Creek Mining and Smelting Company.

H. C. Browne, of Philadelphia, has returned East after a visit of inspection to uranium interests in Gilpin county, Colorado.

Frederick W. Ridley has been appointed superintendent of the Calumet & Hecla, succeeding Walter Fitch, who resigned Nov. 1 last.

Ernest Thalmann, of Ladenburg, Thalmann & Co., New York, has been elected to the board of the Boston Consolidated Mining Company.

Dr. William Wahl, for many years secretary of the Franklin Institute, of Philadelphia, has resigned that position on account of ill health.

Prof. J. W. Richards, of Lehigh University, is on an extensive travel abroad, his intention being to visit Egypt and India among other places.

Samuel McKirahan has been appointed general manager of the Georgetown Mining, Power and Tunnel Company, operating at Georgetown, Colorado.

H. N. Spicer, of Denver, Colo., is in-

specting mines and mining methods in the Black Hills district, South Dakota, in the interest of London investors.

L. W. Trumbull has finished an engagement in Arizona and has gone to Van Vleck, Texas, for a few weeks' vacation, before undertaking any new work.

Byron G. Slining, of Chicago, has accepted the position of assistant superintendent and mining engineer with the Hercules Gold Mining Company, Galena, South Dakota.

Samuel B. Montgomery, of Cumberland, Md., has been appointed a special agent of the Department of Commerce and Labor, to collect information about mines and mine labor.

Spurr & Cox (Inc.) have transferred their main offices from Denver, Colo., to 165 Broadway, New York. Branch offices will continue to be maintained in Denver and Mexico City.

W. B. Rhodes, superintendent of mines at Rosario, Sinaloa, Mexico, has been making a visit to Colorado points during the past month, inspecting mills and smelters in the interests of his company.

A. H. Roller and Warwick M. Downing, mining engineers of Idaho Springs, Colo., are making a business trip to Eastern points, in connection with the erection of a 300-ton mill at Alice, Colorado.

John McVicker, recently superintendent of the Marianna coal mine of the Pittsburgh & Buffalo Coal Company, on Dec. 1, assumed the duties of general manager of the Zeigler Coal Company at Zeigler, Illinois.

George Mitchell, president and general manager of the Clara Consolidated Gold and Copper Mining Company, has just returned to Los Angeles, Cal., after a visit to the mines at Swansea, Yuma county, Arizona.

E. W. Pargny has been chosen president of the American Sheet and Tin Plate Company, in place of Charles W. Bray, who has resigned. S. A. Davis succeeds Mr. Pargny as first vice-president of the company.

J. H. Robeson, a former operator in the Clear Creek district, Colorado, has returned from Cobalt, Canada, where he was in charge of the Kerr Lake mine, and will go to Parral, Mexico, to look after mining interests.

W. L. Cumings, geologist of the Bethlehem Steel Company, at South Bethlehem, Penn., has been granted a leave of absence for a few months, and is doing some work in economic geology in Mexico with C. W. Botsford, of Guanajuato.

Baron Herbert Von Pohl and George O'Hanlon, of the banking firm of Hudson's Consolidated, London, England, who have extensive mining interests in America, are in Toronto and will make a thorough inspection of the Cobalt camp.

Hon. C. R. Devlin, minister of mines

and colonization for Quebec province, has returned to Canada from an extended European tour, during which he succeeded in interesting a number of capitalists and mining men in the mineral resources of the Province.

F. L. Wanklyn, vice-president, and G. H. Duggan, general manager of the Dominion Coal Company, have returned to Sydney, N. S., from a trip during which they visited the terminals of the large American coal corporations at Buffalo, Cleveland, Pittsburg, and other points.

The firm of E. N. Breitung & Co. has been formed to deal in Lake Superior iron ores, with office in the Rockefeller building, Cleveland, Ohio. The persons associated with the firm are E. N. Breitung, H. L. Kaufman, Mary Kaufman and G. F. Knapp. The firm will handle the ores from the Mary Charlotte, the Breitung Hematite, the Washington and other mines.

## Obituary

William A. Crist, who died at Johnstown, Penn., Dec. 3, aged 64 years, was for many years a coal operator and manager, well known in western Pennsylvania. He was general manager of the Berwind-White Coal Company for several years, retiring last year on account of ill health.

Patrick McBryde, who died at Wheeling, W. Va., Dec. 12, aged 63 years, was born in Scotland, but came to this country 43 years ago. He worked as a coal miner for a number of years in the Youghiogheny district near Pittsburg. He took a prominent part in organizing the miners, and about 1893 was chosen general secretary of the United Mine Workers, holding that position for a series of years, until he retired on account of ill health. When in office his influence was always exercised against strikes and in favor of conciliation and arbitration of disputes. After retiring he published a coal-mining paper for some years, and also served as secretary of the Pittsburg Vein Coal Operators' Association, of Ohio.

## Societies and Technical Schools

*National Association of Cement Users*—The fifth annual convention will be held at Cleveland, Ohio, Jan. 11-19, 1909. In connection with the convention there will be a large and well classified exhibit of cement and cement products of all kinds. The papers to be read will deal largely with the cost of concrete construction and particularly matters pertaining to rates of insurance and a suggested building code for concrete and reinforced concrete, which should be matters of interest to every user of cement. The data obtained through the reading and discussion of these papers will be valuable.

# Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Denver, Butte, Goldfield, Salt Lake City and Toronto

## REVIEWS OF IMPORTANT EVENTS

### San Francisco

Dec. 16—The Board of Supervisors of Contra Costa county has passed a county ordinance which is a blow to the smelting interests along the shores of Carquinez straits and Suisun bay. In that region are the smelting plants of the Selby Smelting Company, the Mountain Copper Company and the Peyton Chemical Company. Protests had been made by farmers from Ygnacio and Clayton valleys against the smelter fumes from the Mountain Copper and Peyton Chemical Companies plants and this ordinance is the result. The complaint is that the fumes are detrimental to health and vegetation in the smoke zone which includes those valleys. The ordinance is a copy of that passed by the supervisors of San Mateo county which prevented further construction of the Guggenheim smelting plant at Point San Bruno.

The Union Oil Company has leased the entire 7000 acre holdings of the Sunset Road Oil Company, known as the Jewett & Blodgett, in Kern county. The lease includes the refinery at Hazleton. The Sunset Company has the largest supply of extra heavy oil yet developed in California and it is especially useful for road oil. The product can only be moved in cars.

The Big Bend Consolidated Placer Mining Company is about to start a tunnel through the mountain on the south fork of the American river near the mouth of Silver creek in El Dorado county. The tunnel will be 800 ft. long, 12 ft. wide on the floor, 10 ft. wide at the top and 8 ft. in the clear. It will cut through the country rock and is not expected to be timbered. The turning of the water through this tunnel will leave exposed for working 4800 ft. of the present river bed which is supposed to be rich in placer gold.

Horace Monroe, of Chicago, has purchased the group of copper-gold claims owned by the Southern Oregon Company, in the Blue Ledge district, Siskiyou county. The group is one of the best developed of the Blue Ledge district. The claims are opened by tunnels, the longest of these being driven about 400 ft., from which a crosscut exposes the main orebody. The main ledge is from 7 to 10 ft. wide. The ore is sulphide, running from 4 to 5 per cent. copper, 5 oz. silver and \$2.80 a ton in gold.

It is understood that the Hazel Mining Company, which owns the Gladstone mine at French Gulch, Shasta county, and also other properties, including the origi-

nal Hazel mine in Siskiyou county, is about to reopen the latter, which, though formerly a producer, has been idle for some time. A new mill of 50 stamps will be erected and the property mined by steam shovel.

W. S. Brice, a mining promoter of Los Angeles, has been held to answer in the Superior Court on a charge of obtaining money under false pretenses from Charles J. Berry, a prominent Alaska miner. Berry claims Brice inveigled him into paying \$4000 for stock of the Eclipse Gold Mining Company, in Placer county, pretending to invest a like amount himself, but brought stock worth only \$350. Brice was formerly prominent at Auburn and was for two years manager of the Eclipse mine.

### Goldfield, Nevada

Dec. 15—Another bonanza lease has been opened on Florence ground. After the Reilly lease made its famous production and established the standing of the Florence as a mine and the Little Florence and the Rogers Syndicate leases on the opposite end of the properties had jointly produced nearly \$4,000,000, it was generally considered that the ore lay along the western side of the property, for the leases on the east side had failed to find ore. But finally the Baby Florence lease on the east side made a strike. Afterward, an old, forgotten drift of the previous leasers was broken into. This drift was within 2 ft. of the rich ore when the leasers quit, discouraged and broke. Then the Engineer's lease, after following a very low-grade stringer struck a "jewel box;" this lease produced over \$1,000,000 in four months. The latest abandoned lease to be renewed and to produce bonanza ore is the Daisy Florence, now owned by Mitchell & Fairfield. The ore is the typical Florence ore and contains free gold in very fine grains placed so close together that the quartz appears to have a band of solid gold, about ¼ in. wide, through it. This lease expires next March.

As soon as the new Consolidated mill is put in operation the old Combination will cease treating Consolidated ores and will be leased to the Combination Fraction company, whose property adjoins the Combination mine and which is now controlled by Wingfield and Nixon. The Fraction has large quantities of \$15 to \$30 ore in the mine which cannot be shipped or treated at custom smelters at a profit, but

which it will pay to treat in the company's own mill.

George H. Phillips, known on the Chicago Board of Trade as the "Corn King," who owns the largest part in the Hazel Goldfield lease, has been in Goldfield the past week. Mr. Phillips has put a very large sum of money into the Hazel lease for the shaft, now almost 800 ft. deep, has cost about \$50,000; the new strike, however, satisfies the management, and the shaft will probably be sunk deeper.

Owing to the very low price of silver the newspapers have spread the report that the Tonopah mines, whose ores contain mainly silver, would close down. This is indignantly denied by all the Tonopah companies. It is true that the drop in the price of silver makes a big difference in the profits, but there is a large amount of gold in the Tonopah ores so that the mining of them is still profitable even with the prices of silver less than 50c. per ounce.

The oil excitement between Blair and Goldfield continues; last week owing to considerable jumping of oil locations, a mass meeting assembled at Blair to organize for protection, and a request was sent to the Governor to send a squad of the State police to prevent trouble. The operations of the Nevada Bay State are very encouraging. The Goldfield Oil and Gas Company is negotiating for a drilling outfit.

Suit to dissolve the Nat C. Goodwin Company, mining brokers, of Reno, has been brought in the district court by Warren Miller, formerly vice-president of the company. He asks for a receiver for the company and for \$100,000 damages, alleging that he put in money to start the company, and that he worked for the completion of the deal which has netted the company its largest profits and saved it from failure. He states that Goodwin and George Graham Rice conspired to keep him in ignorance of the affairs of the concern and to cheat him out of his share of the company's holdings. Rice was formerly connected with the L. M. Sullivan Trust Company, of Goldfield; that company's history is still fresh in the minds of the JOURNAL's readers.

### Salt Lake City

Dec. 16—The directors of the Uncle Sam Consolidated Mining Company at their last meeting declared a dividend of 2c. per share, in all \$10,000, payable Dec. 21. This makes \$95,000 paid in dividends during the last six months. Last year the com-

pany paid \$70,000 in dividends, while the total paid to date is \$295,000. About a year ago the mine had to shut down owing to the refusal of the smelters to receive ore. Last June the mine began to ship again.

The improvements to the Yampa smelter are now almost completed. The converter is working nicely and the blister copper produced is as high in value as in the first experiments. The McDougals and the reverberatories, as well as the blast furnaces, are working well. It is said that 800 tons of ore per day are being treated. The mine is in good shape.

The Boston Consolidated Company has benefited considerably by storing its concentrates at its mill for several months. During this time the American Smelting and Refining Company, so that the Boston company would not ship the concentrates to the smelter, has allowed the Boston Consolidated to draw 85 per cent. of the assay value of the concentrates at the time they were stored. But the final settlement must be made at the metal prices prevailing when the concentrates are received at the smelter. This supplementary agreement expires Jan. 1, and as the price of copper has advanced during the last few months, the Boston Consolidated will profit considerably. By Jan. 1 the company should have 9,000,000 lb. of copper in concentrates ready for smelter treatment.

The report of Duncan MacVichie on the mines belonging to the Silver King Coalition has been made public. This report shows that 99,000 tons, having a gross value of \$5,580,781, or a net value of \$3,671,649, are blocked out in the mines. The possible ore is estimated at 974,755 tons. Mr. MacVichie estimates that half of this is probable ore and that it will have the same average as the ore blocked out, which has a net value of \$51.76 per ton; this gives a total value of \$25,226,633 for the probable ore.

Owing to the completion of the Western Pacific railroad so that connection is made at Shafter with the Nevada Northern freight rates on ores shipped to Argo, Colorado have been reduced. The present rates on ore from East Ely to Salt Lake, via the Nevada Northern and Southern Pacific are as follows: On ore valued at \$30 per ton, \$5.50; on \$40 ore, \$6.40; on \$50 ore, \$7.85. From Salt Lake to Argo the rate is \$7.50 for all ores under \$100, thus making the through rates on the three grades of ore \$13, \$13.90 and \$15.35 respectively. The new rates from East Ely to Argo will become effective Dec. 19 and are as follows: On \$30 ore, \$7.50; on \$40 ore, \$8.50; on \$50 ore, \$9.50. From Kimberley the rate is 50 cents additional on all classes.

These rates have been established at this time for the benefit of the Giroux Consolidated, which is now making regular shipments of concentrates from its mill at Kimberley.

### Butte

*Dec. 17*—The excitement incident to the report that the Government would institute action to enjoin the further operation of the Washoe smelter at Anaconda has subsided and business is resuming its normal condition. The real basis for the scare which the report created was the popular misconception of the powers of the President with regard to the situation. On more sober thought it was realized that the President has no power to close the smelter. True, he could request the Department of Justice to institute action in the Federal Court for the purpose of enjoining the smelter operations, and the Attorney General could file a bill in equity on behalf of the Government; but the same long drawn out legal battle would follow that came about when the Deer Lodge valley farmers instituted their action for the same purpose. In the case of the farmers against the company Judge Hunt refused to issue a temporary injunction pending the determination of the action and it is quite probable that the same result would follow should the Government begin action.

The Northern Pacific Railway Company's civil engineers are working on a plan to use electric power for trains going over the mountain west of Livingston in Park county. It is possible that a large power plant will be constructed on the Yellowstone river as there are several good locations within easy access of the town.

In the action of the South Butte Mining Company against the East Butte Mining Company for the purpose of quieting title and recovering damages for injury to a small parcel of ground under the right of way of the Great Northern Railway, the local district court has rendered its decision in favor of the South Butte company. By its decision the court quiets the title of the South Butte company to the property in question and awards it judgment in the sum of \$19,531 as damages for the taking of ore from the property by the East Butte company. The judgment stands against the directors of the East Butte as well as against several leasers under the company.

### Denver

*Dec. 19*—In the Central City district, the heading was started yesterday in the Newhouse tunnel on its course through Quartz hill to its projected terminus in Eureka gulch, a distance of about 5000 ft. The tunnel has been idle since early in 1907, for the reason that many of the owners in that district, whose properties were at that time full of water and not working, or working and pumping, declined to pay for the drainage of their mines, which the further advance of the bore was certain to accomplish. So the tunnel manager declined to proceed until his company

was properly remunerated for the benefits it was conferring. He has now apparently brought these people to terms, to the great delight of the whole district and the benefit of the gold-mining industry. This may serve as an object lesson to future promoters of long mining drainage and transportation tunnels, for all the delay and trouble and loss incident to the same in this case would have been saved had drainage contracts been made with the owners of the mines on the line of the tunnel before a shot was fired.

In the Cripple Creek district a decision by the judge of the District Court makes permanent the injunction prayed for by a mining company restraining the assessor of Teller county from issuing tax deeds for delinquent taxes of 1900. This was a test case for about 25 other companies, who contended that being nonproducing, their properties should not be assessed at the same rate, and in some instances much higher than that of other companies which were rich and producing largely.

The new system which is to smelt copper ores by what is called "a hydro-oxygen-carbon process," which is to "produce pure metal in 30 minutes" and is to "revolutionize the mining industry," is still being ventilated in Denver papers.

### Toronto

*Dec. 18*—The contractor having encountered many difficulties in constructing the road from Elk City, in the Montreal river district, to Gowganda lake, the provincial Public Works Department has decided to take over the work and push the road to completion without delay. A government engineer has been sent forward with instructions to engage a staff of experienced men and to finish the road as quickly as possible. A large number of merchants and building contractors are waiting to get material and supplies through to the new mining field.

A number of charges of infraction of the Ontario Companies Act regarding prospectuses were heard this week. Frank C. Loring, as a director of the Obisse Mining Company, was fined the usual fine of \$200 imposed. Several other cases were withdrawn on the agreement by the companies to comply with the law. Information has been received by the provincial secretary's department that some mining companies are trying to avoid the operation of the law. Prosecutions have hitherto been confined to cases in which advertisements soliciting stock subscriptions have appeared in the newspapers. The plan now pursued to escape prosecution is to send out circulars through the mails, which fail to contain the information required by law. It is now announced that such documents, whether issued by the companies or by brokers, are just as much a violation of the Act as newspaper advertisements and that if the practice is continued prosecutions will follow.

# Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

## THE CURRENT HISTORY OF MINING

### Arizona

#### COCHISE COUNTY

*Shattuck-Arizona*—This mine has put on a force of 60 men and has begun shipping the ore reserve of about 500 tons which had accumulated on the sixth level. It is anticipated that this will be shipped within a week and regular shipments of about 70 tons per day will be maintained.

#### GILA COUNTY

*Inspiration*—Control of this property at Globe has been secured by William B. Thompson. A new company will be organized.

#### GRAHAM COUNTY

*Arizona Copper Company, Ltd.*—Production during the month of November amounted to 1426 tons of copper.

*Mascot Mining Company*—This company is developing properties in the Clark district, in the south half of the Pinaleno range north of Wilcox. The formation is granite and limestone cut by heavy porphyry intrusions. The district is said to abound in large veins mostly mineralized. There are both copper and lead ores with more or less gold and silver.

#### PINAL COUNTY

*Clark & Scanlon*—Two stageloads of miners have been sent to work in the mines which were taken over a few months ago by the Calumet & Arizona company at a price of \$65,000. This is the first instalment of miners ordered for the beginning of development work in the new properties. It is said that it is the intention of the management to increase the force as fast as the nature of the work will permit.

### California

#### AMADOR COUNTY

*Mitchell*—At this mine, Pine Grove, a hitherto unsuspected orebody has been found near the surface. Some of the rock milled \$50 per ton.

#### BUTTE COUNTY

*Cohn & Goodday*—At this mine, six miles south of Magalia, a hoisting and pumping plant and compressor have been installed. The incline will have to be 600 ft. long to tap the gravel channel.

#### CALAVERAS COUNTY

*Columbia*—In this mine, on the north fork of the Mokelumne river, a 2-ft. vein of ore carrying free gold was struck while doing annual assessment work.

### EL DORADO COUNTY

*Excelsior*—In this gravel mine owned by an English company and under management of Baring Gould, near Placerville, pay gravel is being taken from five different benches. This was formerly a hydraulic mine, but is now being worked by drifting. The gravel is crushed in a mill.

#### FRESNO COUNTY

*International Mining and Development Company*—This new company has been organized to operate near Dunlap, near the Brushy Ridge and English Hill mines. There is both quartz and placer gravel in the ground purchased.

#### HUMBOLDT COUNTY

*Sugar Bowl*—This ranch, near the Hoopa Indian reservation, has been purchased by George W. Hennings, who will develop the mining ground on the property.

#### INYO COUNTY

*Gold Spur*—Thurman & Gray have leased this property at Ballarat to Colorado men on a working bond, and a tunnel will be continued on the 30-in. vein.

*Loretta*—Preparations are under way for reopening this copper mine owned by Charles M. Schwab and the Gail Borden estate. The property is situated in Termination valley some distance from Big Pine.

*Montezuma*—This old mine, near Big Pine, is now under lease to Stevens & Horn, and they are getting ready to ship ore to the smelter at Keeler.

*White Horse*—George Mans has leased this mine in the Panamint range where there is a small mill with concentrator.

#### KERN COUNTY

*Piute District*—Considerable development work is being done in the district this season and affairs are more active than for a long time.

#### MARIPOSA COUNTY

*La Sarle*—At this mine, F. L. Wallingford, manager, a new mill is being installed. The mine is better known as the Ortega or Turner.

*Mount Gaines*—At this property, near Hornitos, F. C. Longe, president, 75 men are employed and the 20-stamp mill is running steadily.

#### MONO COUNTY

*Boston Masonic Mining Company*—This new organization has a group of four

claims in Masonic district and will extend the present tunnel.

*Masonic Golden Cycle Mining Company*—This Carson City, Nev., company, of which A. M. Duncan, of that place, is secretary, has recovered the ledge at Masonic at a depth of 85 ft. The finding of this high-grade ore to the north of the Pittsburg-Liberty mines is considered of great importance to the camp of Masonic.

### NEVADA COUNTY

*Buena Vista Mining Company*—Grass Valley men have incorporated under this name to reopen the Jackrabbit mine, near Buena Vista in Grass Valley district. The funds have been assured for development.

*Idaho-Maryland*—The 20-stamp mill of this company at Grass Valley has been started on ore from the 700 level of the old Idaho mine.

#### PLACER COUNTY

*Cañon Creek*—After working several years and running several tunnels on this claim near Towle, G. W. Downing has struck fine gravel.

#### PLUMAS COUNTY

*Dutch Hill*—This mine, idle some time, is to be started up and equipped with electric hoisting and pumping machinery. A lower bedrock tunnel 2000 ft. long is to be cut. W. Savercool, one of the original owners, will be superintendent.

### SAN BERNARDINO COUNTY

*Daggett*—This old camp is now very dull indeed. All the borax companies operating there have quit work and removed their plants and quartz mining in the vicinity has been steadily on the decline for some time.

#### SIERRA COUNTY

*Omega*—In this mine, near Forest City, they have struck a broad pay streak of cemented gravel. W. G. Sharwood is manager and C. W. Brown, superintendent. The mine was formerly known as the Nellie Bly.

#### SISKIYOU COUNTY

*Johnson*—In this mine at Oro Fino, Superintendent Addison reports having struck ore which is being sacked for shipment.

#### TRINITY COUNTY

*Globe*—The mine at Dedrick will be closed for the winter, but five men will be left to continue the tunnel from the

Chloride-Bailey side of the mountain. Five stamps have been added to the mine this summer and electric power put in.

### Colorado

#### GILPIN COUNTY

*Gilpin Ore and Reduction Company*—This company has purchased the Gilpin 40-stamp mill and improvements in Black Hawk, and will proceed to remodel the plant into a modern concentrating mill. H. Irving Jones, Central City, Colo., is manager.

*Newhouse Tunnel*—After a suspension of operations for nearly two years, during which time the Gilpin County Chamber of Commerce and business men have labored assiduously with the view of having the tunnel extended through Quartz and Eureka hills, operations were resumed by Manager George E. Collins, of Idaho Springs, Dec. 15. The tunnel is in from the Idaho Springs side a distance of 17,470 ft., and a further distance of 5000 ft. will run it under territory which has produced largely from mines ranging from 500 to 2300 ft. deep. The tunnel will not reach its intended terminus at the Eureka mine inside of 18 months. It will drain a great many mines which have been closed down for years past on account of the enormous expense of handling the water, and these mines will be tapped at depths ranging from 1500 to 1700 ft. The basis of resumption is an agreement between the various mineowners along the line of the tunnel and the tunnel company, the former agreeing to pay 25c. per ton royalty on all milling ores and \$1 per ton on smelting ores taken out of the various properties after the mines are drained, whether the ores are taken out through the tunnel level or hoisted out through the various shaft workings. The water in the various mines now stands about 600 ft. deep. Besides the drainage feature, there is also that of ventilation. It is estimated that within the next year employment will be furnished to at least 1000 additional men, as a number of mines will be able to work along liberal lines by that time. The starting up of the tunnel, in which British investors are interested, marks the most important epoch in the history of Gilpin county, and is the source of much rejoicing.

*Tungsten*—Frank Augustus, of Rollinsville, Colo., is arranging for the installation of an air-compressor plant on the Mammoth tunnel tungsten workings on North Beaver creek, and also for the daily shipping of 20 tons of tungsten ores to Henry E. Woods, of Denver, for treatment. The ores run about 10 per cent. tungsten for the milling ores, the high-grade ores to be shipped separately.

#### LAKE COUNTY—LEADVILLE

*A. Y. & Minnie*—About 30 tons a day is being shipped to the Western Chemical works at Denver; the work of cleaning

out a number of drifts is still in progress and when completed the daily tonnage will be more than doubled. When the contracts for the output for the coming year are signed the company will be in a position to ship 150 tons daily, and in all probability the mill will be started.

*Aztec Group*—This group, in the same South Evans gulch, is being worked under lease by James Kavanaugh and associates. The work is being carried on in a drift from the old shaft at a depth of 125 ft.; 80 ft. from the shaft a good streak of ore was encountered carrying gold, silver, lead and copper. The mine is sending out in the neighborhood of 50 tons a week. The ore is found in the lime.

*Aztec Group*—This group, in the same district, is being worked by a tunnel, which is now in a little over 100 ft.; the tunnel will be driven a distance of 750 ft. when a shaft will be sunk at that point to the ore horizon.

*Evelyn Shaft*—This shaft, South Evans gulch, has been unwatered and drifting southwest and northeast is now being carried on. The drift to the south is expected to catch the oreshoots from Breece hill and that to the north should open an oreshoot before it reaches the Ball Mountain fault.

*Hilltop*—From this mine, Horseshoe district, about 100 tons daily of a good grade of zinc ore is being shipped from this property to the zinc works at Kansas City.

*Lou Dillon*—Work has been carried on in this mine, Iowa gulch, for the past few months. Within the last few days the ore has been caught, carrying gold, and when it is developed shipments will be started to the smelter. The lessees expect this to take place by the first of the year.

### Idaho

#### SHOSHONE COUNTY

*Reno Group*—This property, situated near Burke, is to be operated by W. A. McCune, of Salt Lake, and Walter Mackay, of Portland. A force of men will be put to work about the beginning of the week to drive a 1200-ft. tunnel to tap the ore at depth. A large amount of development work has been done and a good showing made.

*Dalmatia Company*—A contract for 100 ft. of tunnel work has just been let to Steve Barbora. At a meeting of directors held this week it was decided to levy an assessment of one mill a share Jan. 11; delinquent Feb. 8.

*Butte & Coeur d'Alene Mining Company*—An arrangement has been made by which the company will ship its ore to the Panhandle smelter at Sandpoint. A force of 25 men is engaged at the mine and the new hoisting machinery and compressor plant are being installed.

*Monarch*—Work will be resumed Dec.

20. Manager Spalding is in the district purchasing machinery and making all preparations for extensive development.

*Spring Gulch Mine*—Of the bond of \$37,500, there has been paid \$22,500, and it is announced that arrangements will be made to pay the balance in the near future. One car of ore recently shipped netted \$135 per ton.

*Saltese Consolidated*—Four feet of solid copper ore has been encountered and arrangements are being made to commence shipments. Three cars of ore are already on the dump; this will be shipped to the smelter at Anaconda.

*Copper Mountain Company*—At the annual meeting of stockholders the following directors were elected for the ensuing year: Doctor Alexander, Katherine Green, E. B. Crawford, J. W. Hutchins, U. H. Fillio, C. D. Brock, M. Coal and W. Cluff. An assessment of one mill a share has been levied, payable Jan. 8.

#### BOISE COUNTY

*El Casa Placer Mining Company, Ltd.*—The property consists of 800 acres of ground, known as the Kemper ranch, situated about 22 miles northeasterly from Boise City. Prospecting has been carried on since 1906, and recently steps were taken looking to the beginning of active operations. The company is incorporated under the law of Idaho.

### Iowa

*Iowa Coal Operators' Association*—At the annual meeting in Des Moines recently, the following officers were chosen: President, H. L. Waterman, Ottumwa; vice-president, David Dimming, Cincinnati; treasurer, E. C. Smith, Des Moines; secretary and commissioner, Joseph Sharp, Albia.

### Michigan

#### COPPER

*Copper Range*—The sand pipes have reached the ledge preparatory to diamond drilling on Sections 7 and 8 which adjoin the old Atlantic workings. It is to prove this lode on these lands that the drilling is being done.

*Superior*—This mine is practically ready to begin daily rock shipments to the Atlantic mill; the surface equipment is completed and the shaft has been enlarged to accommodate two skips and only a little retimbering is necessary before the shaft can go into commission. Work in the lateral openings has been resumed, and shaft sinking will soon begin again. A small quantity of rock has been shipped to the mill and a preliminary run has been made; but actual stamping will not start for a few weeks.

*Ojibway*—No. 2 shaft is nearing the 650-ft. or third level, and crosscutting to the lode will then be started. It is believed that as greater depth is obtained

the shattered condition, existing at the levels above will be eliminated. No. 1 shaft is sinking about 75 ft. below the first, or 500-ft. level, and the lode opened at this point was of a very substantial character and exceptionally rich.

*LaSalle*—Sinking has been temporarily suspended at the two shafts on the Caldwell tract and crosscutting is now under way; in this manner the surrounding territory will be exposed. Sinking is going forward in the Tecumseh shaft.

*Centennial*—No. 1 shaft is nearing the 35th level and No. 2 the 32d. The northern drifts from the lower levels of No. 2 shaft are approaching the mineralized zone of the Wolverine and a much better grade of rock is in evidence.

*Hancock*—No. 1 shaft is down to the 14th level and sinking has been discontinued. Developments on the west lode, opened by a crosscut from the shaft are encouraging, the formation being of a better grade and more consistent than the Hancock lode, which this company previously worked. No. 2 shaft is sinking close to the 15th level on its way to intercept the various lodes traversing the tract. From the 13th level a crosscut is being extended to connect with a similar one from No. 1 shaft, and when completed all rock will be hoisted through No. 2 shaft.

*Elm River*—This property continues sinking its vertical exploratory shaft preparatory to driving a crosscut to cut the various formations in that vicinity.

*Tremont-Devou Mining Company*—This is a new incorporation; the property consists of 680 acres adjoining the Victoria, and is believed to carry the strike of the Lake lode. The company is capitalized at 100,000 shares, par value \$25. Charles Smith, of Hubbell, Mich., is president.

## Montana

### BEAVERHEAD COUNTY

*Gladstone Gold Mining Company*—The installation of a new headframe and hoisting machinery and the erection of an engine house have recently been completed.

### BROADWATER COUNTY

*Keating Gold Mining Company*—At a recent meeting of directors it was decided to dispose of some of the treasury stock for the purpose of increasing the fund for development work. The company's property is situated about 10 miles from Radersburg and consists of eight claims on which development work has been done to a depth of about 400 ft. Shipments are being made steadily to the Butte Reduction Works.

### BUTTE DISTRICT

*Butte & Superior*—A body of copper ore of commercial grade was struck a few days ago at the 1350-ft. mark in the Black Rock shaft. Should the vein prove to be of sufficient extent to warrant develop-

ment on a large scale it will mean a great deal for the properties in the northern part of the Butte district.

### DEER LODGE COUNTY

*Rock Mountain Gold Mining and Milling Company*—This company has recently been formed to work gold properties in the neighborhood of Danielsville. James Belf is president, M. Whalen secretary, and D. Lappin, of Boston, and Dan Daniels and C. A. Winters, of Anaconda, are the directors. Benjamin Daniels will have charge of the work as superintendent.

## Nevada

### ESMERALDA COUNTY—GOLDFIELD

*Goldfield Consolidated*—The 600-ton mill will go into commission about the end of the year. It is expected that a dividend will be paid in January. The company is said to have \$800,000 cash on hand.

*Daisy Florence*—This lease on the Florence recently acquired by Mithcell and Fairfield has developed bonanza ore in a raise from the 315-ft. level. This high-grade ore was found within 6 in. of the point at which the former owners abandoned the lease. Under the terms of the lease to Mitchell and Fairfield the Florence company gets a flat royalty of 25 per cent. and the former owners a royalty of 7½ per cent. The ore has a streak, about ¼ in. wide, of almost solid gold. Ten inches of ore alongside this streak assays between \$400 and \$500 per ton. Machine drills have been installed, the compressed air being obtained from the Baby Florence.

*Joshua Man Gold Mining Company*—This company owning patented ground on Vindicator mountain will start work on company account as well as by leases. A. H. Leisering has been granted the first lease and will begin work in the old 300-ft. tunnel. The lease has 2 years to run and the royalty to be paid is 20 per cent.

*Goldfield Mining and Reduction Company*—This company, owning four claims in the northern portion of the district two miles beyond Columbia mountain, has started work. The shaft, now 80 ft. deep, will be sunk to a depth of 200 ft.; at that depth crosscutting will begin. A gasolene hoist has been installed.

*Shoshone*—Morris Jones, of Manitou, Colorado, has started work on his Shoshone property on Horton mountain.

*Stoneham-Moore Griffiths*—This lease, which is on the Combination No. 2 claim, is stacking ore valued at \$60 per ton. The extent of the orebody, found on the 400-ft. level at a distance of 170 ft. east of the shaft, has not yet been determined.

*Little Florence Lease*—The winze from the 300-ft. level is down 30 ft. An air hoist is being installed, and the winze will be sunk to the 370-ft. level. This winze is in a fine body of ore averaging about \$40 per ton. The three-compartment shaft

is now 600 ft. deep; it will be sunk 100 ft. deeper at once.

### ESMERALDA COUNTY—RAWHIDE

*Grutt Mining Company*—A few days ago a pocket of rich ore was found at surface near where the large boulder of rich ore was found last year. The main vein is 32 in. wide and contains some shipping ore.

*Grutt Hill Mint*—The shaft is now 300 ft. deep and has passed through 6 ft. of milling ore.

*Grutt Hill Truitt*—A 10-in. streak of rich ore has been found on the 110-ft. level. There is considerable milling, developed in the property.

*Consolidated Mines Company*—The Murray and the Big 4 leases on this company's property are preparing to build mills. The timbers for the Murray ten-stamp mill have arrived. Considerable milling ore assaying from \$20 to \$40 per ton has been developed in the Murray lease above the 200-ft. level. The shaft on the Big 4 lease is 200 ft. deep; considerable milling ore assaying \$12 to \$40 per ton has been developed.

*Hooligan Hill*—In the Holland Rickard, the Truitt and the Miller leases on Hooligan hill, considerable ore, rich enough to ship to Shurz for milling, has been developed.

*Rawhide Rector*—In this property, about 1½ miles west of Grutt and Hooligan hills where the ore contains mainly gold, are the best defined veins in the district; these veins contain mainly silver.

### ESMERALDA COUNTY—TOKOP

*Tokop Keystone Company*—This property, 30 miles south of Goldfield in the Slate range, is being opened up in earnest. The Keystone incline is down 200 ft. on a 45-deg. slope and shows 8 ft. of low-grade quartz ore. A vertical shaft has been started to cut this vein at a depth of 300 feet.

### HUMBOLDT COUNTY—CHAFEY

*Black Hole*—The new power plant consisting of a 40-h.p. hoist, an 80-h.p. boiler and an air compressor has been started up. Crude oil is used for fuel.

### NYE COUNTY—BULLFROG

*Pioneer*—The second carload of ore brought \$4269; the shipment contained 74,461 lb. of ore. A 25-ton plant has been erected to treat the ore that will not pay to ship.

*Mayflower*—At the recent annual meeting of the company it was decided to erect a five-stamp mill. A. C. Eisen, of Goldfield, was elected president.

*Yankee Girl*—Work on a small scale has been resumed on the Yankee Girl.

### NYE COUNTY—CLIFFORD

Helena is now the official name of this camp, for the Government has established a post office by that name there. In the



future the camp will be called Helena in these columns.

*Broken Hills*—Ground is being broken for the 50-ton stamp mill which will be erected as soon as possible.

#### NYE COUNTY—JOHNNIE

*Crown Point Globe Mining Company*—From the clean-ups at the one-stamp mill gold bullion amounting to from \$10,500 to \$11,000 was obtained during November.

#### NYE COUNTY—TONOPAH

The output of the Tonopah mines for the week ending Dec. 11 was 5268 tons, having an estimated value of \$131,700. The Tonopah Mining Company sent 3000 tons to the mills; the Belmont, 700; the Montana-Tonopah, 593; the Midway, 100; the MacNamara, 375; the West End, 150; and the Jim Butler, 350 tons.

*MacNamara*—From Jan. 1, 1908, to Dec. 1, 1908, the MacNamara mine produced a little over 400,000 oz. silver.

*Tonopah Mining Company*—Another record-breaking week's work was recorded for 520 ft. of development work was done. Ore has been found in the Red Plume shaft in a drift near the Tonopah Extension ground.

*Jim Butler*—The Stone Cabin shaft is now 725 ft. deep, having been sunk 9 ft. during the week. No further sinking will be done for the present.

*Belmont*—Winze No. 9 from the 1000-ft. level along the hanging-wall side of the Mizpah fault is down 125 ft. and has found several good bunches of ore. Drifts from the 50-ft. point in the winze have also opened up considerable good ore. A station is being cut at the bottom of the winze.

*Montana-Tonopah*—During the week ending Dec. 5 the mill treated 611 tons of Montana and 394 tons of MacNamara ores.

#### STOREY COUNTY

*Ward Shaft*—On Dec. 13 the Ward shaft was pumped out and the sump on the 2500-ft. level emptied. The water is being easily handled by the Knowles-Blake pump.

#### WHITE PINE COUNTY

*Giroux*—It is said that the Guggenheims are still trying to secure control of this company.

### Oregon

#### LANE COUNTY—BOHEMIA

*Vesuvius*—Supplies for the winter and spring are being hauled to this property belonging to F. J. Hard and near to Bohemia post office. A contract for building three miles of road between the Vesuvius and the Riverside properties has been let. The stamp mill will start soon.

*Riverside*—A contract for 500 ft. of drifting on the Riverside vein has been let by the owner, F. J. Hard.

*Mayflower*—Machinery for the 100-ton mill is being hauled to the mine. About 15 to 30 men are working underground.

*West Coast Mines*—The 30-stamp mill at these mines, formerly known as the Oregon Securities property, will be started soon.

### South Dakota

#### LAWRENCE COUNTY

*Blue Belle*—A lead and zinc ledge 30 ft. wide is being developed by Aaron Dunn, the owner.

*Branch Mint*—The old Richmond-Sitting Bull Company dumps at Galena have been purchased by New York men under Michael Hecht and test runs will be made in the big stamp mill.

*Horseshoe*—The new hoist at Terry is in commission and work has been resumed on the ground again.

*Julius*—James Julius, of Lead, has discovered a new ledge on his ground near there. The ore is free milling and shows values that average over \$5 gold.

*Phoenix*—A deal is now pending for the purchase of this ground, together with the Jupiter ground owned by New York men. Both are old-time producers, but have lain idle for several years owing to disputes among the owners. The Phoenix is the old Deadbroke. J. G. Thomas, of Deadwood, is interested in the deal.

*Mogul*—The production is maintained at 400 tons daily. The Lucile claim has been unwatered and is again producing ore.

*American Eagle*—Extensive repairs are being made in the mill and considerable development work will be done on the property by Manager Goldbloom.

*National Gold Mining Company*—John Treber and associates have organized a new company to which the old property in Carbonate has been deeded.

#### PENNINGTON COUNTY

*Continental Copper*—Preparations are being made to blow in the smelter at Sheridan as the property is being fast unwatered with the new pumps. Manager A. C. Overpeck, of Hill City, is in charge.

*Hymalulu*—A small stamp mill will be erected on the property near Mystic, as recent development has shown up good ore. Judge Bennett, of Mystic, is the owner and manager of the property.

*Clara Belle*—A new strike of ore of good milling grade has been found on the 200-ft. level. So far it is several feet wide.

*Bismark*—Under the management of James T. West, of Chicago, a force of men is opening up this mine near Keystone and will shortly start up the 200-ton cyanide mill.

*Mariposa*—Superintendent Wise has

gone to Minneapolis to confer with the owners about erecting a mill on the property near Mystic. Several good gold ledges have been opened up and the ore supply is ready.

### Utah

#### SALT LAKE COUNTY

*Boston Consolidated*—According to L. Hanchett, general manager, while steam-shovel mining has not been so successful at Bingham as was anticipated, it will be many years before this method will be abandoned, inasmuch as it is the best and cheapest method for winning much of the porphyry ore. Recent developments have largely increased the tonnage of ore assaying 1.5 to 1.8 per cent. copper in the property of the Boston Consolidated. By the end of 1908 the concentrating mill will be in commission with its full capacity of 3000 tons of ore daily.

### Wisconsin

#### ZINC-LEAD DISTRICT

*Cuba City*—The Pittsburg company is sinking on new ground where drilling showed disseminated jack at 23 to 45 ft. and a lower run at 60 to 66 feet.

*Model Mining Company*—This company has started sinking on the Emma Harms land, one mile north of Elmo.

*Platteville*—Milwaukee men have leased the J. S. Jones property, formerly the Reliance, and will commence shaft sinking.

*Shullsburg*—The Maid of Erin and Bessie mines will be equipped with concentrators by Ironwood, Mich., parties, who hold lease and title to 300 acres adjacent to the village.

*Toadville Mining Company*—This company struck rich sheet jack recently at 42 ft. on the Hartshorn land just north of the St. Rose.

*Weigle*—Negotiations are pending for the sale of this mine and 75-ton mill equipment to Eastern interests.

### Canada

#### ONTARIO—COBALT DISTRICT

*Ore shipments*—Shipments of ore for the week ending Dec. 12 were as follows: Crown Reserve, 57,000 lb.; Chambers-Ferland, 60,000; Drummond, 40,000; La Rose, 151,100; McKinley-Darragh, 41,340; Nipissing, 202,562; O'Brien, 127,837; Right of Way, 185,480; Silver Queen, 127,000; Silver Cliff, 120,000; Temiskaming, 60,000; Temiskaming & Hudson Bay, 120,000; total, 1,357,319 pounds.

*La Rose*—The appeal of the La Rose Mining Company in the action against the Right of Way Company and the Temiskaming and Northern Ontario Railway Commission, has been dismissed by the British Privy Council. The suit began two years ago. The Ontario government in the original title given to the La Rose

property reserved a strip 99 ft. wide for the railway. The La Rose owners contended that this reservation did not include minerals beneath the surface. The T. & N. O. Commission, however, representing the government, granted the mineral rights to the Right of Way Company, but the La Rose extracted ore from the strip amounting in value to \$175,000. The case was tried in the Canadian courts, which found against the La Rose, and the Privy Council has confirmed this view and awarded the amount mentioned to the Right of Way. The net earnings of the La Rose mine for November were \$93,447, and for the six months ending November \$560,418.

*Beaver*—Since a recent accident at the mine the shaft has been timbered to the bottom and development work is in progress at the 200-ft. level, where about 200 ft. of cross-cutting has been done. Drifting is being done at about the 75-ft level on a 12-in. calcite vein.

*Buffalo*—A boiler explosion occurred Dec. 16, E. Lavergne, an employee, being fatally injured. The company's operations will be delayed until the boiler which was specially made, can be replaced. It had been in use only two months.

*Cobalt Central*—An important strike has been made by diamond drilling at a point 350 ft. below the surface. At 58 ft. west of the intersection of "Big Pete" and No. 2 vein, a vein was cut running 5000 oz. silver to the ton, with native silver showing plentifully in the wall rock on both sides.

*Kerry Mining Company*—On the Peterson Lake lease of this company two calcite veins have been found; one of them carries silver on the surface. The main shaft is down 50 ft. and will be sunk to the 100-ft. level, where crosscutting will be undertaken to tap seven veins which show on the surface. On the company's Cart Lake lease, No. 1 shaft is down 100 ft., and drifting on the vein will be begun.

*McKinley-Darragh*—Nos. 1 and 2 shafts have been connected at the 150-ft. level, and crosscutting has been extended west to the Right of Way. In crosscutting under Cobalt lake seven veins have been worked and drifting will be begun on others during the winter.

#### ONTARIO—MONTREAL RIVER DISTRICT

*Marcel*—A shaft is being sunk on a vein from 1 to 8 in. wide, carrying calcite, cobalt bloom, copper and native silver, which has been traced for 500 ft. on the property.

### Mexico

#### AGUASCALIENTES

*El Corralillo*—This property at Cobre has been sold by William Davidov to a group of Pittsburg capitalists.

#### CHIHUAHUA

*International Oil and Gas Company*—

This company, in which Indianapolis men are interested, has begun drilling operations on its tract in the vicinity of Falomir along the line of the Orient railway east of Chihuahua. Two wells have been started and the drilling machinery is now en route. A. M. Nelson is the general manager in charge.

*Chicago-Mexican*—The five-stamp mill will be placed in operation early in January. The ore runs largely in silver. The mine is near Cusihiuriachic. W. W. Hinkle, of Chicago, is the secretary-manager.

*Sta. Eulalia Exploration Company*—The monthly shipments from this company's Santa Eulalia mines average nearly 3000 tons, the bulk of this tonnage coming from the Buena Tierra property. The ore runs about 25 oz. silver and 10 per cent. lead. Operations are in charge of F. Chapallet, manager, and J. H. Gilmore, superintendent.

*Palmarejo & Mexican Goldfields, Ltd.*—It is reported that this English concern, carrying on operations in the Chinipas section close to the Sonora state line, is to adopt a new milling system, in the event of which a new mill will be erected at a site near the mines. T. H. Oxnam, formerly general manager and President Southcott are now at the properties.

*Velardeña*—The opening up of a considerable body of ore running 50 oz. silver and 60 per cent. lead is reported on the 500-ft. and 750-ft. levels of this mine at Santa Eulalia. It is a holding of the American Smelting and Refining Company.

#### GUANAJUATO

*San Matias Mill*—This mill of the Mexican Milling and Transportation Company, one of the allied interests of the Guanajuato Development Company, has made its last purchase of ore from the larger shippers, and has set the last day for the buscones to bring their ore to this custom mill. The main reason for closing the mill is the present low price of silver, which does not permit a profit on the milling of the ores brought to the mill by the buscones and small shippers.

#### SINALOA

*Palmarito Mining Company*—The 150-ton lixiviation plant of this Philadelphia company in the district of Mocorito, is practically closed down pending changes in the crushing and roasting departments. Charles D. Smith is manager.

*Mina Grande and Los Tajos*—James B. Shepard, late of Jalisco, is developing these properties in the district of Santiago de los Caballeros, Badiraguato. A mill is contemplated and a test lot is being shipped to Denver for treatment. Both properties are producers of high-grade silver-lead ores and have produced a great deal of silver.

*West Coast Mining and Smelting Com-*

*pany*—This company, operating the Los Tajos copper mines on the Huajote river, Badiraguato, is erecting a 40-ton concentrating plant and installing a six-drill compressor and drills. The mill crushes wet. The equipment includes a 7x10-in. crusher, two sets of 20x12-in. rolls, screens, elevators, and Bartlett tables. The mines have been developed by a series of tunnels and during the past two years a large amount of ore has been opened up. Edward H. Hicks is manager, and R. N. Hines superintendent.

*Rosario*—This mine, San José de Gracia district, is operating on low-grade ore. The properties are still in litigation, with the defendants in possession of the mines.

*Jesus Maria*—This mine, San José de Gracia district, owned and operated by Francisco Paraza and Toriba Hermanos, is producing \$60,000 per month in gold bars. The plant consists of stamps with cyanide annex. This property was owned and operated at one time by the Anglo-Mexican Mining Company, of Boston, and was sold to Francisco Paraza, son of the original owner.

#### SONORA

*Silver Tiger*—The property at Nacozari, formerly owned by the Kansas City-Credo Liberal Mining Company, has been reincorporated under the name of the Silver Tiger Mining Company, of Kansas City, Mo., which expects to resume operations in the near future. T. L. Crane, formerly resident manager, will be in charge of active operations. The new company expects to install a hoisting plant and complete surface equipment.

*Moctezuma*—The Mina Gruto de Monte Cristo is reported to have been sold to C. B. Bell, C. H. Jones and F. S. Douglas, of Nacozari and Douglas, for a price approximating \$200,000, of which \$25,000 is to be paid within 90 days. This property lies about 30 miles southeast of Moctezuma, and under the ownership of Don Carlos C. Soto has shipped about 1,000,000 oz. silver in ores averaging about 600 oz. to the ton. The maximum depth attained in the present workings is less than 200 feet.

*Cumpas*—The San Lorenzo property, about 25 miles west of Cumpas, has been sold by the owners represented by Martin Higginson to eastern men for a sum not made public. This property has been shipping high-grade copper ore carrying silver for some time.

#### TAMAULIPAS

*Sulphur Discovery*—A deposit of sulphur has been discovered about 50 miles from Matamoras, 35 miles from the nearest railroad and about the same distance from the nearest seaport. A deposit from 25 to 30 ft. thick, high in sulphur, covered by only 5 to 7 ft. of soil, is said to have been disclosed by 30 drill holes.

# Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

## QUOTATIONS FROM IMPORTANT CENTERS

### Coal Trade Review

New York, Dec. 23—Coal trade in the West is still quiet. Domestic demand is kept down by the weather, and there has not been sufficient increase in the call for steam coal to make up for the lull caused by the closing of the Lake trade. There is not as much over-production as was feared, and trade has been rather even, with little change in prices.

The Seaboard bituminous trade is still rather dull. Coastwise trade is falling off, but that is not unusual in December. Steam-coal demand improves slowly.

The anthracite market still depends on the weather. Shipments are kept up from the mines, but it is probable that a large quantity is going into storage. The companies are possibly accumulating stocks in order to be provided in case of trouble with the miners next April.

#### COAL TRAFFIC NOTES

Tonnage originating on Pennsylvania lines east of Pittsburg and Erie, year to Dec. 12, in short tons.

	1907.	1908.	Changes
Anthracite.....	5,427,766	4,935,787	D. 491,979
Bituminous.....	38,131,372	32,295,861	D. 5,835,511
Coke.....	12,816,027	6,822,053	D. 5,993,974
Total.....	56,375,165	44,053,701	D. 12,321,464

The total decrease this year to date was 21.9 per cent.

Bituminous coal and coke shipments, Pennsylvania and West Virginia, 10 months ended Oct. 31, short tons:

	Coal.	Coke.	Total.
Balt. & Ohio.....	18,558,560	2,459,605	21,018,165
Buff., Roch. & Pitts.	4,522,931	273,788	4,796,719
Buff. & Susqueh'na	940,259	160,925	1,101,184
Penn. lines, N. Y. C.	5,474,651	59,238	5,533,889
Pitts. & L. Erie.....	6,811,757	2,429,317	9,241,074
Norfolk & Western.	9,152,684	1,571,202	10,723,886
Total.....	45,460,842	6,954,075	52,414,917
Total, 1907.....	55,434,947	10,222,657	65,657,604

Total decrease, 13,242,687 tons, or 23.9 per cent. In addition the Baltimore & Ohio carried 823,293 tons of anthracite in 1907, and 632,013 in 1908; a decrease of 191,280 tons.

Coal tonnage of railroads in Ohio Coal Traffic Association, 10 months ended Oct. 31, short tons:

	1907.	1908.	Changes.
Hocking Valley.....	3,399,574	2,691,594	D. 707,980
Toledo & Ohio Cent..	1,506,729	1,309,875	D. 196,854
Baltimore & Ohio....	1,909,401	1,184,887	D. 724,514
Wheeling & L. Erie..	2,910,115	2,257,118	D. 652,997
Cleve., Lorain & Wh.	2,443,620	1,996,796	D. 446,824
Zanesville & Western	1,322,452	1,050,341	D. 272,111
Toledo Div., Pen. Co.	1,886,568	1,278,968	D. 607,600
L. Erie, Alliance & Wh.	1,017,548	870,041	D. 147,507
Marietta, Col. & Clev.	27,898	43,967	I. 16,069
Total.....	16,423,905	12,683,587	D. 3,740,318

The total decrease shown this year was 22.8 per cent.

Coal shipments reported by Southwestern Interstate Coal Operators' Association, nine months ended Sept. 30, short tons:

	1907.	1908.	Changes.
Missouri.....	2,012,944	1,626,494	D. 386,450
Kansas.....	4,664,696	3,485,586	D. 1,179,110
Arkansas.....	1,663,941	1,280,613	D. 383,328
Oklahoma.....	2,121,429	1,789,727	D. 331,702
Total.....	10,463,010	8,182,420	D. 2,280,590

The total decrease for the nine months this year was 21.8 per cent. The shipments for the month of September showed an increase of 9.5 per cent.

### New York

#### ANTHRACITE

Dec. 23—The market for all sizes is quiet, and not much business is being done. The weather is mainly responsible for present conditions. Colder weather is promised, which will help the trade.

Schedule prices are \$4.75 for broken, and \$5 for egg, stove and chestnut. Small steam prices are: Pea, \$3.25@3.50; buckwheat No. 1, \$2.35@2.50; buckwheat No. 2 or rice, \$1.60@2; barley, \$1.35@1.50. All prices are f.o.b. New York harbor points.

#### BITUMINOUS

The soft-coal market is dull and consumers are not taking coal, preferring to let their stocks get low until after Jan. 1, at which time they take their inventories. In the far East business is quiet, but along the Sound it is better. New York harbor has not improved, and good grades of coal sell at \$2.45@2.65 per ton. All-rail trade is better than tidewater business, as a whole. Transportation from mines to tide is variable. Cars are in good supply.

In the coastwise-vessel trade boats are not plentiful, nor are they in good demand on account of the restricted business. A number of vessels are seeking business, but with small success. Freight rates remain unchanged. Quotations are as follows, for large vessels from Philadelphia: To Boston, Salem and Portland, 70@80c.; Lynn, Newburyport and Bath, 80@85c.; Portsmouth, 80c.; Bangor., \$1@1.10; Providence, New Bedford and the Sound, 70@75c. per ton.

### Birmingham

Dec. 22—Coal operations in Alabama have been quite active recently. There has been but little cold weather. The larger consumers of coal, however, have been increasing their demand right along,

and there has been a steady operation at mines. Contracts recently have been renewed by coal operators in the Birmingham district for the hire of State and county convicts. The Bessemer Land and Improvement Company has made a contract for the use of 200 convicts at a price that practically equals what free labor is given. A daily wage is paid for the convicts according to their physical grade, or so much per ton, for run-of-mine; the advantage of this contract to be in a steady employment of the men. According to the contract either the president of the convict board or the governor can conclude the contract at will. The contract is to run for a term of five years. Other companies in the Birmingham district have been closing contracts recently for the hire of county convicts. There are quite a number of miners and mine employees who are waiting for an improvement in conditions.

There has been no change in coal quotations. Coke is strong still. There is still considerable coke on hand, but the larger companies are going to need all of it during the winter.

### Chicago

Dec. 22—The coal trade is not especially active and shows little change from the previous week. Colder weather ought to have stimulated domestic trade, but few people buy at this season, if they can avoid it. Shipments from mines have slackened up a little, and there is not so much surplus to depress prices.

Illinois and Indiana coals are unchanged with a little better demand reported for steam coals. Brazil block is fairly active. Hocking Valley does not vary much from circular. Deliveries of Youghiogheny are still mainly on contract, and the same can be said of smokeless.

Anthracite is selling only in small lots. There is plenty of all sizes; chestnut, which was scarce, now seems to be in good supply.

### Cleveland

Dec. 22—The market is very dull, except for fine coal, for which there is a good demand. Massillon slack has brought 75@80c. at mine; No. 8 district slack, 75c. at mines. For large coal there is so little demand that Ohio producers are talking of short time, or a complete shut-down over the holidays. The demand for domestic coal continues small, on account of the weather.

### Indianapolis

Dec. 21—The unusually mild weather continues to curtail the output of the Indiana coal mines. The output for November was considerably less than for the corresponding month last year. The operators say they have made no attempt to force coal upon unwilling buyers. The curtailment is due to a lack of demand for all grades except steam coal. They have had little difficulty during the past week in disposing of all the steam coal produced. Reports from the Northwest are to the effect that neither consumers nor local dealers are stocked up as heavily as usual, and they are inclined not to buy any coal in advance of the probable mild weather demand. Indiana operators say that if discomfiture overtakes them when the winter begins to strengthen, the burden will be on them, for they have been urged persistently for some time to supply themselves in order to avoid such a contingency.

### Pittsburg

Dec. 22—Operations and prices continue about the same, but the outlook is somewhat better. The rains of the past week have made the rivers navigable, but the water was not sufficient today to let out any coal. Several large tows of empty coal boats and barges that had been held at down-river points for over six months came in and were immediately sent up to the pools. Arrangements are being made to start a number of the river coal mines that have been idle for lack of empties. The railroad coal mines are being operated at about 60 per cent. of capacity. There is an unusual demand for slack and prices are firmly held at 80c. Mine-run coal is still quoted at \$1.15 and 1¼-in. at \$1.40, an advance of 5c. over prices during the fall months.

*Connellsville Coke*—Conditions in the coke market remain unchanged. Consumers delay in placing contracts for next year. Producers insist that no advantage is to be gained by delay, as prices will be firmly held after the opening of the year. For spot shipment contract prices are shaded by from 10 to 20c. Furnace coke for the first half is quoted at \$2 and foundry at \$2.25@2.40 f.o.b. ovens. The *Courier* gives the production in the two Connellsville fields at 244,399 tons. The shipments were 9260 cars as follows: To Pittsburg district, 3218; to points west of Pittsburg, 5553; to points east of Connellsville, 489 cars.

### Foreign Coal Trade

*Welsh Coal Prices*—Messrs. Hull, Blyth & Co., London and Cardiff, report prices as follows on Dec. 12: Best Welsh steam, \$3.48; seconds, \$3.36; thirds, \$3.24; dry coals, \$3.60; best Monmouthshire, \$3.18; seconds, \$3.06; best small steam, \$1.92;

seconds, \$1.68. All per long ton, f.o.b. shipping port.

*British Coal Exports*—Exports of fuel from Great Britain, with coal sent abroad for use of steamships in foreign trade, 11 months ended Nov. 30, long tons:

	1907.	1908.	Changes.
Coal.....	58,407,880	57,375,422	D. 1,032,458
Coke.....	875,639	1,087,618	I. 211,979
Briquets.....	1,360,798	1,345,705	D. 15,093
Total exports....	60,644,317	59,808,745	D. 835,572
Steamer coal.....	17,080,575	17,815,990	I. 735,415
Total.....	77,724,892	77,624,735	D. 100,157

The larger exports this year were 9,538,322 tons to France, 8,951,104 to Germany, and 3,993,288 to Sweden.

### Iron Trade Review

*New York, Dec. 23*—The iron trade generally seems to be waiting for the new year, and the past week has been rather a quiet one.

In pig iron there have been some inquiries for foundry iron, but they are of a tentative sort, not resulting in orders, but apparently intended to establish a range of prices upon which foundries can base calculations. Basic iron shows more sales, and more inquiries based upon actual demand. The scarcity and high price of scrap is helping sales of foundry pig. Basic-steel makers also find heavy steel scrap scarce and high, and are, therefore, inclined to take more pig.

Structural steel is very quiet for the present, with few orders being placed. Some orders for rails are coming forward, and quite a large tonnage is expected to be placed soon. Other finished material is quiet for the time being; the question is how soon a revival will come.

*Ontario Iron Ore*—A deposit of iron ore on the southwestern arm of lake Temagami, in Ontario, is being tested by five diamond drills. It is reported that this work is being done in the interest of the United States Steel Corporation.

### Baltimore

Dec. 22—Exports from the port of Baltimore this week included 3,266,800 lb. steel billets to Liverpool and 1,128,000 lb. to Glasgow; 736,278 lb. tin scrap to Rotterdam; 147,285 lb. zinc dross to Liverpool.

### Birmingham

Dec. 21—While this is usually the season for a lull in the pig-iron and steel market, Alabama furnace companies continue to book orders right along for delivery during the first half of the coming year. There is not great activity, however, producers apparently waiting for an advance in the quotations, and holding back from bidding on possible business. Inquiries that are heard of in the open market would indicate that there is to be a strong demand for iron by some of the larger consumers in the near future. During the past week one of the large cast-

iron pipemaking concerns was in the field inquiring as to a large tonnage. The fact that there has not been a complete cessation of trading in the Southern iron and steel market with the holiday season at hand is accepted with considerable encouragement. There has been another lot of early-delivery iron sold above \$13 per ton, No. 2 foundry, but a general advance has not been authorized in the quotations. No. 2 foundry iron is quoted at \$13 per ton, delivery during the first quarter of the coming year, with two of the larger companies still out of the market. There has been no improvement in the make in this section lately, and none will be announced this year.

### Chicago

Dec. 22—Pig iron is dull for the time, but the lull now apparent does not look like a set-back, but rather the quiet which we usually expect at the end of the year. What sales have been made are of small lots for early or first-quarter delivery. Some inquiries are in for second-quarter iron, but no sales of this class have been made this week.

Southern No. 2 holds at \$13@13.50 Birmingham (\$17.35@17.85 Chicago). The higher price is quoted for second-quarter deliveries. Northern is still \$17, but at least 50c. more is asked, and some furnaces hold to \$1 more for any deliveries after March.

In finished iron and steel there is a lull, as with pig iron, but it seems to be only temporary. Coke is unchanged.

### Cleveland

Dec. 22—The Lake receipts of iron ore are at an end for the season. The dock stocks are being gradually drawn down, as shipments to furnaces are increasing. Some sales of iron ore are being made at the prices which have ruled through the season.

Pig iron is dull, the orders coming in being for small quantities only. There is no change in prices, though makers are inclined to be firmer in their views, as they look for better business in January.

### Philadelphia

Dec. 23—The pig-iron market has developed strength for forward delivery, especially in basic pig. Negotiations are still pending for large lots for first-quarter delivery in this territory. General consumption is increasing. The feature of the week is a number of inquiries from large consumers for delivery during the second quarter of the year, but no business of importance of this character has been placed.

Another interesting feature is the larger quantities of iron asked for. Poor iron has been pretty well cleaned out of the market. Foundry iron has improved materially, although the bulk of the business

is in small lots thus far. Makers of good brands are holding prices firmly. Forge still drags, although the bar mills are getting more work. The general situation is improving.

**Steel Billets**—Increased activity prevails mostly in small lots.

**Bars**—The feature of the market is the presentation of inquiries for large lots of iron for delivery during the first quarter of the year. The present demand is for small lots for prompt delivery. Stocks among consumers are low. Prices show no weakness.

**Sheets**—While there are few large orders for forward delivery there is more business going to the mills.

**Merchant Steel**—The retail demand has improved, and large consumers in a few instances have asked for quotations on first-quarter business.

**Plates**—The plate business has wonderfully improved, and large orders are coming along; but there is no toning up of prices.

**Structural Material**—Bridge work is coming along and car work is more promising than for months.

**Scrap**—Scrap was suddenly advanced 25 or 50c. for railroad and No. 1 yard. A further advance is announced. Millmen are anticipating this and are actively buying, but there is not enough material to supply them.

### Pittsburg

Dec. 22—This is an exceptionally dull week in the iron and steel trade, only orders for small tonnages being placed; most of the active mills will be closed for the Christmas holiday. Some plants closed yesterday for the week as repairs are necessary but the rest will be idle only from Dec. 24 and will resume again on Dec. 27.

The feature of the past week was the placing of an order for 135,000 tons of steel rails by the Pennsylvania Railroad. The Carnegie Steel Company got 30,000 tons of this order and will roll the rails early next month. While the tonnage looks large it is insignificant compared with the capacity of the rail plant. The Edgar Thomson works can produce 90,000 tons a month when running full. The Carnegie company, which is operating the Mingo steel plant at one-half capacity, will put the entire works on in full immediately after the opening of the new year, also the two idle blast furnaces. The company started one of the three Isabella furnaces in the Pittsburg district today and expects to put the other two in blast about the middle of January. The American Steel and Wire Company is rushing repairs at the steel plant and blast furnaces at Donora and will put them in full operation early next month. The wire departments are running full. The company expects to have all of its plants run-

ning at normal within the next three weeks as the outlook for the wire trade after Jan. 1 is extremely good. Independent wire interests also report excellent conditions. In tinplate there is a good run of business and the leading producer will have about 90 per cent. of its capacity going early in the new year. New business in structural steel is limited to small tonnages. The only large work pending for which bids have gone in is for the plant of the Crane-Best Company at Oakmont. It was to have been let this week but was deferred. The contract calls for about 2500 tons of steel. The Republic Iron and Steel Company closed its bessemer-steel plant at Youngstown for repairs, but expects to have it going in full early next week. Other plants of the company in the Youngstown district are idle for repairs.

**Pig Iron**—The market continues quiet, but prices are firm and some furnaces have advanced current quotations about 25c. a ton. Sales of the week consisted of carload lots; one contract for 300 tons of No. 2 foundry was closed at the minimum rate of \$16, Valley furnace. The American Car and Foundry Company was in the market for 8000 tons for its Detroit works. It does not usually buy Valley iron, but on this tonnage sent inquiries here. The prices, however, were not satisfactory and the contract was placed with Western furnaces. It is understood the company bought 1000 tons of No. 1, 2000 tons of No. 2 and 5000 tons of gray forge. Quotations for first quarter are as follows: Standard bessemer, \$16.50@17; No. 2 foundry, \$16@16.25; malleable bessemer and basic, \$15.75@16; gray forge \$14.50@15; all f.o.b. Valley furnaces.

**Steel**—There have been but few transactions in crude steel, most of the deliveries being on contract. The price of both bessemer and open-hearth billets remains firm at \$25, Pittsburg. Tank plate is quoted at 1.60c. and merchant-steel bars at 1.40 cents.

**Sheets**—The sheet trade continues exceptionally good for a dull period and prices are strong. Black sheets are quoted at 2.50c. and galvanized sheets at 3.55c. for No. 28 gage.

**Ferro-Manganese**—There is no change in the ferro market and quotations continue around \$47 a ton.

### Foreign Iron Trade

**British Iron Trade**—Values of exports and imports in Great Britain, 11 months ended Nov. 30, as given by Board of Trade returns:

	Exports.	Imports.	Excess.
Iron and steel	£34,463,140	£ 7,003,869	Ex. £27,459,271
Machinery	28,663,022	4,223,584	Ex. 24,439,438
New ships	10,184,412	.....	Ex. 10,184,412
Total	£73,310,574	£11,227,453	Ex. £62,083,121
Total, 1907..	81,966,828	11,388,970	Ex. 70,577,858

Total decrease in exports this year,

£8,656,254, or 10.6 per cent.; decrease in imports, £161,517, or 1.4 per cent. The quantities of iron and steel were, in long tons:

	1907.	1908.	Changes
Exports	4,839,782	3,786,799	D. 1,052,983
Imports	834,791	1,017,201	I. 182,410

Imports were largely of billets, blooms and other half-finished material.

Imports of iron ore into Great Britain for the 11 months were 7,118,569 long tons in 1907, and 5,521,199 in 1908; decrease, 1,597,370 tons. Of the ore imported this year 4,073,204 tons were from Spain.

**German Steel Syndicate**—Sales of steel reported by the Steel Syndicate for the 10 months ended Oct. 31 were, in metric tons:

	1907.	1908.	Changes.
Billets, blooms, etc.	1,360,276	1,169,982	D. 190,294
Railroad material.	1,885,788	1,729,037	D. 156,751
Beams, shapes, etc.	1,555,505	1,165,325	D. 390,180
Total	4,801,569	4,064,324	D. 737,215

There were important decreases in all lines, the total loss from last year being 15.4 per cent.

**German Iron Trade**—Exports and imports of iron and steel in Germany, 10 months ended Oct. 31, metric tons:

	1907.	1908.	Changes.
Exports:			
Iron and steel	2,858,176	3,145,409	I. 287,233
Machinery	271,785	301,877	I. 30,092
Total	3,129,961	3,447,286	I. 317,325
Imports:			
Iron and steel	675,864	476,967	D. 198,897
Machinery	77,557	67,237	D. 10,320
Total	753,421	544,204	D. 109,217

The increase in exports was mainly in half-finished material—pig iron, steel billets and blooms.

### Metal Markets

**New York, Dec. 23**—The metal markets generally do not show any important changes in conditions this week. They are quiet, as a rule, and no great increase in activity is expected until the new year opens.

### Gold, Silver and Platinum

#### UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Nov. 1908..	\$ 2,967,795	\$ 2,892,225	Exp. \$ 75,570
" 1907..	615,169	63,574,871	Imp. 62,959,702
Year 1908..	73,857,749	45,105,993	Exp. 28,751,756
" 1907..	54,211,240	98,949,557	Imp. 44,738,317
Silver:			
Nov. 1908..	3,951,987	3,275,609	Exp. 676,378
" 1907..	4,187,378	3,602,405	" 584,973
Year 1908..	47,111,382	37,814,676	" 9,296,706
" 1907..	57,212,168	41,690,324	" 15,521,844

Exports of specie from New York, week ended Dec. 19: Gold, \$4,003,500, almost all to Paris; silver, \$873,850, chiefly to London. Imports: Gold, \$412,291, from Australia and the West Indies; silver, \$156,049, from Mexico and South America.

Foreign trade of the United States, 11 months ended Nov. 30, as reported by Bureau of Statistics, Department of Commerce and Labor:

Merchandise:	1907.	1908.
Exports.....	\$1,716,306,209	\$1,564,023,950
Imports.....	1,330,927,836	1,004,474,822
Excess, exports.....	\$ 385,378,373	\$ 559,549,128
Add excess of exports, silver.....		9,296,706
Add excess of exports, gold.....		28,751,806
Total export balance.....		\$ 597,597,640

The gold and silver movement in detail will be found in the table at the head of this column.

Gold and silver movement in France, 10 months ended Oct. 31:

	Imports.	Exports.	Excess.
Gold....	Fr.789,825,000	F.18,347,000	Imp.Fr.771,478,000
1907...	389,243,000	94,004,000	Imp. 295,239,000
Silver...	138,467,000	149,391,000	Exp. 10,924,000
1907...	148,791,000	165,063,000	Exp. 16,272,000

Imports of copper and nickel coins, 86,000 fr. in 1907, and 57,000 fr. in 1908; exports, 623,000 fr. in 1907, and 586,000 fr. this year.

Gold and silver movement in Great Britain, 11 months ended Nov. 30:

	Imports.	Exports.	Excess.
Gold.....	£41,539,849	£45,197,929	Exp. £3,658,080
Gold, 1907...	49,306,609	45,986,743	Imp. 3,319,866
Silver.....	9,588,812	11,804,119	Exp. 2,215,307
Silver, 1907.	14,667,024	15,813,329	Exp. 1,146,305

Of the silver imported this year a total of £7,682,064 is credited to the United States.

**Gold**—The open-market price for gold in London shows no material change. As for several weeks past the Bank of France has taken all the available gold offered. In New York, nearly \$1,000,000 additional has been taken for export to Paris, making a total of \$6,100,000 going out on the present movement.

**Platinum**—Dealers quote this metal at unchanged prices: \$24 per oz. for refined platinum, \$26.50 for hard, and \$20@21 for scrap. Business is good for the close of the year, and the market is strong.

**Silver**—Under China buying and some speculative covering, silver has improved in value with 229/16d. bid today in London. While stocks are large in the various silver centers, a more hopeful feeling would create a demand and help materially to distribute the stock.

SILVER AND STERLING EXCHANGE.

December.	17	18	19	21	22	23
New York....	48 3/4	48 3/4	48 3/4	48 3/4	48 3/4	48 3/4
London....	22 1/8	22 1/8	22 3/8	22 3/8	22 3/8	22 1/2
Sterling Ex..	4.8690	4.8700	4.8695	4.8725	4.8710	4.8710

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

Shipments of silver from London to the East, year to Dec. 10, reported by Messrs. Pixley & Abell, London:

	1907.	1908.	Changes.
India.....	£10,531,354	£8,377,390	D. £2,153,964
China.....	417,350	641,400	I. 224,050
Straits.....	691,150	164,885	D. 526,265
Total.....	£11,639,854	£9,183,675	D. £2,456,179

Receipts for the week £2000 from Mexico and £115,000 from New York; total, £117,000. Exports, £7750 to India and £70,000 to China; £77,750 in all.

Copper, Tin, Lead and Zinc

Dec.	Copper.			Tin.	Lead.	Spelter.	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.	Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
17	14 3/4 @14 3/4	14 @14 3/4	62 3/4	29	4.17 1/2 @4.22 1/2	5.12 1/2 @5.15	4.97 1/2 @5.00
18	14 3/4 @14 3/4	14 @14 3/4	62 3/4	29	4.17 1/2 @4.22 1/2	5.12 1/2 @5.15	4.97 1/2 @5.00
19	14 3/4 @14 3/4	14 @14 3/4	....	29	4.17 1/2 @4.22 1/2	5.12 1/2 @5.15	4.97 1/2 @5.00
21	14 3/4 @14 3/4	14 @14 3/4	62 3/4	29 3/4	4.17 1/2 @4.20	5.12 1/2 @5.15	4.97 1/2 @5.00
22	14 3/4 @14 3/4	14 @14 3/4	62 3/4	29 3/4	4.17 1/2 @4.20	5.12 1/2 @5.15	4.97 1/2 @5.00
23	14 3/4 @14 3/4	14 @14 3/4	63 1/8	29 3/4	4.15 @4.15	5.12 1/2 @5.15	4.97 1/2 @5.00

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

**Copper**—Domestic consumers have taken a more active interest in the market during the week. It is reported that good-sized transactions in electrolytic copper have taken place for distant delivery at current prices. Business in Lake has also been active, and as the lots in second hands have been disposed of, the copper had to be secured from first hands, who had hitherto not met the extreme decline. Europe has played a small part in the business of the week, but at the close a good inquiry is reported from that quarter, stimulated doubtless by the firmer tendency of the Standard market.

Beginning with Dec. 17, considerable sales of Lake copper were made to domestic manufacturers at 14 3/4c., these amounting to several million pounds and being participated in by at least three important selling agencies. Calumet & Hecla is reported to have made a sale at 14 3/4c., but this being under exceptional conditions does not represent the actual market. On the other hand, electrolytic copper has been freely offered at 14 1/8c., while sales have been made at close to 14c.

At the close we quote 14 3/8 @14 5/8c. for Lake copper; 14 @14 1/8c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper has been 13 3/4 @14 cents.

Copper sheets, cold-rolled, 20c.; hot-rolled, 19c. Wire, 15 3/4c. base, carload lots at mill.

The Standard market in London showed a slight but steady recovery throughout the week and the close is cabled firm at £63 1s. 3d. for spot, £63 18s. 9d. for three months.

Refined and manufactured sorts we quote: English tough, £66 10s.; best selected, £65 10s. @66 10s.; strong sheets, £77 10s. @78 10s.

The imports of copper into the United States, 10 months ended Oct. 31 were divided as follows, in pounds:

	In Ore.	In Matte.	Metal.
British N. America.	7,859,165	1,588,090	23,741,312
Mexico.....	10,270,778	127,626	34,121,965
South America.....	7,577,252	.....	23,732,072
Japan.....	.....	.....	2,929,673
Europe.....	.....	.....	13,492,188
Other countries.....	11,562,861	2,319,494	28,822,264
Total ....	37,270,056	4,035,210	126,839,474

The total was 168,144,740 lb

**Tin**—There was a firmer tone noticeable in the London market throughout the week, although quotations do not show much advance. The close is cabled at £132 12s. 6d. for spot, £134 5s. for three months.

The domestic market suffered so far as transactions were concerned from the holiday dullness, but closes somewhat higher, in sympathy with London, at 29.25 cents.

Arrivals of Bolivian tin ore in Europe in November were: Great Britain, 884 tons; Germany, 148; France, 140; total, 1172 tons, equivalent to 714 tons fine tin.

Output of the Federated Malay States in November was 4206 long tons tin; for the 11 months ended Nov. 30 it was 45,669 tons tin, a decrease of 2762 tons from last year.

Tin shipments from the Straits for the 11 months ended No. 30 were 48,776 long tons in 1907, and 55,539 in 1908; increase, 6763 tons.

**Lead**—A reduction in the price of the leading interest to 4.20c. on Dec. 22 has not relieved the deadlock. Other producers, particularly in Missouri, reduced their price correspondingly, but consumers continue to await developments and transactions are altogether of a retail character. The market opened at 4.17 1/2 @ 4.22 1/2c. New York and 4.02 1/2 @ 4.07 1/2c., St. Louis; the closing is weak at 4.12 1/2 @ 4.15c., New York, and 3.97 1/2 @ 4c., St. Louis.

The London market has been steady and closes at £13 3s. 9d. for Spanish lead, £13 6s. 3d. for English lead.

**Spelter**—There has been no change in the character of the market since last week and prices close firm at 5.12 1/2 @ 5.15c. New York, 4.97 1/2 @ 5c. St. Louis.

The London market is unchanged at £20 15s. for good ordinaries, £21 for specials.

Base price of sheet zinc is 7c. f.o.b. La Salle-Peru, Ill., less 8 per cent.

Other Metals

**Aluminum**—Prices continue unchanged. The Aluminum Company of America quotes 24c. per lb. base for No. 1 ingots, and 33 @ 34c. base for sheets. Offers of foreign metal are still made at 22c. It is difficult to ascertain actual sales, but they are reported to be small. The foreign market is still demoralized, with prices low.

**Antimony**—The market is quiet and no business has been done during the week. Quotations are unchanged at 8.15@8.25c. for Cookson's, 8@8½c. for Hallett's and 7½@7¾c. for ordinary brands.

**Quicksilver**—The market is quiet with little business doing. New York prices are unchanged, at \$45@46 per flask of 75 lb. San Francisco quotations are \$45 per flask for domestic orders and \$43 for export. The London price is steady at £8 10s. per flask, with £8 8s. 9d. named by jobbers.

**Nickel**—Large lots, 40c., New York.

**Cadmium**—In 100-lb. lots, 75c. per lb., at Cleveland, Ohio.

**Magnesium**—This metal is offered in New York at \$1.25 per lb. in 100-lb. lots. The price is \$1.40 per lb. for 5-lb. lots.

**British Metal Imports and Exports**

Imports and exports of metals in Great Britain, 11 months ended Nov. 30, figures in long tons, except quicksilver, which is in pounds.

	Imports.	Exports.	Excess.
Copper.....	155,159	63,304	Imp. 91,855
Copper, 1907...	112,522	61,403	Imp. 51,119
Tin.....	42,946	38,361	Imp. 4,586
Tin, 1907.....	40,589	33,703	Imp. 6,882
Lead.....	216,811	46,539	Imp. 170,27
Lead, 1907.....	186,213	40,506	Imp. 145,707
Spelter.....	97,854	7,554	Imp. 90,300
Spelter, 1907...	99,325	5,902	Imp. 93,423
Quicksilver, lb..	3,228,092	1,600,175	Imp. 1,627,917
Quicksilver, '07	2,939,796	2,140,753	Imp. 799,043
Ores:			
Tin ore and con.	22,888	.....	Imp. 22,888
Tin ore, 1907...	18,946	.....	Imp. 18,946
Pyrites.....	709,329	.....	Imp. 709,329
Pyrites, 1907...	698,327	.....	Imp. 698,327

Copper totals include metallic contents of ore and matte. Exports include re-exports of foreign material. Of the imports this year the United States furnished 6467 tons copper matte, 53,346 tons fine copper and 33,125 tons lead.

**Zinc and Lead Ore Markets**

**Joplin, Mo. Dec. 19**—The highest price paid in settlement for zinc ore was \$46.50 per ton; the assay base ranged from \$43 down to \$41 per ton of 60 per cent. zinc, with the usual premium of a \$46.50 base for ore carrying 6 per cent. iron. Silicate ore sold on a base of \$19@19.50 per ton of 40 per cent. zinc with the high price at \$26 per ton. The average price, all grades, was \$39.78. Despite a further decline in pig lead this mineral held its own, receding no farther downward. Probably the principal reason was the reappearance in the market of the St. Louis Smelting and Refining Company for the purchase of several hundred thousand pounds at \$50 per ton. Prices ranged down to \$48, for under-grade ore, and all grades averaged \$49.68 per ton.

Notwithstanding the enormous sales that have been made during the past month the reserve stock is decreased less than 2000 tons, as the output has been growing steadily and shipments on most

of the heavy purchases have been made very gradually, leaving small accumulations widely scattered over the district. This week purchases were very light, a great portion of the shipment being from previous purchases. Thus new accumulations were made this week, as there was no decrease in the output.

**SHIPMENTS, WEEK ENDED DEC. 19**

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	4,087,380	499,290	\$98,314
Joplin.....	2,220,120	186,190	51,278
Galena.....	796,250	71,500	17,685
Spurgeon.....	656,270	117,600	13,874
Alba-Neck.....	612,660	.....	12,865
Miami.....	574,960	62,080	10,154
Oronogo.....	419,990	.....	9,161
Aurora.....	453,520	.....	9,639
Prosperity.....	319,410	30,190	7,462
Duenweg.....	314,790	48,690	7,317
Granby.....	540,000	28,000	7,175
Quapaw-Baxter.....	189,160	67,080	4,897
Carthage.....	152,880	.....	3,209
Carl Junction.....	105,590	.....	2,270
Zincite-Sherwood.....	104,480	.....	2,089
Badger.....	89,030	.....	1,870
Cave Springs.....	84,500	.....	1,775
Sarcoile.....	101,350	.....	1,512
Wentworth.....	65,020	.....	1,340
Reeds.....	60,270	.....	1,205
Totals.....	11,947,630	1,100,620	\$265,091

51 weeks.....503,662,760 75,489,070 \$10,694,808  
Zinc value, the week, \$237,749; 51 weeks, \$8,626,806  
Lead value, the week, 27,342; 51 weeks, 2,068,002

**MONTHLY AVERAGE PRICES**

Month.	ZINC ORE.				LEAD ORE.	
	Base Price.		All Ores.		All Ores.	
	1907.	1908.	1907.	1908.	1907.	1908.
January.....	\$46.90	\$37.60	\$45.84	\$35.56	\$83.58	\$46.88
February.....	48.30	36.63	47.11	34.92	84.58	49.72
March.....	49.75	36.19	48.66	34.19	82.75	49.90
April.....	49.25	35.40	48.24	34.08	79.76	52.47
May.....	46.90	34.19	45.98	33.99	79.56	56.05
June.....	47.00	33.06	44.82	32.07	73.66	60.48
July.....	46.80	34.55	45.79	31.67	58.18	59.90
August.....	44.56	36.53	43.22	33.42	59.54	60.34
September.....	41.00	37.63	40.11	34.44	53.52	54.59
October.....	41.75	35.95	39.83	33.28	51.40	52.63
November.....	38.60	39.13	35.19	35.02	43.40	54.53
December.....	31.50	.....	30.87	.....	37.71	.....
Year.....	\$44.36	.....	\$43.68	.....	\$68.90	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

**Platteville, Wis., Dec. 19**—The highest price paid this week was \$45 per ton for zinc ore on a basis of \$42 per ton of 60 per cent. zinc, the base price declining \$1 per ton from last week. For 80 per cent. lead ore \$50 to \$51 was paid.

**SHIPMENTS, WEEK ENDED DEC. 19**

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville.....	763,060	96,900	60,000
Benton.....	508,490	.....	.....
Hazel Green.....	448,600	83,500	.....
Harker.....	344,160	.....	.....
Cuba City.....	334,970	86,065	.....
Linden.....	284,830	.....	.....
Days Siding.....	242,700	.....	.....
Livingston.....	192,000	.....	.....
Highland.....	188,600	.....	.....
Galena.....	111,620	.....	.....
Strawbridge.....	87,600	.....	.....
Mineral Point.....	20,000	.....	.....
Total.....	3,521,630	266,465	60,000
Year to Dec. 19.....	111,302,220	10,456,520	4,946,504

In addition to the above there was shipped to the Platteville Separating Company, 1,005,700 lb.; to the Joplin Separator Works, 114,300 lb. zinc ore.

The total shipment of zinc ore from the mines this week was 4,570,000 lb., the largest the district has ever recorded. Nearly 500 tons of this tonnage, however, represented reserve stock, shipped from Galena to the Platteville Separating Company. Shipment was also begun of nearly 2000 tons of accumulated stock to be moved from Linden to the Mineral Point Zinc Company. The tonnage of finished zinc ore shipped to the smelters was curtailed by the fact that the Platteville Separating Company shipped out only one car of zinc, its plant being used during the week to test ores brought in from Utah.

**Chemicals**

**New York, Dec. 23**—The market is steady and devoid of extraordinary features. The uncertainties of the tariff revisions keep consumers from contracting for large quantities of chemicals.

**Arsenic**—Prices are firm and no shading has been done. Spot goods are offered at 3¼c. per lb., New York.

**Copper Sulphate**—The volume of business is restricted on account of the uncertainty of the metal market. Prices, however, are unchanged at \$4.75 per 100 lb. for carloads, and up to \$5 for smaller lots.

**Nitrate of Soda**—The market is quiet but firm, and prices are unchanged at 2.17½c. for spot and all future positions.

**Mining Stocks**

**New York, Dec. 23**—The general stock market this week was characterized by a sharp break in quotations for the more prominent stocks; but this was followed today by a partial recovery. There was considerable activity, but the close is ragged and irregular. The liquidation on the break was large, and the recovery inclined to be slow.

On the Curb the course of events was very much the same as on the Exchange—a sharp break in prices, followed by some upward reaction. The movement was most apparent in the copper stocks, which close irregularly and rather soft. The Cobalt shares were stronger, chiefly on account of the declaration of some extra dividends. Nevada gold stocks were in moderate demand only.

**Boston, Dec. 22**—It has been a rather unsatisfactory week in the copper-share market. Prices have been weak, and considerable liquidation has ensued. The organization of a new copper producers' association and the new smelter combine in New York mixed things a trifle, and gave the traders an opportunity to force prices. Today, however the market turned, and prices were quite buoyant, following the strength of Amalgamated Copper in New York. Superior Copper has been in the foreground, and has been about the only feature. From \$34 it broke to \$32, but

rallied to \$35.37½. Very favorable reports of mill tests have been responsible for the sharp advance, and the orders have come largely from the Lake district.

Amalgamated Copper has had a range between \$82.25 and \$76, rallying to \$79.37½ today. Copper Range fell \$2.50 to \$77.50, but recovered to above \$79 today. The Baltic company has declared a dividend of \$7, making \$9 for the current year. Copper Range owns all but 341 of the 100,000 shares. Arizona Commercial fell \$3.50 to \$36, closing at \$37.25 tonight; Boston & Corbin fell \$2.12½ to \$20.12½, recovering partially. Greene Cananea spurted from \$10.87½ to \$12. Lake fell \$2 to \$21.25, recovering to \$22.37½. North Butte broke \$4.75 to \$79.75, but was back to almost \$83 tonight. Old Dominion fell \$4 to \$54, rallying close to \$56. Utah Consolidated ran off \$1.50 to \$43, and Utah Copper \$2.75 to \$42.75.

New interests have come into the United States Smelting Company's board. This company has declared the regular quarterly dividend. President Cuddihy, of the Hancock Consolidated, has been on from Michigan relative to listing the company's shares on the Exchange.

The American Zinc, Lead and Smelting Company is offering \$500,000 in five-year 6-per cent. debenture bonds to shareholders, this representing expenditures not capitalized. The issue has been underwritten at a commission of 4 per cent.

The Curb exchange is increasing its business and has taken on several new mining issues.

STOCK QUOTATIONS

NEW YORK Dec. 22		BOSTON Dec. 22	
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine.....	3/8	Adventure.....	9
Amalgamated.....	79	Allouez.....	36 1/2
Anaconda.....	48	Am. Zinc.....	124 1/2
Balaskala.....	22 1/2	Arcadian.....	3 1/2
British Col. Cop.....	7 1/2	Arizona Com.....	37 1/2
Buffalo Mines.....	3 1/2	Atlantic.....	16 1/2
Butte Coalition.....	26 1/2	Bingham.....	130
Colonial Silver.....	7 1/2	Boston Con.....	15 1/2
Cum. Ely Mining.....	7 3/4	Calumet & Ariz.....	115 1/2
Davis Daly.....	3 1/2	Calumet & Hecla.....	661
Dominion Cop.....	3 1/2	Centennial.....	31 1/2
Douglas Copper.....	2 1/2	Con. Mercur.....	138
El Rayo.....	4	Copper Range.....	79 1/2
Florence.....	4 1/2	Daly-West.....	10
Foster Cobalt.....	47	Franklin.....	15 1/2
Furnace Creek.....	12	Greene-Can.....	11 1/2
Giroux.....	6 1/2	Isle Royal.....	22 1/2
Gold Hill.....	8 1/2	La Salle.....	14 1/2
Goldfield Con.....	8 1/2	Mass.....	5 1/2
Granby.....	104 1/2	Michigan.....	13
Greene Gold.....	1/2	Mohawk.....	67
Greene G. & S.....	7	Nevada.....	18 1/2
Greenw'r & D.Val.....	175	North Butte.....	82 1/2
Guanajuato.....	2	Old Colony.....	160
Guggen. Exp.....	183	Old Dominion.....	55
Hanaphy.....	15	Osceola.....	129
McKinley Dar.....	1.03	Parrot.....	28 1/2
Micmac.....	2 1/2	Quincy.....	93
Mines Co. of Am.....	1	Rhode Island.....	15 1/2
Mitchell Mining.....	1/2	Santa Fe.....	2 1/2
Mont. Sho. C.....	1/2	Shannon.....	16 1/2
New Utah M. & S.....	2 1/2	Superior.....	35 1/2
Newhouse M. & S.....	5 1/2	Superior & Pitts.....	16 1/2
Nipissing Mines.....	10 1/2	Tamarack.....	76 1/2
Old Hundred.....	10 1/2	Trinity.....	15 1/2
Silver Queen.....	95 1/2	United Cop. com.....	11 1/2
Stewart.....	1/2	U. S. Oil.....	29
Tennessee Cop'r.....	44	U. S. Smg. & Ref.....	42 1/2
Tri-Bullion.....	1 1/2	U.S.Sm. & Re.pd.....	40
Union Copper.....	3 1/2	Utah Con*.....	43 1/2
Utah Apex.....	5 1/2	Victoria.....	3 1/2
Utah Copper.....	44 1/2	Winona.....	6
Yukon Gold.....	4 1/2	Wolverine.....	1150
		Wyandotte.....	2 1/2

\*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL		ST. LOUIS Dec. 19		
Am. Agri. Chem.....	131 1/2	N. of Com.	High.	Low.
Am. Smelt. & Ref.....	81 1/2	Adams.....	.40	.30
Am. Sm. & Ref. pf.....	101 1/2	Am. Nettle.....	.07	.05
Colo. Fuel & Iron.....	38 1/2	Center Cr'k.....	2.00	1.50
Federal M. & S., pf.....	184 1/2	Cent. C. & C.....	79.00	78.00
National Lead.....	77 1/2	C. C. & C. pd.....	88.00	86.00
National Lead, pf.....	105 1/2	Cent. Oil.....	110.00	100.00
Pittsburg Coal.....	14	Columbia.....	7.00	4.00
Republic I. & S.....	24 1/2	Con. Coal.....	21.00	19.00
Republic I. & S., pf.....	85 1/2	Doe Run.....	125.00	110.00
Sloss-Sheffield.....	79	Gra. Bimet.....	.30	.20
Standard Oil.....	678	St. Joe.....	14.00	12.00
U. S. Steel.....	53 1/2			
U. S. Steel, pf.....	112			
Va. Car. Chem.....	42 1/2			

Furnished by Hornblower & Weeks, N. Y.

NEVADA STOCKS. Dec. 23. Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick.....	.10
Belcher.....	.26	St. Ives.....	.18
Best & Belcher.....	.45	Triangle.....	.03
Caledonia.....	.16	BULLFROG STOCKS	
Chollar.....	.08	Bullfrog Mining.....	1.03
Comstock.....	.25	Bullfrog Nat. B.....	1.04
Con. Cal. & Va.....	.77	Gibraltar.....	.03
Crown Point.....	.36	Gold Bar.....	1.03
Eschequer.....	.30	Homestake King.....	.07
Gould & Curry.....	.10	Montgomery Mt.....	1.05
Hale & Norcross.....	.36	Mont. Shoshone C.....	.87 1/2
Mexican.....	.90	Original Bullfrog.....	1.01
Ophir.....	1.65	Tramp Cons.....	.09 1/2
Overman.....	.20	MISCELLANEOUS	
Potosi.....	.12	Bonnie Clare.....	.07
Savage.....	.24	Lee Gold Grotto.....	.12
Sierra Nevada.....	.25	Nevada Hills.....	1.37 1/2
Union.....	.32	Nevada Smelting.....	1.00
Utah.....	.04	Nevada Wonder.....	.30
Yellow Jacket.....	.70	Nevada-Utah.....	2.81 1/2
TONOPAH STOCKS		Penn-Wyoming.....	.16
Belmont.....	.75	Pittsburgh S. Pk.....	.85
Extension.....	.50	Rawhide Coal.....	.48
Golden Anchor.....	.02	Round Mt. Sphinx.....	.15
Jim Butler.....	.17		
MacNamara.....	.32		
Midway.....	.18		
Montana.....	.65		
North Star.....	.03		
Tono'h Mine of N.....	6.57 1/2		
West End Con.....	.31		

COLO. SPRINGS Dec. 19

Name of Comp.	Clg.	Name of Comp.	Clg.
GOLDFIELD STOCKS		Acacia.....	6 1/2
Adams.....	.02	Black Bell.....	.12
Atlanta.....	.17	C. C. Con.....	3 1/2
Booth.....	.33	Dante.....	5 1/2
Columbia Mt.....	.17	Doctor Jack Pot.....	9
Comb. Frac.....	1.38	Elkton.....	66 1/2
Con. Red Top.....	.10	El Paso.....	49
Cracker Jack.....	.04	Findlay.....	17 1/2
Diadfield B. B. C.....	.11	Gold Dollar.....	8 1/2
Goldfield Belmont.....	.07	Gold Sovereign.....	3 1/2
Goldfield Daisy.....	.71	Isabella.....	24 1/2
Great Bend.....	.25	Index.....	10
Jumbo Extension.....	.20	Jennie Sample.....	6
Kendall.....	.09	Jerry Johnson.....	4
Lone Star.....	.05	Mary McKinney.....	32
May Queen.....	.03	Pharmacist.....	13 1/2
N. Y. C. O. D.....	.05	Portland.....	1.05 1/2
Oro.....	.12	Un. Gold Mines.....	4 1/2
Red Hill.....	.19	Vindicator.....	81
Roanoke.....	.19	Work.....	7 1/2
Sandstorm.....	.18		

Assessments

Company.	Delinq.	Sale.	Amt.
Andes, Nev.....	Jan. 8 Feb. 2	\$0.10	
Caledonia, Nev.....	Jan. 8 Jan. 29	0.05	
Chollar, Nev.....	Jan. 11 Feb. 3	0.10	
Ely Con., Nev.....	Nov. 28 Jan. 11	0.02	
Eschequer, Nev.....	Dec. 30 Jan. 20	0.05	
Federal-Ely, Utah.....	Jan. 9 Feb. 1	0.01	
Iowa, Utah.....	Jan. 5 Feb. 2	0.02	
Julia Con., Nev.....	Dec. 21 Jan. 15	0.03	
Little Chief, Utah.....	Dec. 15 Jan. 5	0.01	
Lower Mammoth, Utah.....	Dec. 18 Jan. 8	0.05	
Mountain Dell.....	Dec. 24 Jan. 12	0.02	
New York Con., Nev.....	Dec. 18 Jan. 8	0.03	
Oro Cobre, Cal.....	Dec. 31 Jan. 16	0.02	
Savage, Nev.....	Jan. 6 Jan. 28	0.10	
Silver King Con., Utah.....	Jan. 6 Jan. 26	0.10	
Union Con., Nev.....	Dec. 23 Jan. 14	0.10	
Wabash, Utah.....	Jan. 7 Jan. 30	0.10	
Yellow Jacket, Nev.....	Dec. 28 Feb. 3	0.15	
Zelbriht, Cal.....	Dec. 1 Dec. 17	0.05	

Monthly Average Prices of Metals SILVER

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January.....	68.673	55.678	31.769	25.738
February.....	68.835	56.000	31.852	25.855
March.....	67.519	55.365	31.325	25.570
April.....	65.462	54.506	30.253	25.133
May.....	65.971	52.795	30.471	24.377
June.....	67.090	53.669	30.893	24.760
July.....	68.144	53.115	31.366	24.514
August.....	68.745	51.683	31.637	23.858
September.....	67.792	51.720	31.313	23.877
October.....	62.435	51.431	28.863	23.725
November.....	58.677	49.647	27.154	22.933
December.....	54.565	.....	25.362	.....
Year.....	65.327	.....	30.188	.....

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

COPPER

Month.	NEW YORK.		LONDON.	
	Electrolytic	Lake.	1907.	1908.
January.....	24.404	13.726	24.825	13.901
February.....	24.869	12.905	25.236	13.098
March.....	25.065	12.704	25.560	12.875
April.....	24.224	12.743	25.260	12.928
May.....	24.048	12.598	25.072	12.788
June.....	21.665	12.675	24.140	12.877
July.....	22.130	12.702	21.923	12.933
August.....	18.356	13.462	19.255	13.639
September.....	15.565	13.388	16.047	13.600
October.....	13.169	13.354	13.551	13.646
November.....	13.391	14.130	13.870	14.386
December.....	13.163	.....	13.393	.....
Year.....	20.004	.....	20.661	.....

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

TIN AT NEW YORK

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

Prices are in cents per pound.

LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January.....	6.000	3.691	19.828	14.469
February.....	6.000	3.725	19.531	14.250
March.....	6.000	3.838	19.703	13.975
April.....	6.000	3.993	19.975	13.469
May.....	6.000	4.253	19.688	12.938
June.....	5.760	4.466	20.188	12.600
July.....	5.288	4.447	20.350	13.000
August.....	5.250	4.580	19.063	13.375
September.....	4.813	4.515	19.775	13.125
October.....	4.750	4.351	18.531	13.375
November.....	4.376	4.330	17.281	13.538
December.....	3.658	.....	14.500	.....
Year.....	5.325	.....	19.034	.....

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

SPELTER

MONTH.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January.....	6.732	4.513	6.582	4.363	27.125	20.563
February.....	6.814	4.788	6.664	4.638	25.338	20.875
March.....	6.837	4.665	6.687	4.527	26.094	21.075
April.....	6.685	4.645	6.535	4.495	25.900	21.344
May.....	6.441	4.608	6.291	4.458	25.563	19.906
June.....	6.419	4.543	6.269	4.393	25.469	19.000
July.....	6.072	4.485	5.922	4.338	23.850	19.031
August.....	5.701	4.702	5.551	4.556	21.969	19.350
September.....	5.236	4.769	5.086	4.619	21.050	



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No. 26.

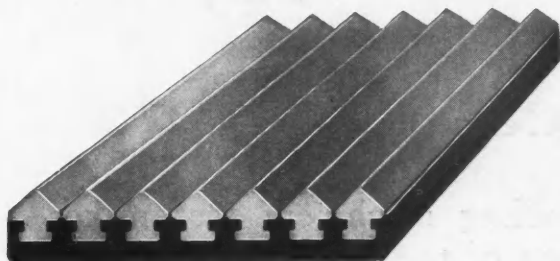
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Index to Advertisers, 40.

Buyers' Directory, 42.

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## The Canda Tempered Steel Jaw Plate for Blake Type Crushers



Patented March 31, 1908

Over 1,000 tons of these plates now in use, giving excellent results as to durability and efficiency, out-wearing any other kind of Jaw Plate yet produced

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Chrome Steel Works, Chrome, N. J.

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In reference to comparative wear of your Canda Steel tempered jaw plates for 18" x 30" Blake crusher and manganese plates: one set of Manganese plates crushed 55,000 tons of our "Harmony" ore. A set of your Canda Steel jaw plates crushed 126,000 tons of the same ore.

The cost per ton of ore crushed was as follows:

Manganese Steel	-	-	-	.0055¢
Canda Steel	-	-	-	.0026¢

We are very much pleased with the results.

Yours truly,

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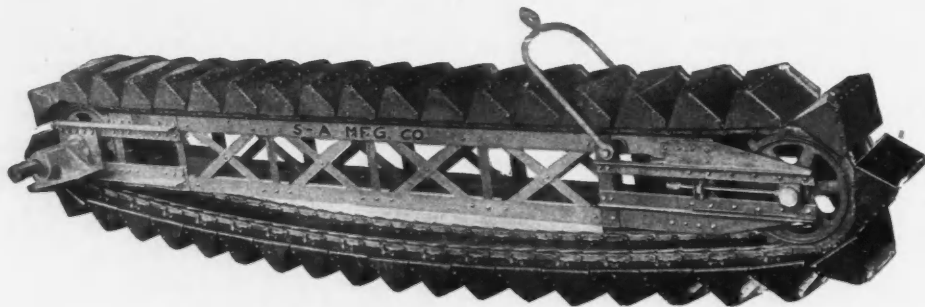
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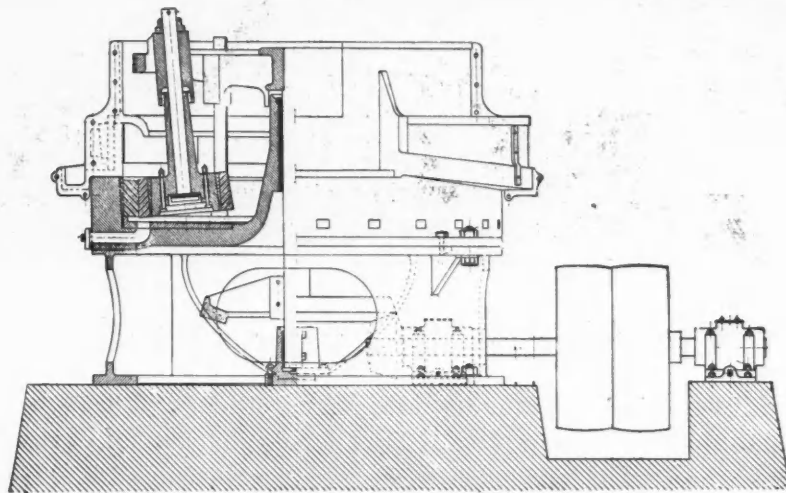
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Note the main bearing with "quarter box" adjustment. Consider it in every detail. The same care to secure strength in every part is carried out to the letter.

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Our shop practice is of the highest grade, all parts being made to gauge, and none but skilled mechanics employed under a rigid system of inspection.

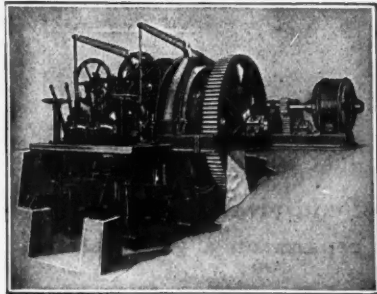
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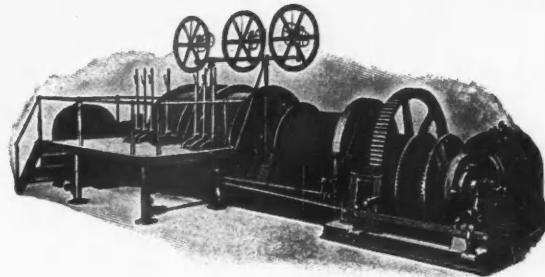
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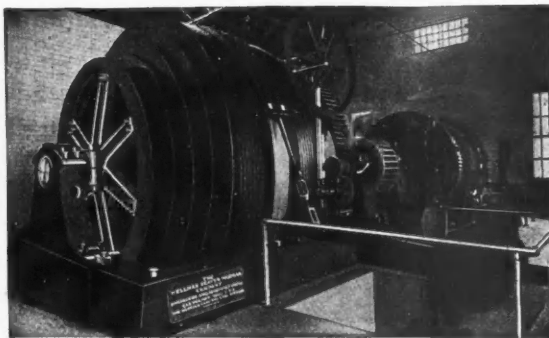
Special double reel Electric Hoist geared to A. C. Motor



Special Electric Hoist for 3-compartment shaft, 2 A. C. continuous motors operating through a Special BEVEL GEAR REVERSE

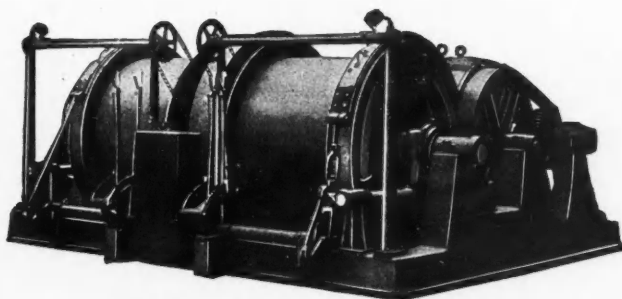
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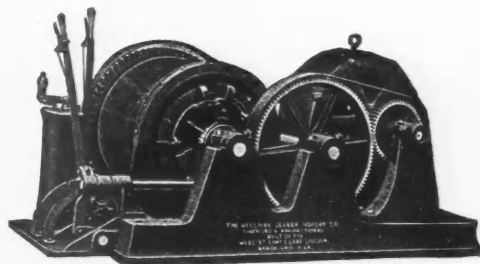


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We also build  
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Standard double drum Electric Hoist with D. C. motor



Standard single drum Electric Hoist with D. C. motor

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was less than one-quarter of a cent per ton when working in thin veins ranging from 36 to 42 inches, and under conditions which were more severe than the average. So much for evidence of durability.

As for efficiency, it is an established fact that the Pneumelectric is 200 per cent. more efficient than any other coal cutter, as it will do the same amount of work with one-third the power.

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The Pneumelectric is an Electrically Driven Compressed Air Coal Puncher combining an electric motor and an air cylinder in which the air is both compressed and utilized. It weighs only 800 lbs. and requires but 7½ H.P. for operation.

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TRADE MARK.

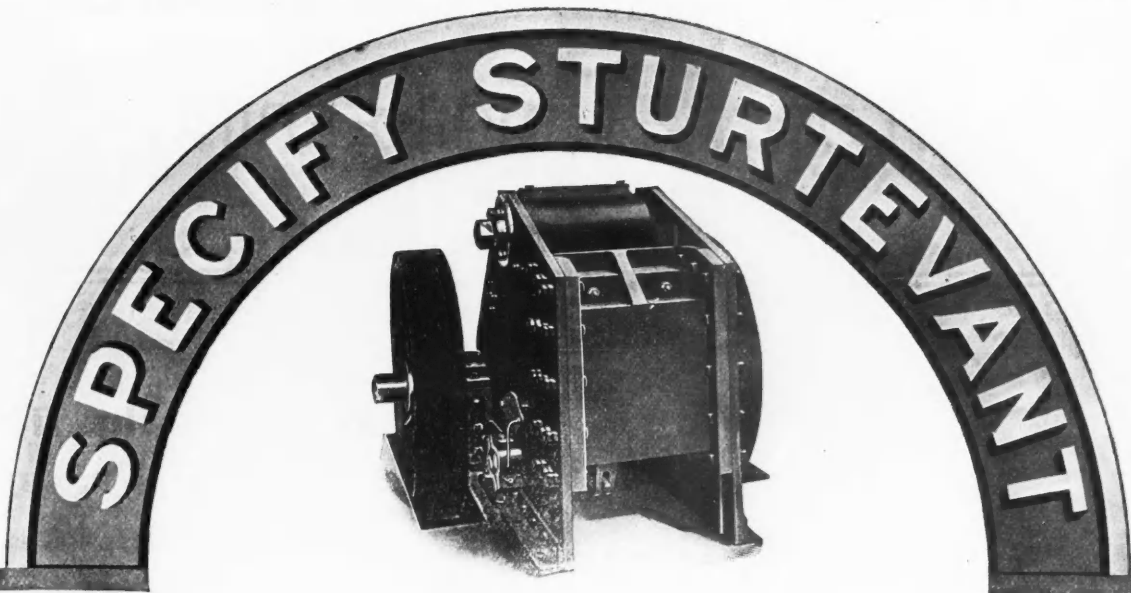
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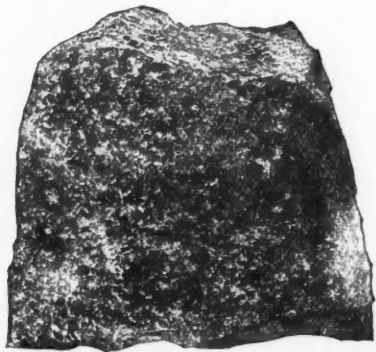
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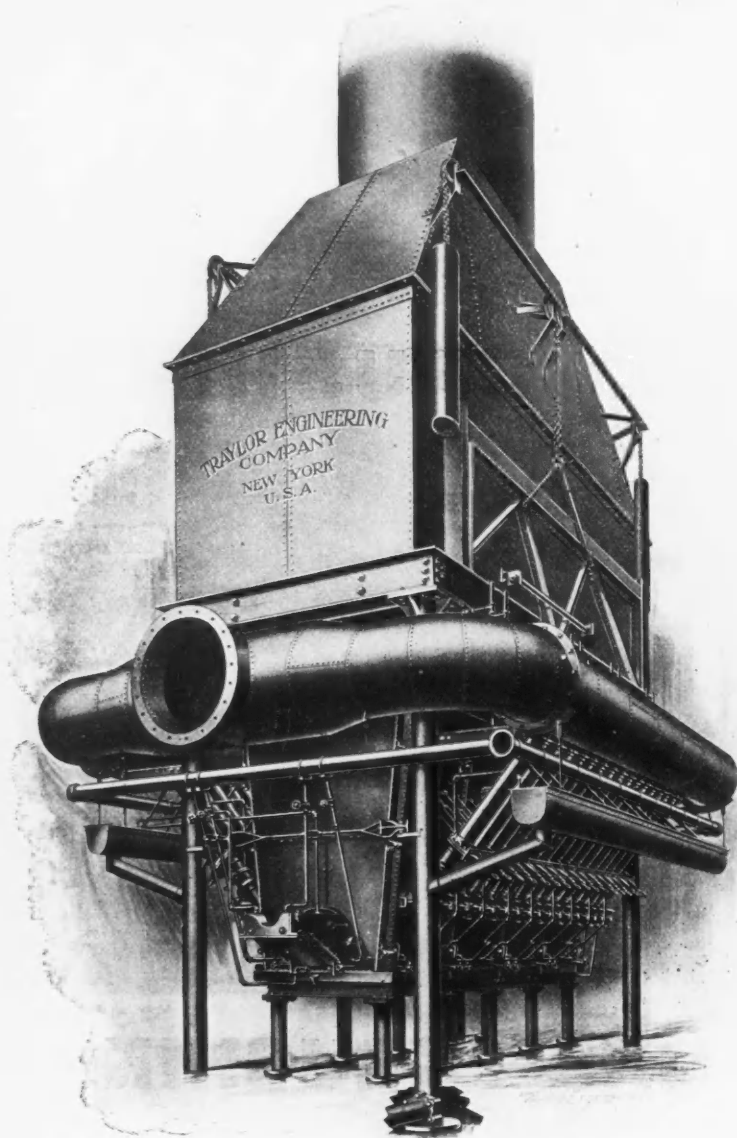
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42' x 192' Copper Matting Furnace.

We have the finest facilities of any shop in the country for building

## Smelting Furnaces

and our products show it.

This cut shows one of the furnaces recently built at our works, Allentown, Pa.

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Cable Address—TRAYLORIAN.

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# "CALYX" DIAMONDLESS CORE DRILLS



Prospecting with the "Calyx" Drill in a Southern quarry

In prospecting for coal in Colorado recently, the following record was made by a Davis "Calyx" Diamondless Core Drill:

Total actual drilling time (10-hour shift) . . . . . 33 shifts  
 Total depth drilled . . . . . 600 feet  
 Average depth drilled per shift . 18 feet  
 Size of hole—diam. . . . . 6 inches  
 Diameter of core . . . . . 5 inches  
 Average total cost per foot of hole cored . . . . . \$0.72

The formations drilled included sandstone, slate, shale and limestone. Three good working seams of coal were penetrated, from all of which "100 per cent" cores were secured.

This is only one record verifying the claim for ACCURACY OF RECORD and MINIMUM COST when prospecting with the "Calyx" Drill in coal or metal mining, quarry or contract fields. The use of steel cutters or chilled shot in this machine at once eliminates the cost of diamonds, the largest item in core drilling with the "diamond" drill.

"Calyx" Drills are furnished in all desirable types, for hand-power horse-power, gasoline or steam engine, for cores from 1 1/4 to 15 inches diameter, from all depths to 6000 feet.

PNEUMATIC PUMPING SYSTEMS    COAL CUTTERS    AIR COMPRESSORS

## INGERSOLL-RAND CO.

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# The Moore=Clancy Slime Process

TO MINE OWNERS: Has it ever dawned upon you that **infringers** of the Moore Patents are asking you to pay **\$100.** (which a number of you already have paid), per **cell or leaf**, instead of from **\$8 to \$22.50**, depending upon the size; and that they are asking you to take **999** chances out of **1000** of paying, a little later on, **dollars in infringement** damages, where we with *absolute security* ask a royalty of but a few **cents**?

## ACTUAL RESULTS

(20-Ton Working Scale)

**CRIPPLE CREEK SULPHO-TELLURIDE ORE:** Containing 5% Iron Sulphides with Gold and Silver Tellurides assaying \$31.20 gold and \$10.00 (at 50c oz.) silver per ton. The above ore (**without roasting or concentration**) was ground in tube mill to 100 mesh with cyanide solution containing "Chemical Salts." The cyanide solution used contained 1 lb. cyanide per ton of solution. The "chemical salts" are added as an additional solvent for the gold tied up in tellurium and other refractory sulphides, and at the same time being a solvent for tellurium and assisting the cyanide solution—overcoming reducing agents.

The following is an actual working test:

Heads assayed	\$31.20 gold	\$10.00 silver
Tails	.20 "	1.00 "

Gold extraction over 99%. Silver extraction 90%.

Consumption of cyanide was two-fifths pound per ton of ore

Consumption of chemicals in addition to cyanide cost, 15c per ton. The same ore given practically the same treatment but without addition of the "chemical salts"—as follows:

Heads assayed	\$31.20 gold	\$10.00 silver
Tails	19.00 "	9.00 "

The difference between the two tests are obvious.

**GOLDFIELD NEVADA ORE:** Containing reducing agents in the form of Ferrous Silicate, Iron Sulphides assaying \$30.00 gold.

The above ore given the same treatment **without roasting or concentration** with 1 lb. per ton cyanide solution and "chemical salts", ground to 100 mesh in tube mill:

Heads assayed	\$30.00 gold
Tails	.20 "

Gold extraction over 99%.

Cyanide consumption was two-fifths pound per ton of ore treated.

Cost of chemicals in addition to cyanide 25c per ton of ore treated. The same ore treated with cyanide solution in same manner, but without addition of the "chemical salts":

Heads assayed	\$30.00 gold
Tails	4.00 "

Gold extraction 86%.

**COBALT SILVER ORE:** Containing arsenic, antimony and cobalt assaying \$100.00 silver per ton of ore was ground to 100 mesh in tube mill and given analogous treatment to the preceding tests (**without roasting or concentration**) but with a stronger cyanide solution, viz., 3 lbs. per ton solution, with the addition of "chemical salts":

Heads assayed	\$100.00 silver
Tails	.50 "

Silver extraction 99%.

The same ore given the same treatment with straight cyanide solution but without addition of the "chemical salts":

Heads assayed	\$100.00 silver.
Tails	93.00 "

The difference of extraction is again obvious.

## THE MOORE FILTER COMPANY

Sole and Exclusive Owners of The Moore Patents and Pending Applications

Home Offices: Broadway-Maiden Lane Bldg., 170 Broadway, New York, U. S. A.

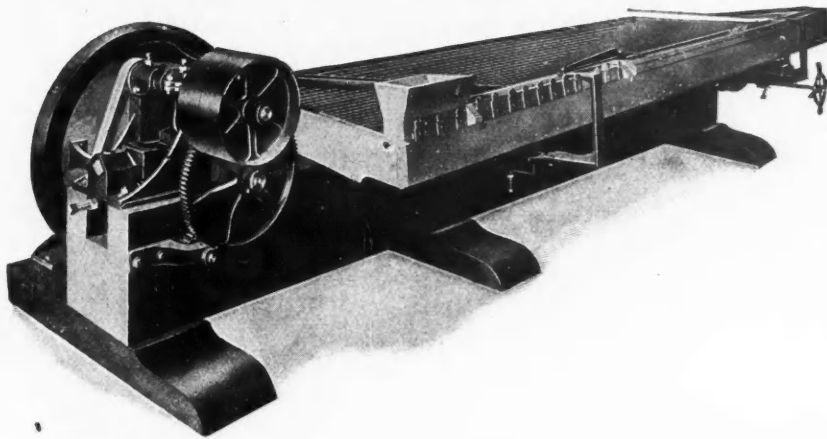
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**THE MINE & SMELTER SUPPLY CO.**  
**SOLE OWNERS AND MANUFACTURERS OF THE WILFLEY CONCENTRATING AND SLIME TABLE**

# THE WILFLEY CONCENTRATING MACHINES

By using these invaluable Machines, the highest possible extraction is obtained, the great losses in concentrating are eliminated. The values stay in the mill.



**THE WILFLEY  
CONCENTRATING TABLE**

is the best concentrating machine in the world. Over 95 per cent of the concentrators in use are

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THE WILFLEY No. 5 CONCENTRATING TABLE.

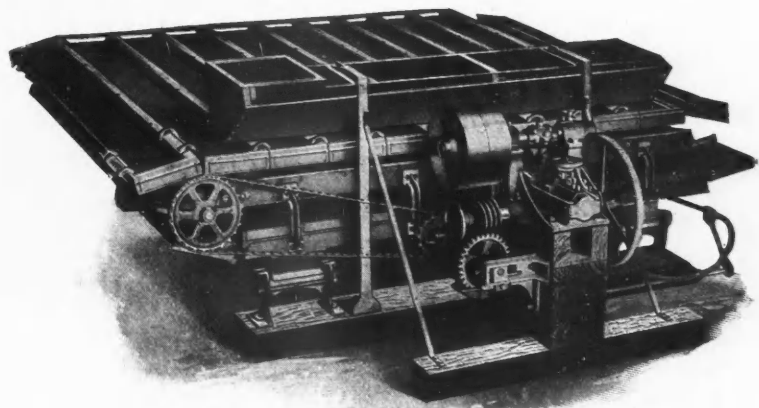
The man who invented the best concentrator in the world invented the

## WILFLEY SLIME TABLE

for saving the fine particles of minerals carried off in slimes (100-mesh and finer), too fine for any concentrating table to recover. Our numerous purchasers of this invaluable adjunct to the

## WILFLEY CONCENTRATING TABLE

express great satisfaction, because of the additional values recovered by its use.



THE WILFLEY No. 3 SLIME TABLE.

**No Up-to-date Concentrating Mill is without Wilfley Tables.**

**42 Broadway, New York City ~ Denver ~  
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# THE LEYNER BULLETIN

December 26

Littleton, Colo., U. S. A.

1908

## LEYNER RESULTS.

You are looking for the greatest results from a given expenditure and we build the *only* drills which can accomplish this. There is no reason why we should not secure your business.

This is our line of drills—all *Hammer* drills.

No. 9 Heavy Duty Water Leyner. Weight 245 or 220 lbs., depending on length of feed. For all kinds of heavy work and hard rock; holes up to 20 ft. in depth.

No. 8 Medium Duty Water Leyner. Weight 120 lbs. A "one man" machine. For holes up to 8 ft. in depth.

No. 7 Light Duty Water Leyner. Weight 97 lbs. A "one man" machine. For holes up to 6 ft. in depth.

The above three drills are used with a mounting.

Two sizes of Leyner Stoppers (air feed), *dry* pattern, for use with solid steel.

Two sizes of Leyner Stoppers (air feed), *water* pattern, for use with hollow steel.

Two sizes of Leyner Hand Drills.

The above line covers every possible requirement in rock work. If you have encountered a difficult problem, or if you wish to increase your output or decrease your expense, write us fully about the conditions and we shall be glad to make our recommendations. *One* of the above drills will *unquestionably* give the desired results.

**The J. Geo. Leyner Engineering Works Company,**  
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GENERAL OFFICES, PITTSBURG, PA.

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The photograph represents square timber sets installed at the Stearns' Shaft, Susquehanna Coal Company, Nanticoke, Pa., in 1897. These timbers were put in 540 feet below the surface and took the place of 24" round timber sets of wood whose life was only about eight months. The steel timbering put in at that time is still in position and in good condition, exposed to constant contact with mine water without sign of failure or corrosion and has fully justified all expectations as to strength, stability and permanence. Carnegie Steel Company manufactures other forms of steel mine timbers to meet all requirements.

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# The Murphy Drill

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## Repair Costs Under \$3.00 A Month

The Murphy will repay its cost in more ways and more quickly in each way than any other machine designed for like service. It is strictly a one-man machine and requires about one third as much air as the 2½", so called, "One Man-Baby" Machine.

Ask for full descriptive particulars.

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at less expense per foot and  
more feet per shift with a

### “Cleveland” Stopping Drill

than with any other Drill of any type.

Moreover a compressor which will run one  
2 $\frac{3}{4}$ -inch reciprocating drill will run two or  
three “Clevelands” with no increase in cost.  
Try one with your other drills and see.

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No. 9 SHAW SLUGGER DRILL  
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Have you any? If not, why  
not? They are the best, most  
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## Our New Year's Message

¶ The International High Speed Steel Co. takes pleasure in announcing to its many friends and customers that on and after January 1, 1909, the retail price of **International** Rolled Hollow Rock Drill Steel will be:

12<sup>1</sup>/<sub>2</sub>¢  
per lb.

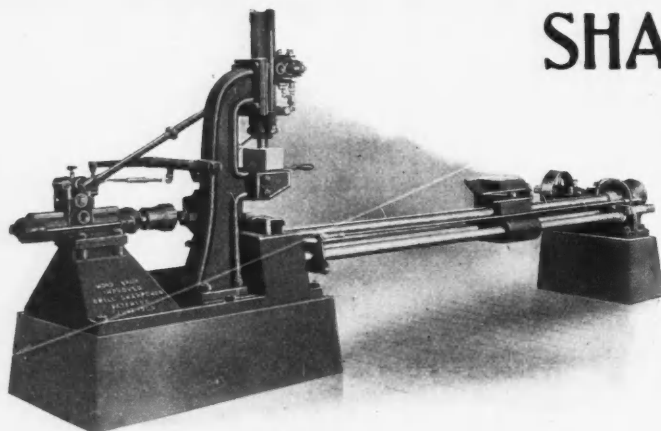
twelve and one half cents per pound, f.o.b. New York, by the bar or ton, in Round, Octagon and Hexagon sections, all sizes.

### International High Speed Steel Co.

Franklin Square

Denver Agents:  
THE HAMPSON-FIELDING ENGINEERING CO.

New York



SHARPENS 600 TO  
800 OLD DRILLS  
IN A DAY OR  
MAKES 500 TO

700 NEW ONES FROM BLANK STEEL

That's the remarkable speed at which the Word Drill Maker and Sharpener works. Think of it! 500 to 700 new drills from blank steel bars. The "Word" does the work of *ten men* and outlasts any other similar machine on the market. The dies and dollies are automatically adjusted to take up the wear and can be replaced at small cost.

Write for details.

A Stock of Machines in New York City Ready for Immediate Shipment.

Manufactured in San Francisco, Cal., Houghton, Mich., Rossland, B. C.

Word Bros., 60 Castro Street, San Francisco, Cal.

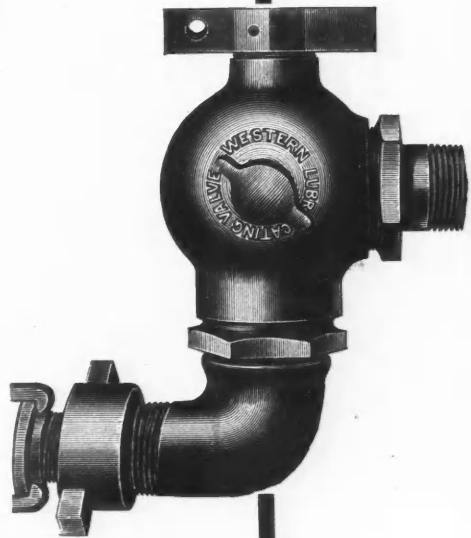


# A Lubricator And A Valve Combined

That describes the Western Lubricating Valve—the greatest little device for Machine Drills and Coal Punchers ever invented.

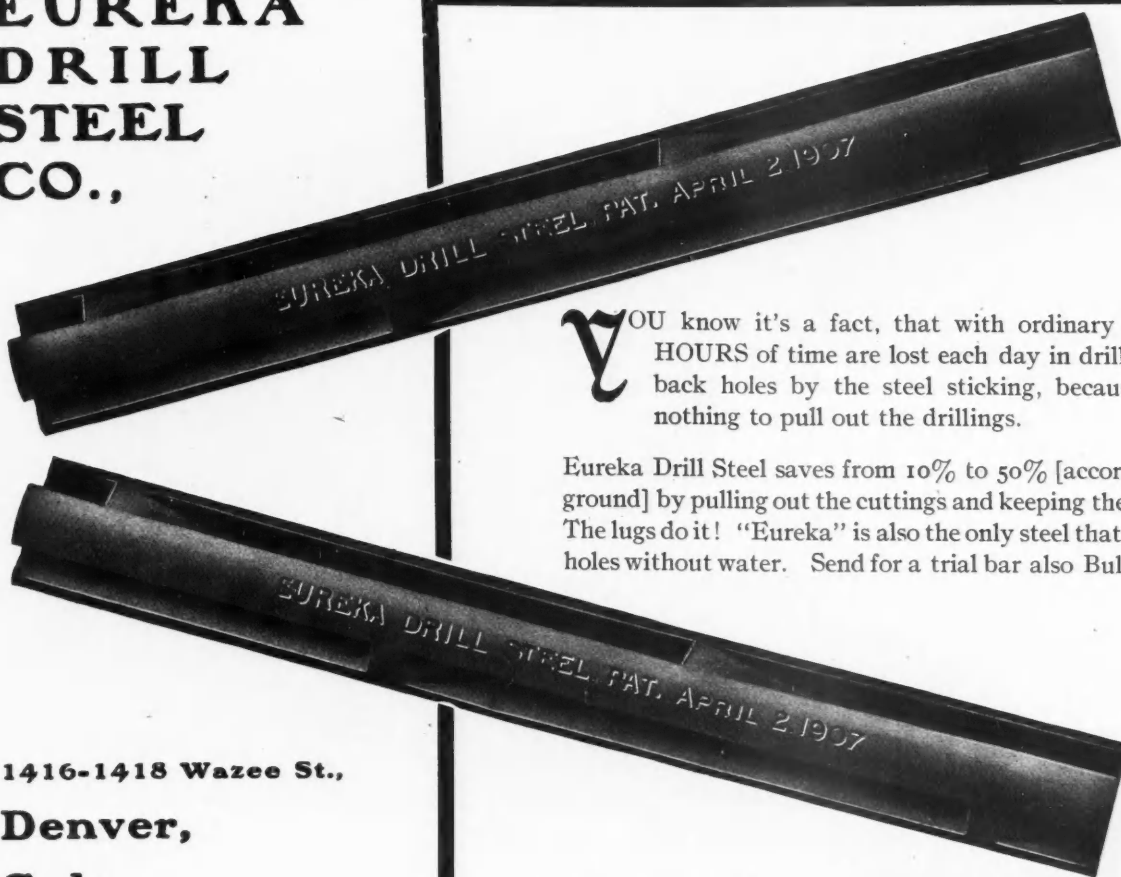
It is no longer necessary to work your drills to death before their time, running them amidst dirt and grit without oil—the day is past for that sort of thing. The "Western" will thoroughly and positively oil the drill to which it is attached, *regardless* of vibration. *This we guarantee.* We also guarantee it to outlast 6 valves of the ordinary stop cock type and to work three inches closer to a wall or column.

Hammer Drill size—\$5. Piston Drill size - \$7.  
Write for Catalog No. 2.



**The Western Lubricating Valve Co.,**  
1416-1418 Wazee Street, Denver, Colorado.

## EUREKA DRILL STEEL CO.,



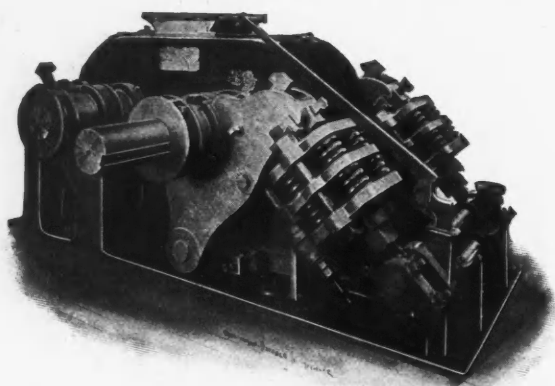
**Y**OU know it's a fact, that with ordinary drill steel, HOURS of time are lost each day in drilling flat or back holes by the steel sticking, because there is nothing to pull out the drillings.

Eureka Drill Steel saves from 10% to 50% [according to the ground] by pulling out the cuttings and keeping the hole clean. The lugs do it! "Eureka" is also the only steel that drills down holes without water. Send for a trial bar also Bulletin No. 2.

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## The Humphrey Crushing Rolls



The Humphrey Crushing Rolls

These rolls embody many special features not found in crushing rolls, as ordinarily constructed. The improvements, correct in principle and exceedingly valuable in operation, are such as will at once appeal to any experienced mill man. In material and workmanship they are of that high standard of excellence which has caused our milling and smelting equipment to become so favorably known for efficiency and durability.

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## AN IRON BASE

Rigidity and durability are desirable, to say the least. Our improved

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has these qualities because it is made with an Iron Base.

Three other qualities will especially appeal to you.

Low first cost.

Low cost of installation.

Requires least power per ton of ore crushed.



COMMERCIAL ART STUDIO, S. C.

Bulletin No. 27 tells about Huntington Mills.

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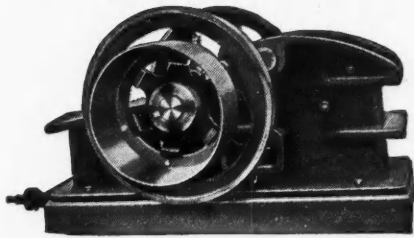
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ALL-STEEL ORE CRUSHER**

*Simplest, Strongest and Most Durable Machine Made.*



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Style C—All Steel Crusher—Two Sizes: 24"x48" and 30"x60.

Crushing Rolls: 18"x12" to 60"x60".

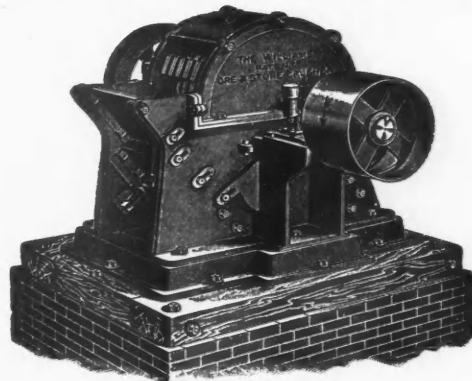
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FOR  
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ANTHRACITE DEBRIS**



1400 Williams Crushers  
in use. Any capacity or  
fineness desired.

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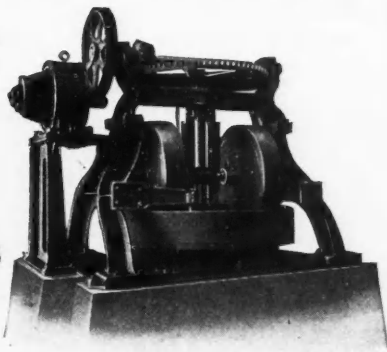
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RECEIVING CAPACITY—SPECIALLY DESIGNED  
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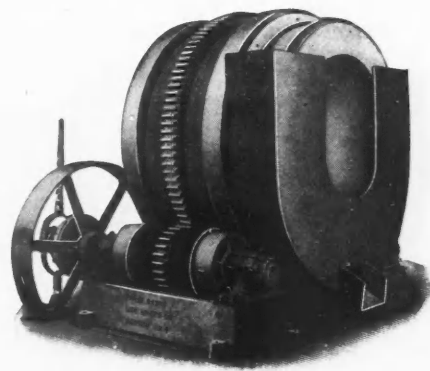
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size. Uses but little power. Write for Catalog 37.

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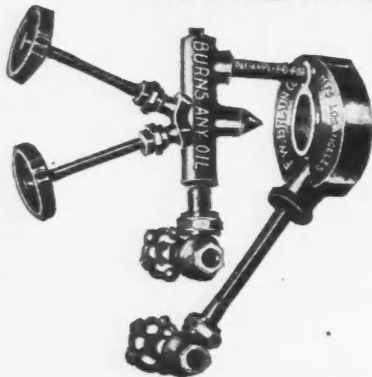
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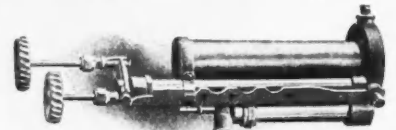
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The air enters the table from below the deck and passes through the pervious top where it instantly expands causing a film of air to support and stratify the material.

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**The S. S. & S. Dry Table.**

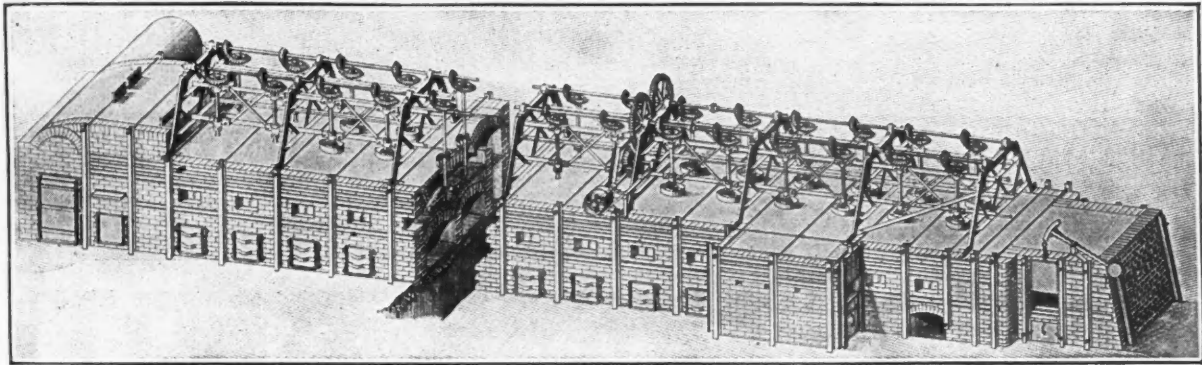


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Tilting, Simplex and Duplex types—for all kinds of Ore Roasting.



DUPLEX

These furnaces are roasting successfully today ores containing Gold, Silver, Copper, Zinc, Cobalt Lead, Arsenic, etc., for after treatment by

**SMELTING, CYANIDE CHLORINATION OR OTHER METHODS**

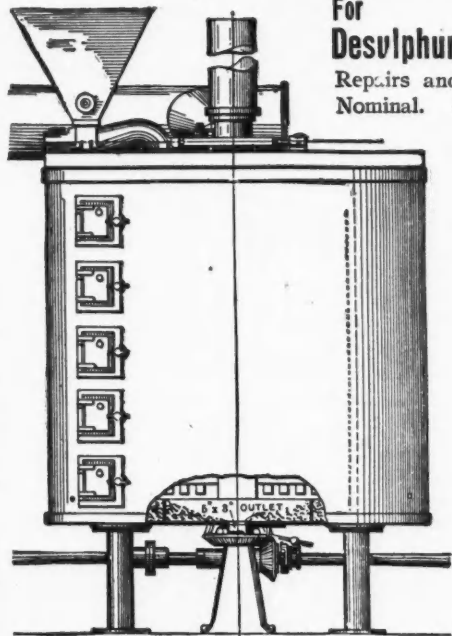
THEY ARE NOT DUST PRODUCERS

**It Will Pay You to Know All About These Furnaces.**

**CHISHOLM, MATTHEW & CO., COLORADO SPRINGS, COLO., AGENTS**

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## The Herreshoff Roasting Furnace



For  
**Desulphurising Ores**  
Repairs and Labor Cost  
Nominal. One man can  
attend 100.

**No Fuel  
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While Run-  
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**Over 750  
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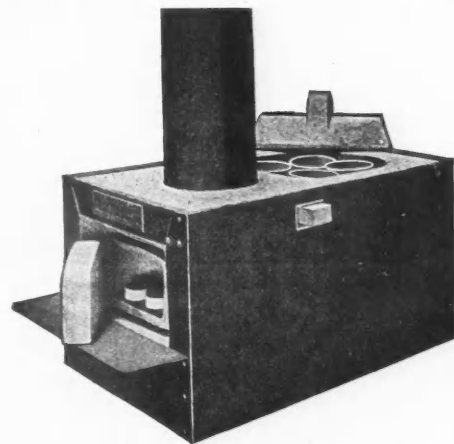
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BROAD EXCHANGE BUILDING,

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are guaranteed in every detail and will  
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Just because Sam Jones cured his boiler troubles by using some "CURE-ALL COMPOUND," is no reason for thinking that it would do the same in your case. The Dearborn Treatment prescribes for your case exactly as if it was the only case in the world. Send us a gallon of water for analysis. We'll advise you what's best to do to effect a POSITIVE CURE.

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Are you satisfied with the present results you are obtaining from your filters? If your filtration is unsatisfactory it may be the fault lies in your filtering medium. Our ten years' experience in this line is at your command. Send us a sample of your cloth and tell us your difficulty. If you are satisfied with what you are using, send us a sample anyway; we think we can duplicate your cloth for less money than you are now paying.

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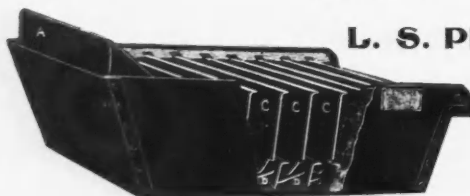
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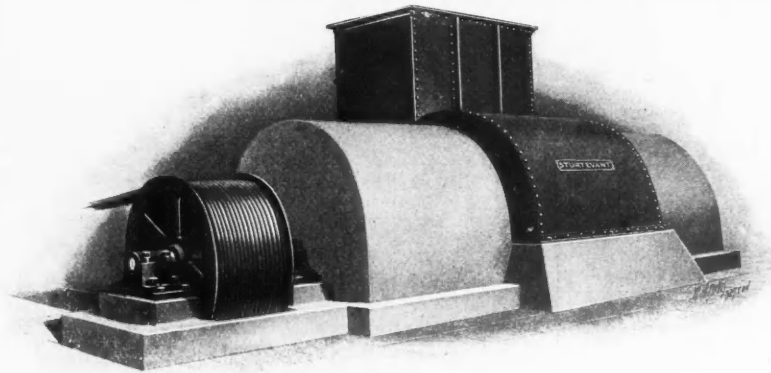
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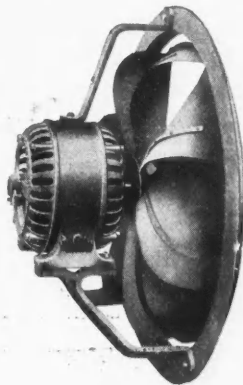
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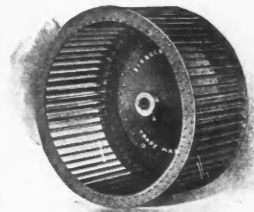
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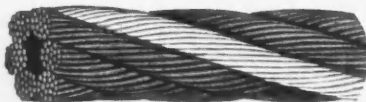
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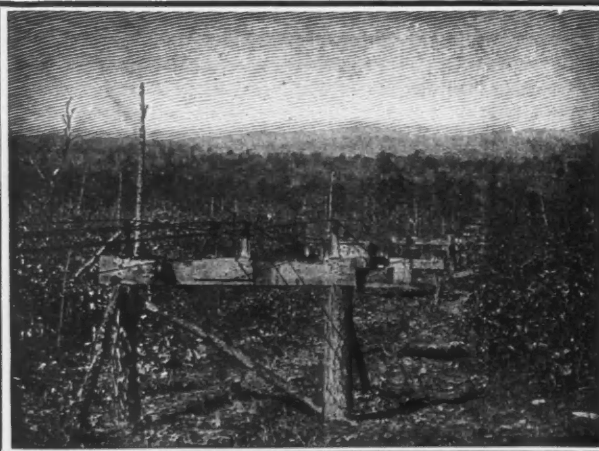
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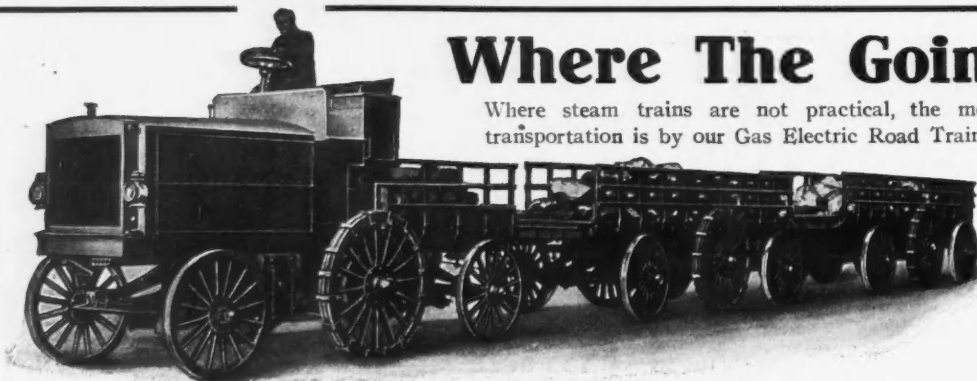
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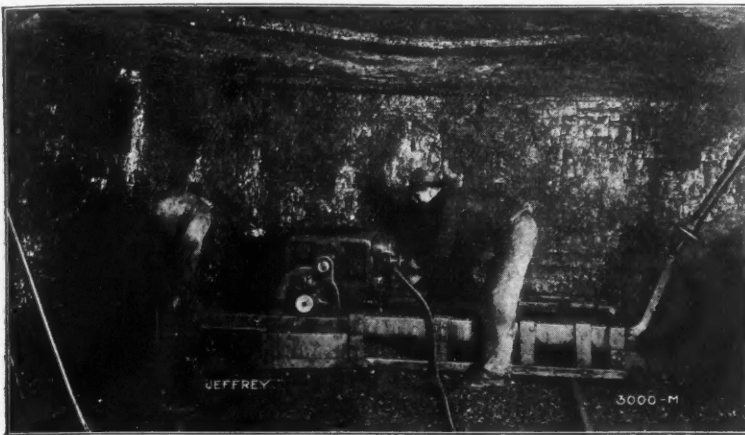
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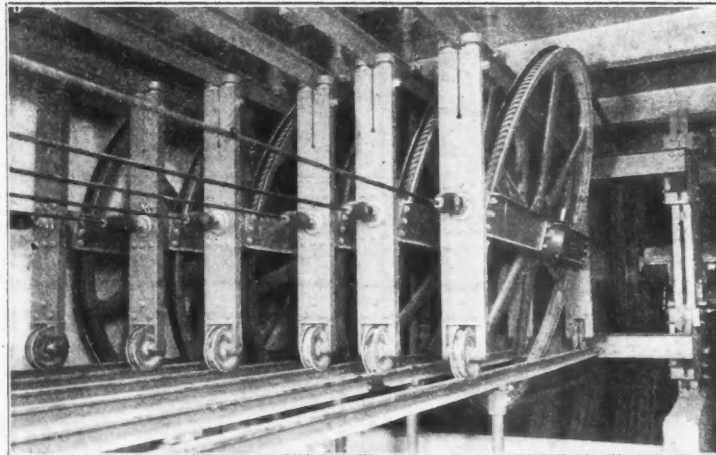
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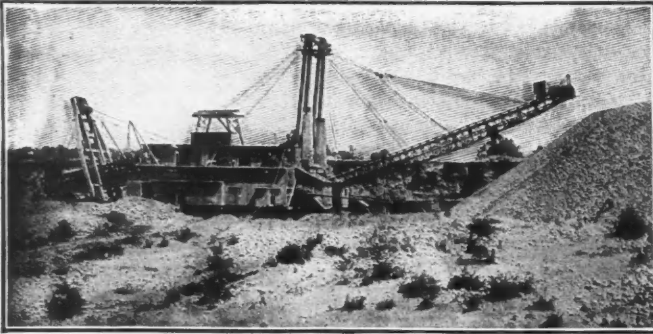
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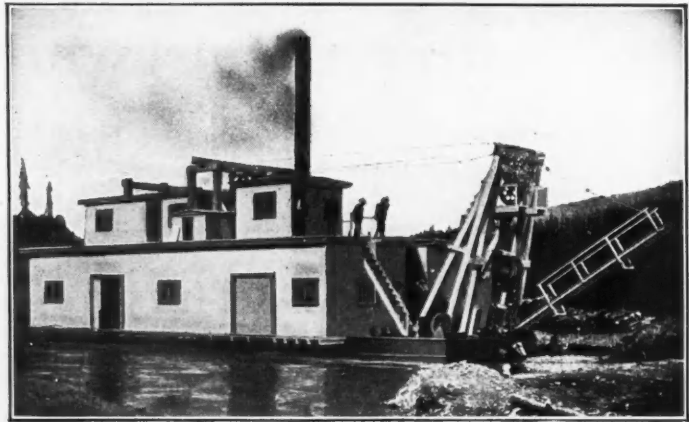
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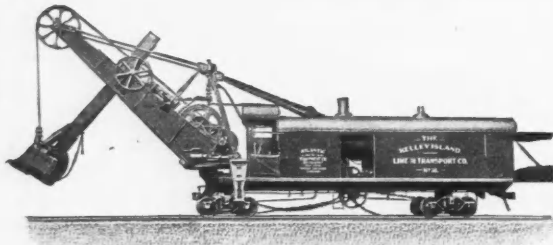
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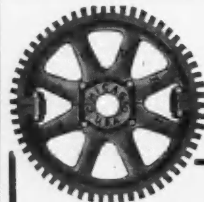


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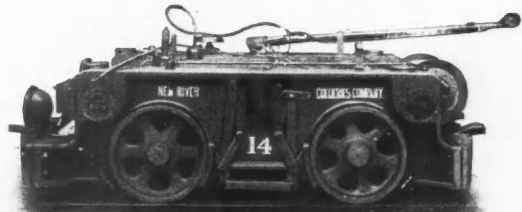
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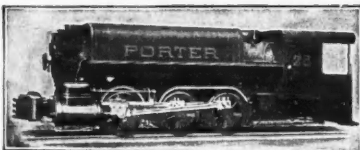
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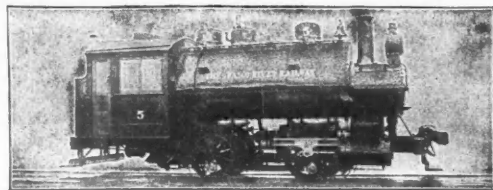
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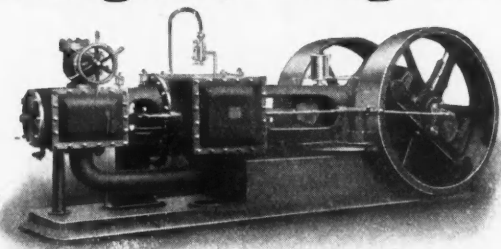
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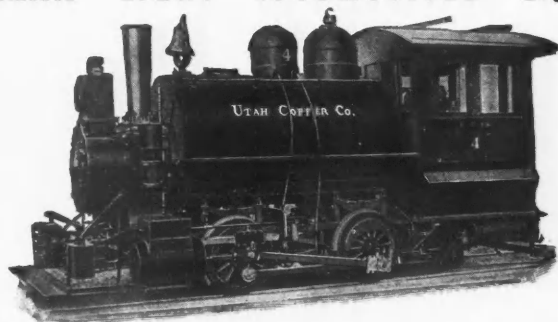


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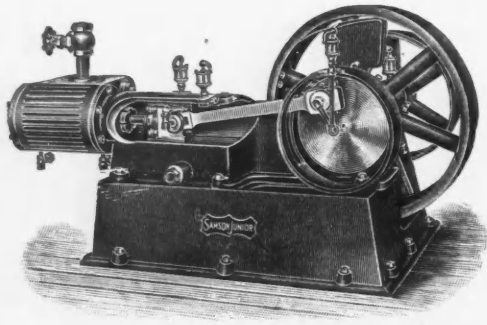
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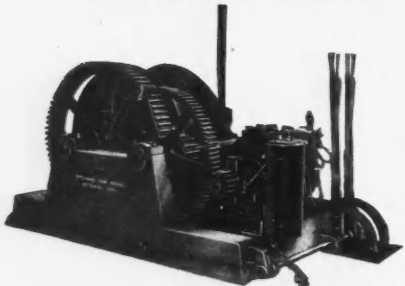
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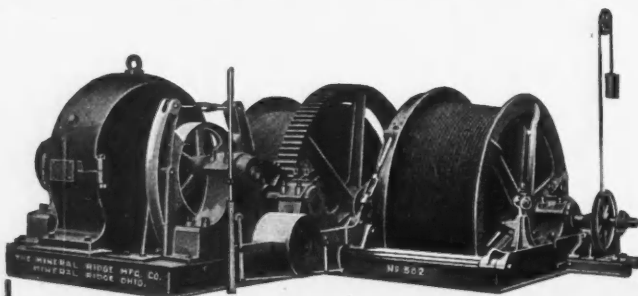
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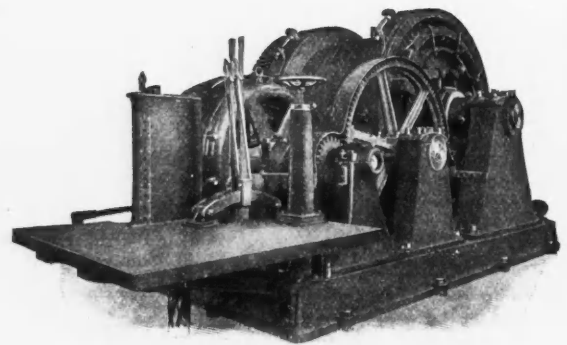
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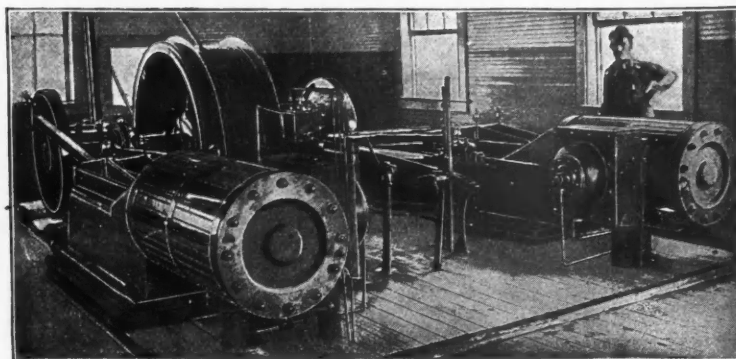
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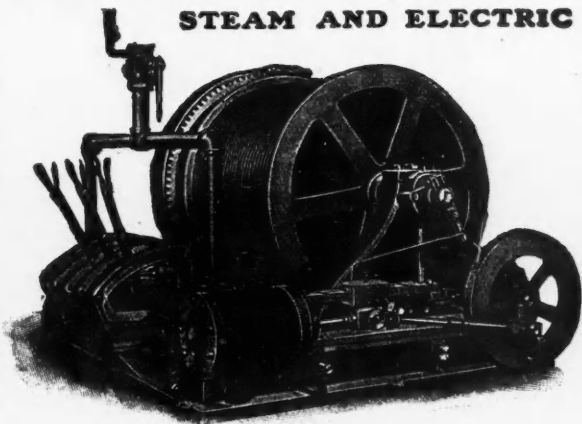
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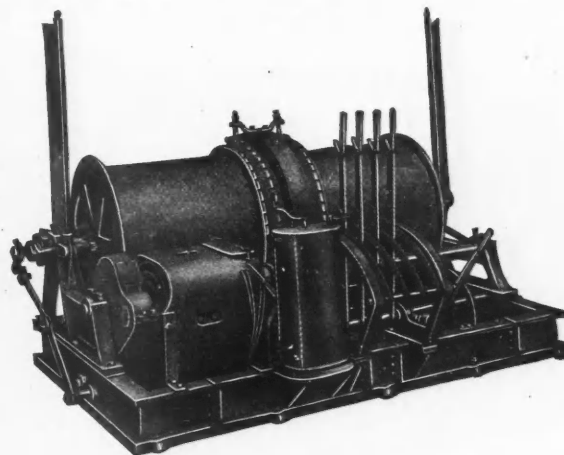
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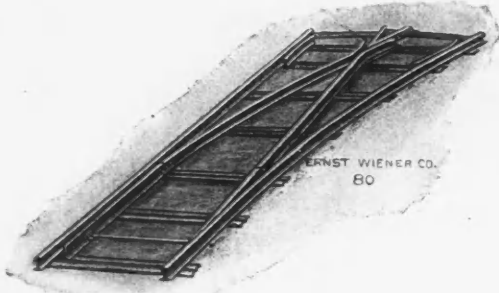
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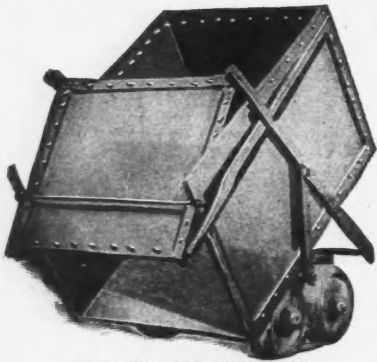
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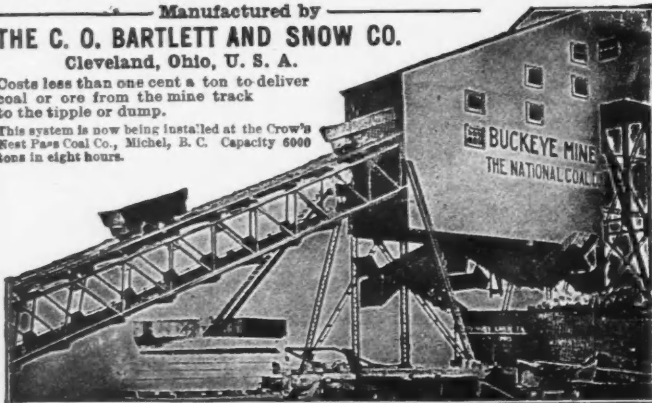
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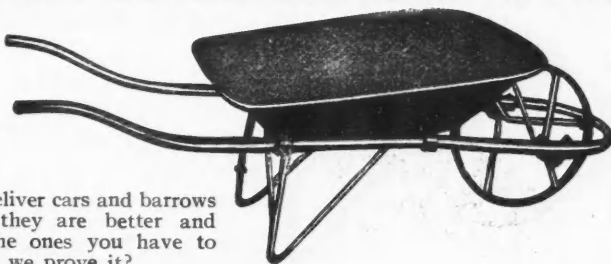
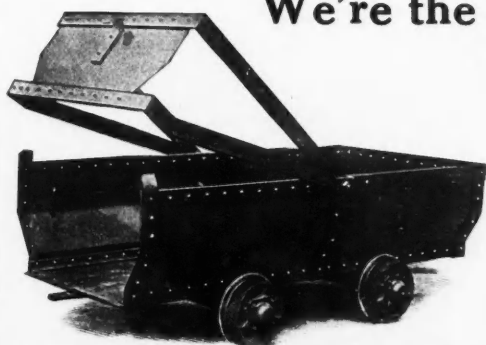
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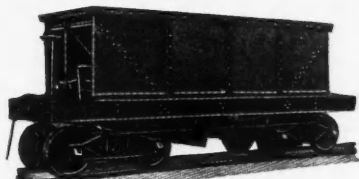
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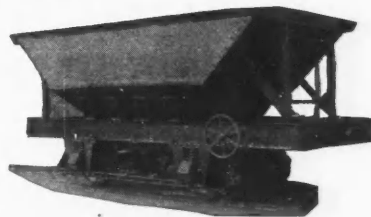
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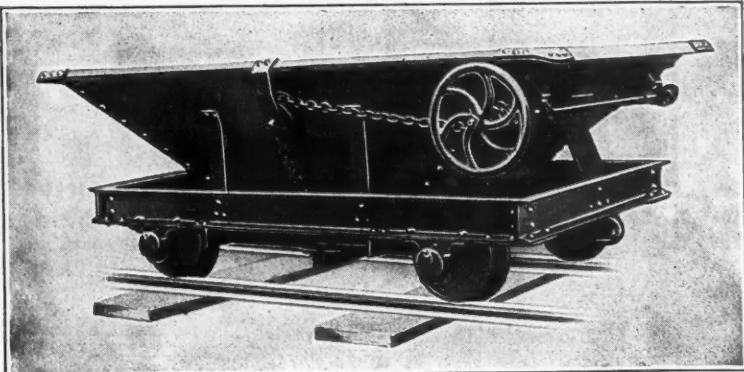
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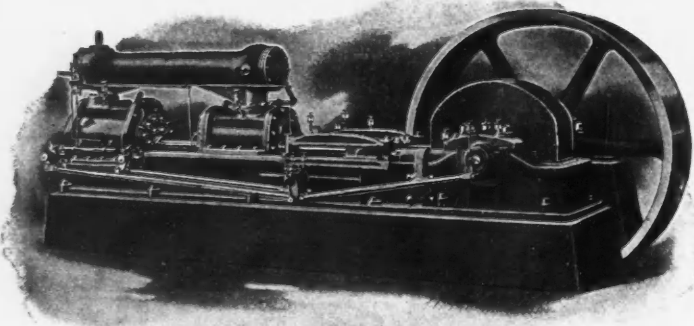


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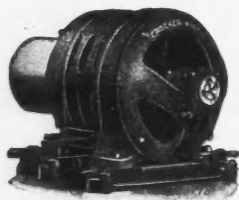


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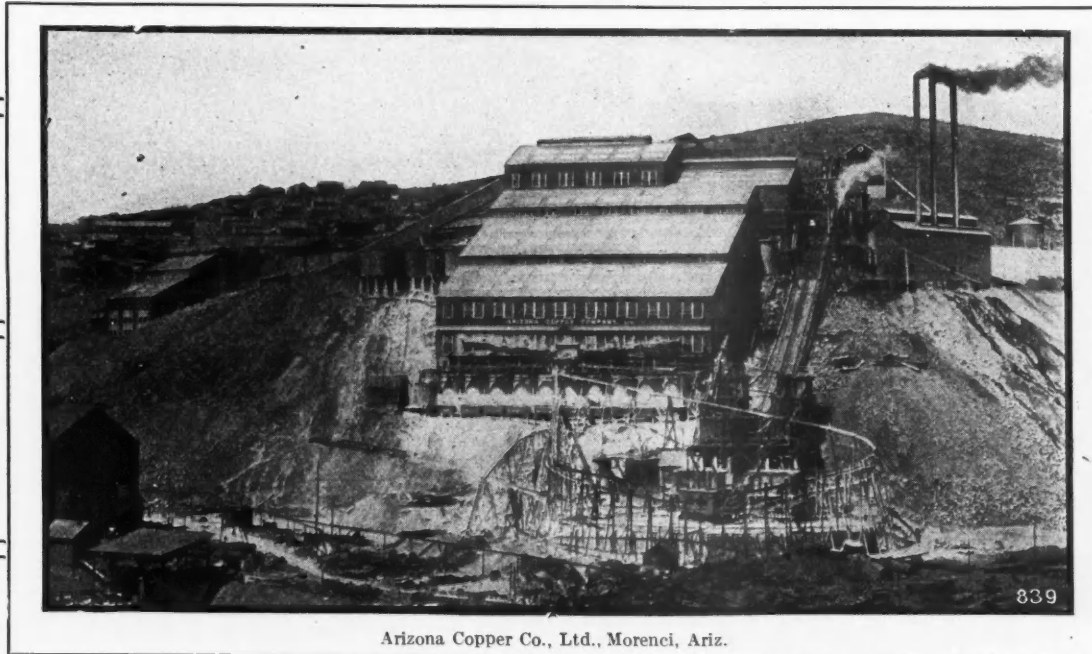
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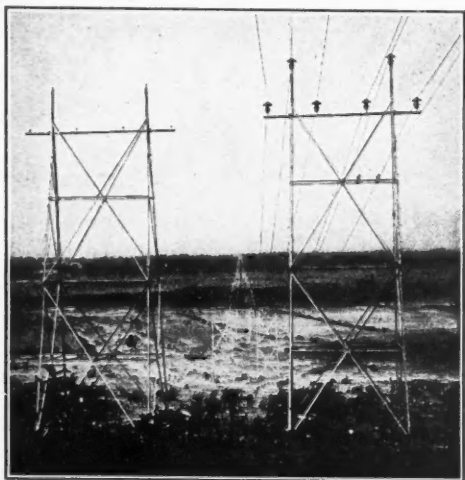
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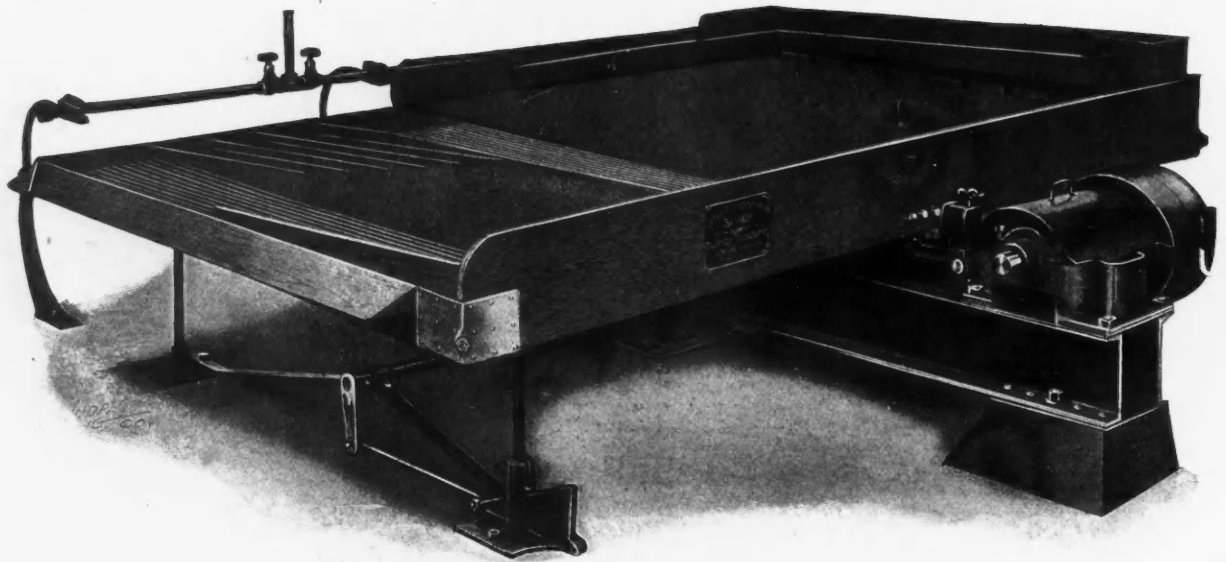
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Mining and Metallurgical Companies—U. S.

Table listing Mining and Metallurgical Companies in the U.S. with columns for Name of Company and Location, Authorized Capital, Shares (Issued, Par Val), Dividends (Total to Date, Latest Date, Latest Amt.), and various financial metrics.

Coal, Iron and Other Industrials—United States

Table listing Coal, Iron and Other Industrials in the United States with columns for Name of Company and Location, Authorized Capital, Shares (Issued, Par Val), Dividends (Total to Date, Latest Date, Latest Amt.), and various financial metrics.

\*Since 1894. †Since 1907. ‡Since 1890.

Canada, Mexico, Central and South America.

Table listing companies in Canada, Mexico, Central and South America with columns for Name of Company and Location, Authorized Capital, Shares (Issued, Par Val), Dividends (Total to Date, Latest Date, Latest Amt.), and various financial metrics.

\*Previous to consolidation \$1,436,250 were divided. †Amalgamated.

\*Mexican Currency. †Since reorganization. ‡Since August, 1905.

## Industrials

H. A. Carpenter & Bro., El Paso, Texas, recently removed from the Coles building to 522 San Francisco street, one block from the Union depot, where a large and complete line of mining machinery and supplies will be carried.

Herbert E. Stone has just become connected with the Dearborn Drug and Chemical Works, as manager of sales in the eastern department, with headquarters in New York City. Mr. Stone was formerly president of the National Association of Stationary Engineers and recently manager of the Pittsburg office of the Chapman Valve Company. Mr. Stone will have associated with him a corps of able assistants. The Dearborn company is to be congratulated upon the splendid addition to its selling force.

Ernst Wiener Company, railroad specialists for all industries, announces that J. N. Richards, who for the last fourteen years was general sales manager for the Standard Paint Company, has associated himself with it. Mr. Richards is well known amongst the large manufacturing interests of the country and his many friends and long experience will no doubt be the means of increasing the business of the well known concern with whom Mr. Richards is now connected. Mr. Richards will make his headquarters for the present at the main office, 50 Church street, New York, N. Y.

The Bausch & Lomb Optical Co., of Rochester, New York, of which George N. Saegmuller, formerly sole proprietor of Fauth & Co., of Washington, D. C., is now a member, announces its "Hand Book for Engineers" for 1909. This book, of vest pocket size, contains the solar ephemeris for 1909 and also directions for using the Saegmuller solar attachment, now so universally employed. There are directions, with diagrams for using and adjusting the engineers' wye level, the dumpy level and the transit instrument, as well as other useful information. This book is of interest to all engineers and students of engineering. It will be sent at once free of charge upon request.

Where current is available, the electric shovel offers many advantages. The boiler and its accessories are eliminated, as is the expense of hauling coal and water. Where a number of shovels are to work permanently, such as dry placer mining, stripping mines and quarries, loading ore, rock, etc., a battery of these shovels could be operated from a central power plant. The saving thus effected is obvious. Vulcan electric shovels, manufactured by the Vulcan Steam Shovel Company, Toledo, Ohio, are no experiment, but have been demonstrated by actual work to be durable, reliable and efficient. They are equipped with the latest and best devices for speed, safety and control. This company will equip any size shovel it builds with motors for electric power and guarantee them to be as efficient in every way as a shovel operated by steam.

J. R. Gordon has accepted the position of manager of power apparatus sales for the Western Electric Company for its southern territory; as a result of this Mr. Gordon will continue to make his home in Atlanta. Since he resigned a month ago from his position of manager in the Southern States for the Westinghouse Electric and Manufacturing Company, he has received many flattering offers from northern manufacturers, but he decided that the large and growing business of the Western Electric Company presented opportunities quite to his liking, and also permitted him to remain in the South among his wide circle of social and business friends. Mr. Gordon is known throughout the country as a pioneer in the electrical field, having been associated with those who organized and operated the first of the Edison plants. For many years he has been a well known member of the American Institute of Electrical Engineers and the American Society of Mechanical

Engineers, and is by many considered the best informed and most experienced engineer in steam and electrical machinery in the South.

Probably the most important feature of the gasolene hoist manufactured by the G. W. Price Pump and Engine Company is the position of the drum and control levers, which are directly in front of and in view of the operator, and can be instantly reached without a change of position. The engines, being multicylinder, and equipped with throttle, are very flexible and responsive. The cylinder heads are removable, and are free from fuel, exhaust or water pipes, making access to the cylinders and pistons much easier and quicker than in any other engine. Balancing of reciprocating parts is exact, and these engines will be found to operate with a minimum of vibration. Bearings are placed between each crank, and all bearings are of ample size to insure long wear. Both the splash and force feed systems of lubrication are used in these engines, and all the cams operate in a separate oil bath, and impart a vertical motion to the valve rods through intervening rolls, thus avoiding all rubbing or sliding action. The engine pinion is of forged steel, and the teeth are machine cut. The drum gear is of cast iron, turned all over, and the teeth are also machine cut.

The Westinghouse Electric and Manufacturing Company has again become the property of the stockholders, after having been in the hands of receivers since the 23d of October, 1907. The petition for the discharge of the receivers was made on December 5 in Pittsburg, Penn., before Judge Young, of the United States District Court of the Western Circuit of Penn., and was immediately signed by him. The petition was presented by G. B. Gordon, attorney for the receivers and for the Merchandise Creditors' committee; Paul D. Cravath, attorney for the Stockholders' committee, and A. H. Larkin, attorney for the Readjustment committee. Mr. Gordon made the address to the court, in which he gave a statement of the company's affairs prior to the receivership, explained the causes which led to the establishment of the receivership, presented a report of the operation of the company during the tenure of the receivership, and finally led up to the great work which has been accomplished within so short a time by Mr. Westinghouse and the various committees in bringing about the rehabilitation and reorganization of the company. He emphasized the fact that during the year the receivers had been in charge, they had not only succeeded in paying off the interest on bonds, as it fell due from time to time, but that they had also kept the large factories of the company in operation during the entire time, doing an excellent business at a net profit of over \$1,000,000. The action of 5000 employees subscribing for \$600,000 of stock of the company was another feature presented to the court, which made a great impression, because it demonstrated the amount of confidence the employees themselves had in the company. It was also brought out that the company under the reorganization would in every way be in a better condition than at any previous period in its history, as it would start upon the new régime with cash on hand amounting to upward of \$15,000,000, and with an indebtedness of only about \$200,000. Mr. Cravath, in addressing the court on behalf of the Stockholders' committee, stated that in the annals of receiverships, this one stood without a parallel as the most successful.

The Hardinge pebble mill found its origin in the practical metallurgical necessities of its inventor. In the ordinary tube, or pebble mill, 4 to 5 ft. in diameter, and 15 to 27 ft. in length, some of the material upon entering the mill is almost immediately reduced to a slime. The work on the particles having been finished, the product should at once be passed out of the mill. Instead of this, the crushed and finely divided material is retained in the older style of tube mill until it has passed through 20 ft. or more of length, interfering with the work

desired by absorbing energy through compression, friction and production of heat. Both ends of the regulation cylindrical pebble mill are loaded with the same quantity and size of pebbles, and when the pebbles are reduced by wear, the larger pebbles act upon the smaller pebbles and upon the material already sufficiently crushed, thus wasting energy by performing undesirable work—making a conveyer of what is intended to be a pulverizer. This unnecessary waste of power fethered the production of the conical mill, in which relative sizes of pebbles to particles to be crushed is obtained through the scientific application of natural forces, resulting in a gradual sizing. The principles involved are diagrammatically illustrated in a booklet issued by Hardinge Conical Mill Company, 43 Exchange Place, New York City, where it will be seen that the larger crushing bodies (pebbles) seek and maintain a position at the largest diameter of the conical mill, and that all the material becomes arranged in zones, composed of pebbles having smaller and smaller diameters as the diameter of the cone decreases, while owing to the conical shape the same speed of rotation results in a multiplicity of gradually changing peripheral speeds. The sizing action not only applies to the crushing pebbles but to the material being crushed. To use the same size pebble to crush a  $\frac{1}{2}$ -in. particle as a  $\frac{1}{4}$ -in. particle (a relation of over 600:1) is quite similar to driving a tack with the same sledge hammer that is used to drive a spike. In the conical mill is employed (comparatively), a sledge hammer upon a spike, a nail hammer upon a nail, and a tack hammer upon a tack—in other words,—adjust the power and mechanism to the work desired and obtain the results sought.

## Trade Catalogs

The Vulcan Steam Shovel Company, Toledo, Ohio. Catalog. Vulcan Giant revolving shovel. Illustrated, 24 pages, 4 $\frac{1}{2}$ x8 inches, paper.

Sturtevant Mill Company, Boston, Mass. Catalog No. 79. Sturtevant ring-roll mill. Illustrated, 12 pages, 8x10 $\frac{1}{2}$  inches, paper.

Western Electric Company, 463 West street, New York. Bulletin No. 5370. Steam turbines. Illustrated, 12 pages, 8x11 inches.

Westinghouse Electric and Manufacturing Co., Pittsburg, Penn. Circular No. 1157. Type S transformers. Illustrated, 16 pages, 7x10 inches.

National Brake and Electric Company, Milwaukee, Wis. Publication No. 386. Air compressors for industrial service. Illustrated, 24 pages, 6x9 inches.

Ridgway Dynamo and Engine Company, Ridgway, Penn. Bulletin No. 20. Single-valve side-crank engine. Illustrated, 16 pages, 8x10 $\frac{1}{2}$  inches, paper.


Western Electric Company, 463 West street; New York. Booklets. Instructions for installation and operation of "E" and "L" generators and motors. Illustrated.

The Yale & Towne Manufacturing Company, 9 Murray street, New York. Catalog. Chain blocks, electric hoists, trolleys and cranes. Illustrated, 70 pages, 6x9 inches, paper.

United Engineering and Foundry Company, Pittsburg, Penn. Catalog. Rolling mills, shears, shears and punches, rail straightening machines, etc. Illustrated, 398 pages, 9x10 $\frac{1}{2}$  inches, cloth.

Allis-Chalmers Company, Milwaukee, Wis. Bulletin No. 1434. Hydraulic classifiers. Illustrated, 12 pages, 8x10 $\frac{1}{2}$  inches. Bulletin No. 1435. Vertical mill elevators. Illustrated, 4 pages, 8x10 $\frac{1}{2}$  inches.

Western Electric Company, 463 West street, New York. Bulletin No. 5113. Three-wire generators, "L" design. Illustrated, 12 pages, 8x10 $\frac{1}{2}$  inches. Booklet No. 1078. Magneto telephone wall sets. Illustrated, 16 pages, 3 $\frac{1}{2}$ x6 inches.



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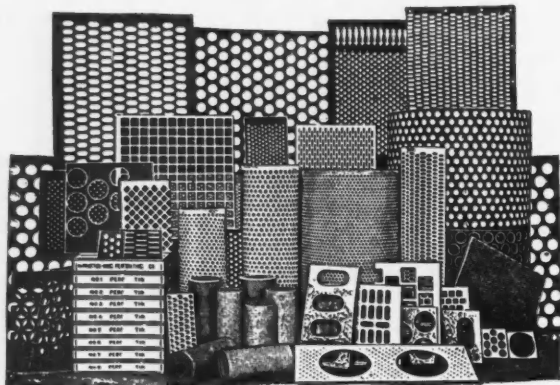
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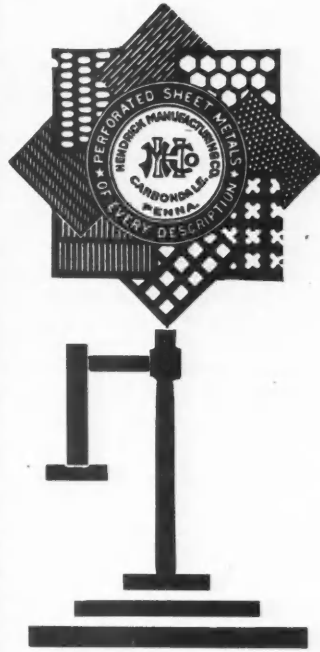
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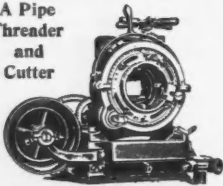
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**CUTS COSTS,  
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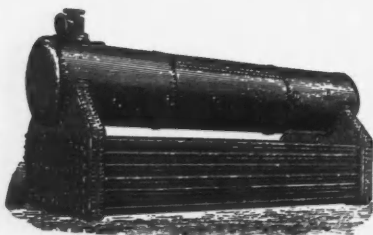
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Work perfectly in every detail, suited to light or heavy oils, smoky or inefficient fires impossible.

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Burners, Oil Pumping Systems and Furnaces obtains an efficient fire at lower fuel expense. CATALOG?

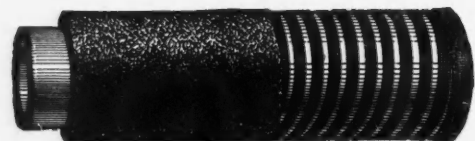
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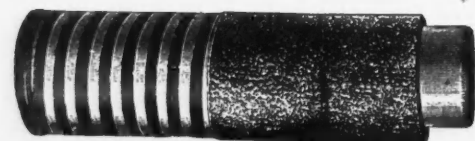
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Manufactured only by the

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**Acids Do Not Affect  
Wyckoff Wood Pipe**


It is proof against rust corrosion and freezing, gritty matter will not wear it away and diameter for diameter it carries 14% more water than iron pipe besides being cheaper to buy and transport, easier to handle and far more durable. Write today.



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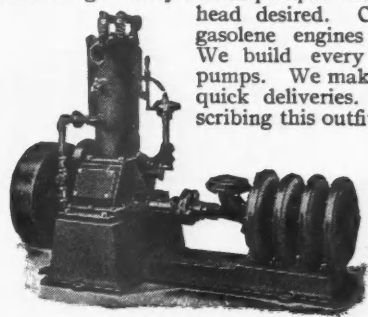
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 The most durable pump for elevating  
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 NO VALVES NO BUCKETS  
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**GENTRIFUGAL PUMPS**  
 For Mines and Sinking Purposes  
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 For Placer Mining a Specialty  
**GIRGULATING PUMP**

**Erie Turbine Pump and Engine**  
 Something entirely new in pumps. Built in all sizes for any  
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 We build every thing in centrifugal  
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**DEMING TRIPLEX MINE PUMPS**

Adapted  
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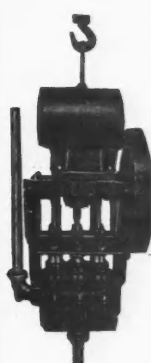
Built in  
 Four Types  
 and  
 Any Sizes

Fig. 61.

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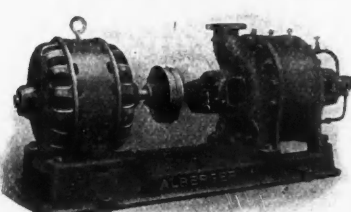
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Arranged with Drip Protected Motor. Large  
 valve area, admitting of high speed in case of  
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 Highest efficiency of pump and motor. Built  
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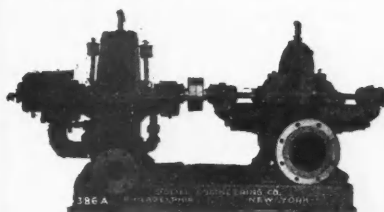
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on which you  
 can rely for  
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Each pump designed for the particular service it  
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**TURBINE PUMPS  
 FOR HIGH LIFTS**

Fitted with  
 Automatic  
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 No Thrust  
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Steam Turbine Motors  
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## Pulsometer Pumps

having no easily deranged inside or outside mechanism, will handle the grittiest, muddiest liquids, without the least injury to any of their working parts.

No engine, belt, oil packing or special foundation required: merely a steam pipe from boiler—that's all.

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**15 Battery Place, New York**

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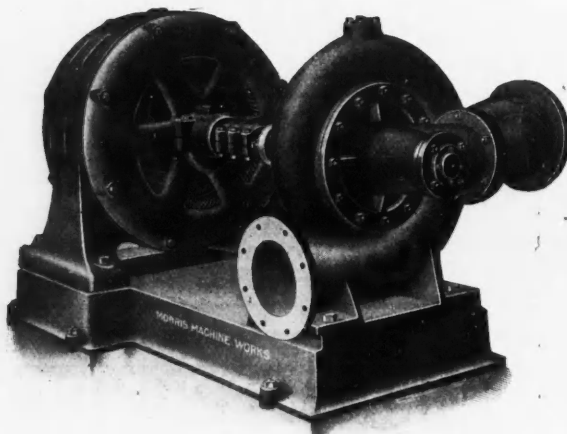
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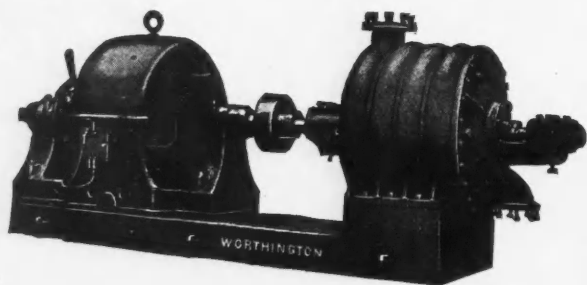


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Direct Connection to Drive,  
Low First Cost,  
Low Cost of Maintenance,  
Unlimited Range of Service,  
Compactness and Durability,  
and most important—

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We will be pleased indeed to furnish Specification T-1 on receipt of request and requirements.

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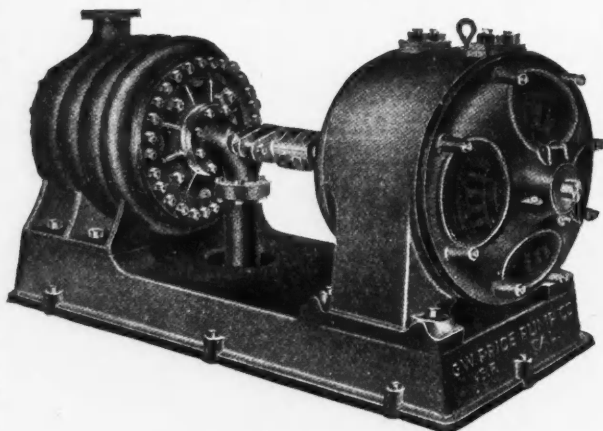
115 Broadway, New York

Works: Harrison, N. J.

## Our Impellers

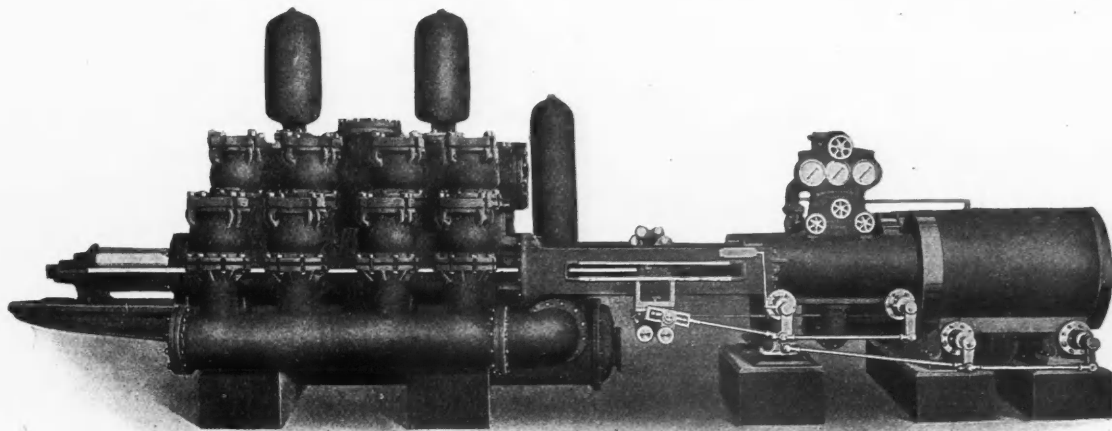
are made one right and one left hand, thus perfectly balancing one against the other and avoiding all end thrust, the thrust box being used only for the purpose of keeping the impellers in a central position. *Write.*

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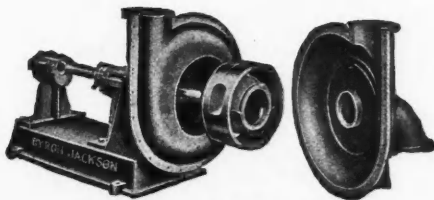


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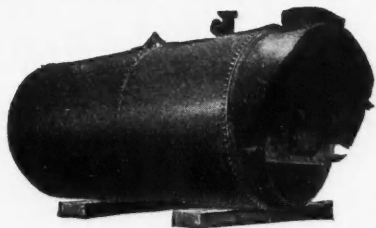
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Some folks still advocate the tailings-wheel,  
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otherwise they would have been converted  
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Immediate  
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**THE  
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**Centrifugal  
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 (THE KINGSFORD KIND)

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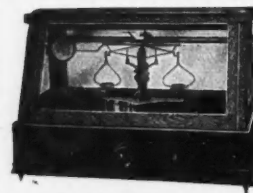


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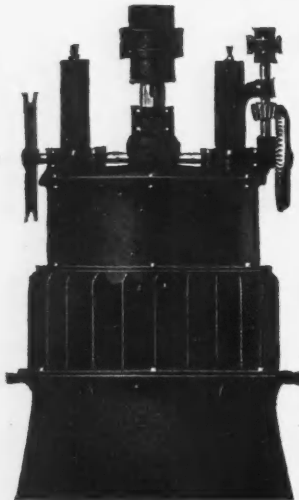
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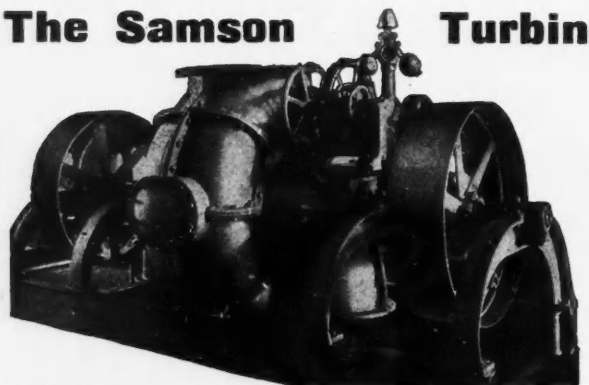
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**New American Turbines**

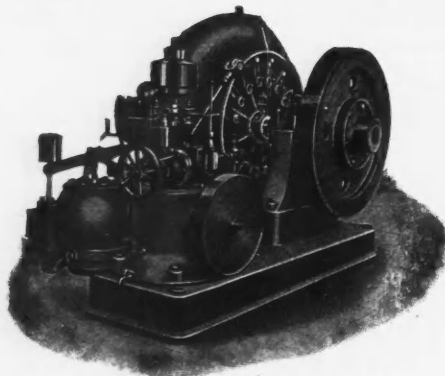
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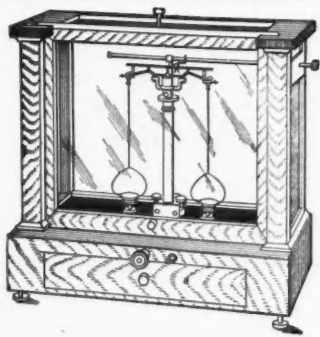
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**This Ainsworth  
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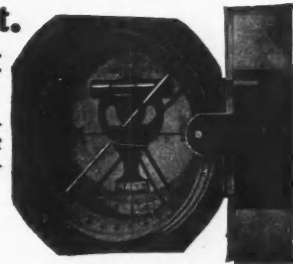
has 5-inch limb, 4½ in. vertical  
circle, with guard, all gradua-  
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For preliminary surveying on the surface or underground

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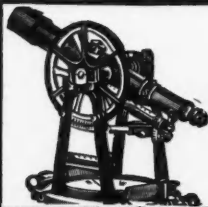
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Combined with speed,  
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Every balance receives  
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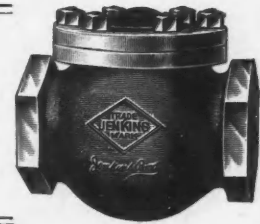


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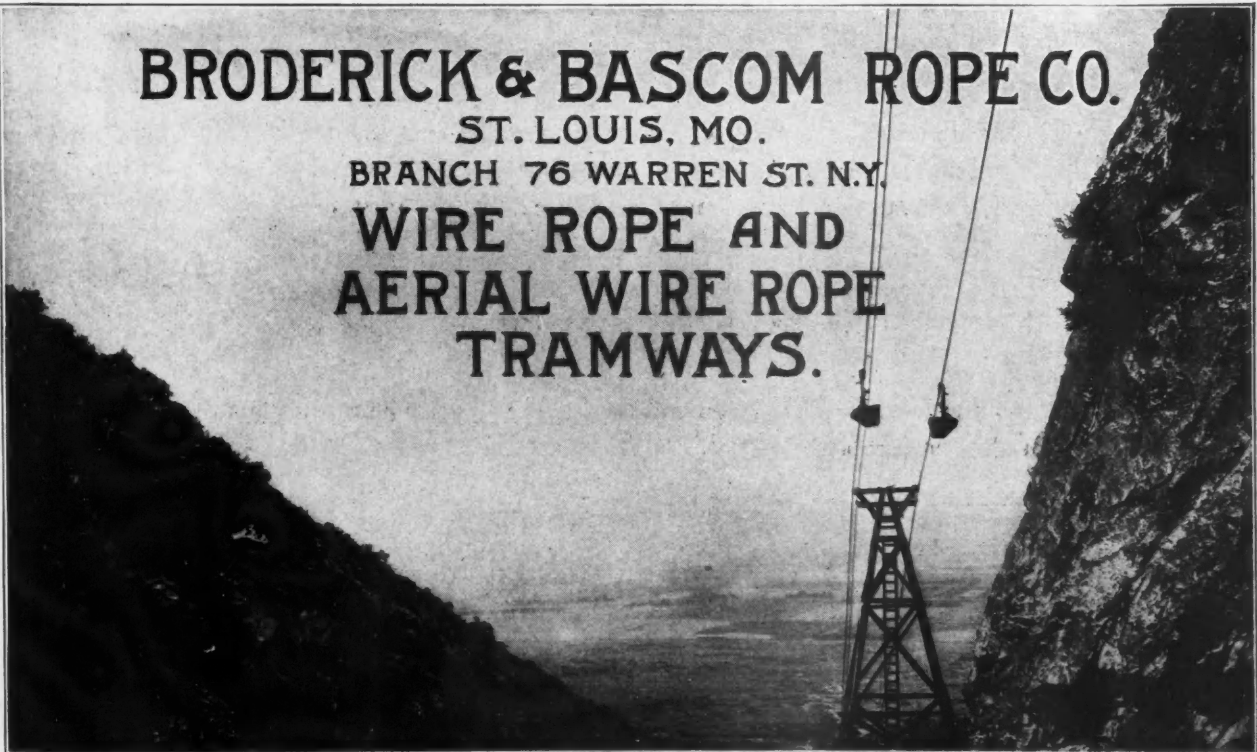
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