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## Developments on Michigan Iron Ranges

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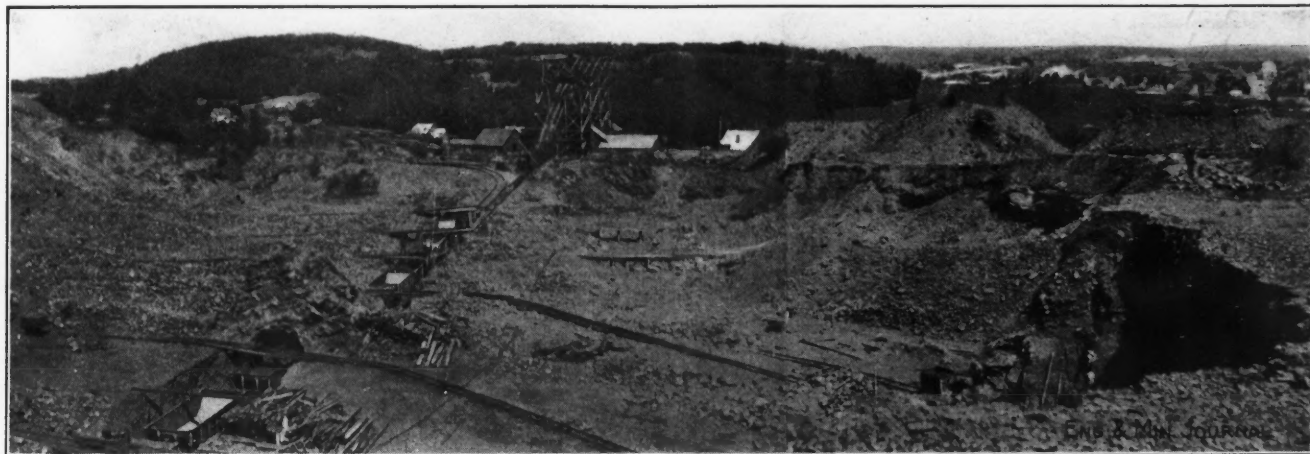
*SYNOPSIS*—A sketch of the history of iron-ore shipments from Michigan ranges, followed by a description of the principal features of the important districts. Concentration of low-grade ore is now being attempted, and if successful, will appreciably increase the available iron-ore reserves.

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Attention has recently been directed to the Michigan iron ranges by the mining boom, which has been taking place in the Iron River field, and also by the extensive exploration and improvement work being carried on by progressive companies in both the old and new districts.

quette range, as was also the case in 1870, when 830,934 tons were shipped. In 1880, the amount was 1,976,096 tons, which came from the Marquette and Menominee ranges, and in 1890, 9,003,725 tons came from Marquette, Menominee, Gogebic and the Vermillion ranges in Minnesota. In 1909, 19,080,379 tons were shipped from Marquette, Menominee, Gogebic, Vermillion and Mesabi ranges (the last contributing 7,809,535 tons), and in 1910, 43,442,397 tons were shipped from the same ranges, of which the Mesabi contributed 29,201,760 tons.

Since 1900 the Michigan ranges have been somewhat overshadowed by the huge shipments made from the



SOUTH JACKSON OPEN-CUT MINE OF THE CLEVELAND-CLIFFS IRON CO.

The record-breaking shipment of over 48,000,000 tons of iron ore from the Lake Superior region, in 1912, has aided in attracting attention. New mining corporations have lately acquired footholds in the Michigan districts; furnace interests from Ohio and New York, as well as local mining men from Michigan and Minnesota, and a steady expansion is in progress.

### SHIPMENTS DATE FROM 1856

Shipment of Lake Superior iron ore to lower Lake ports substantially began in 1856, at the completion of the ship canal along St. Mary's River connecting Lake Superior with Lake Huron, when 6343 tons were shipped, and has increased to such proportions that the enormous quantity of 50,000,000 tons is predicted for 1913. In 1860, the tonnage moved was 114,401, all from the Mar-

Mesabi range in Minnesota, but nevertheless have been growing and expanding steadily, and it is believed that the deeper deposits of Michigan are assured of a much longer life than the flat orebodies of the Mesabi.

### IRON RIVER DISTRICT EARLY OVERLOOKED

The Iron River district, on the western Menominee range, was, for a long time, a minor producer of medium-grade, non-bessemer ores, suitable for pig iron and open-hearth steel. On account of the non-bessemer grade of the ore and the scarcity of outcrops, the field was rather overlooked by the large steel organizations and its mines became controlled by small, aggressive companies which, several years ago, began an active exploratory campaign, the successful results of which attracted others. Much of the land was held in small parcels by settlers, making a diversity of ownerships. It had formerly been believed that the ore formation was confined to a north-

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west-southeast belt between Palatka and Iron River, but drill holes sunk promiscuously beyond these limits disclosed three or four other strong ore-zones, striking in various directions, and it is now recognized that the iron occurs in irregular, discontinuous lenses in the slates so that a lot more drilling will be necessary before it can definitely be indicated where the ore is not. J. R. Finlay credits the district with containing what is probably the second largest ore reserve in Michigan, and R. C. Allen, the state geologist, has predicted that Iron River will be producing iron ore years hence. Following the successful diamond drilling undertaken during the past five years, the district has been experiencing a mild mining boom.

At present, most of the favorable land has been taken up by the score of active companies on the ground, and in general the district is in the development stage. Shafts are being sunk, orebodies blocked out by drifts and raises, and surface equipments are being installed. In 1912, the tonnage shipped from the district was 1,750,000, and this figure will be greatly exceeded when the mines now developing begin to produce in earnest. The Bengal, Rogers, Tully and Forbes, all in process of development, have large proven orebodies, as has the Sherwood property of the Republic Iron & Steel Co., as yet in the exploration stage. In addition to these, a number of mines are developing deposits, which are not determined in extent.

The overburden in the Iron River district, consisting of glacial sand and boulders, is generally thick, and may be as much as 250 ft. The orebodies occur in steeply pitching, tabular lenses, surrounded by black or gray slates. Both the sub-level and caving systems of mining are used. The mines are as yet comparatively shallow, varying up to 800 ft. in depth. Shafts are practically all vertical, and due to the thick overburden and water troubles, the tendency is toward few shafts and permanent installations. Steel shaft houses have been erected at the James, the Forbes, the Rogers, and the Zimmermann mines. Surface buildings are of steel and brick, or frame covered with corrugated iron. Electric power is purchased from the Peninsula Power Co., of Iron Mountain, at about 1c. per kilowatt-hour. The following mines have installed electrically driven air compressors: Cortland, Wickwire, Virgil, Davidson, Bengal and Bates. The type of electric compressor purchased is Ingersoll-Rand, class P E, direct connected, with air supply adjusted by the "clearance-control" device. Several of the mines also purchase power for pumping and underground haulage, but hoisting is practically all done by steam or compressed air.

Installations and equipment are of various types. Thus the Rogers mine used a reinforced-concrete drop shaft, sunk by the caisson method to pierce 140 ft. of overburden, while at the Tully and Bates mines, where similar trouble was anticipated from quicksand and water, timber shafts were put down. At the Forbes mine, the steel headframe is of the two-post type, with hoisting taking place along the outside of the structure. At the Rogers mine, contrary to the usual practice in the district, the gyratory crusher is placed high enough in the steel shaft house to permit crushed ore to drop into the ore bins ready for loading, thus obviating secondary hoisting. Several of the larger mines have erected well equipped machine, forge and wood-working shops in a single long building, separated by partitions, an economical construc-

tion which permits work being readily transferred from one shop to another.

The Rogers and the Dober mines have installed water-tube boilers, contrary to custom at most of the iron mines. Concrete is extensively used for foundations for buildings, crushers, and shaft houses and for floors. A number of Leyner drill sharpeners have lately been purchased and the usual types of compressors installed include Ingersoll-Rand, Chicago Pneumatic Tool Co., Sullivan and Nordberg. Hoists include the Sullivan, Wellman-Seaver-Morgan, Lake Shore Engine Works, Nordberg, and Allis-Chalmers designs. It is becoming customary to install a first-motion hoist for lifting ore in balance and a smaller geared hoist for raising the man and timber cage



ORE DOCK FOR LOADING INTO RAILROAD CARS. OLD WOODEN TYPE, SEPARATE FROM SHAFT HOUSE

(usually balanced by a counterweight). A majority of the rock drills are of Ingersoll-Rand make with the Butterfly-valve type popular, although the Sullivan, Chicago Pneumatic Tool Co., and Murphy are also well regarded.

#### MARQUETTE THE ORIGINAL IRON DISTRICT

The Marquette range was the first discovered, and for 20 years was the only producer. It will likely be one of the last to become exhausted, as the deep deposits of the Negaunee basin are counted as the greatest ore reserve in Michigan.

Important developments have been recently made by the Cleveland-Cliffs Iron Co., the Breitung-Kaufman companies, M. A. Hanna & Co., and the Cascade Mining

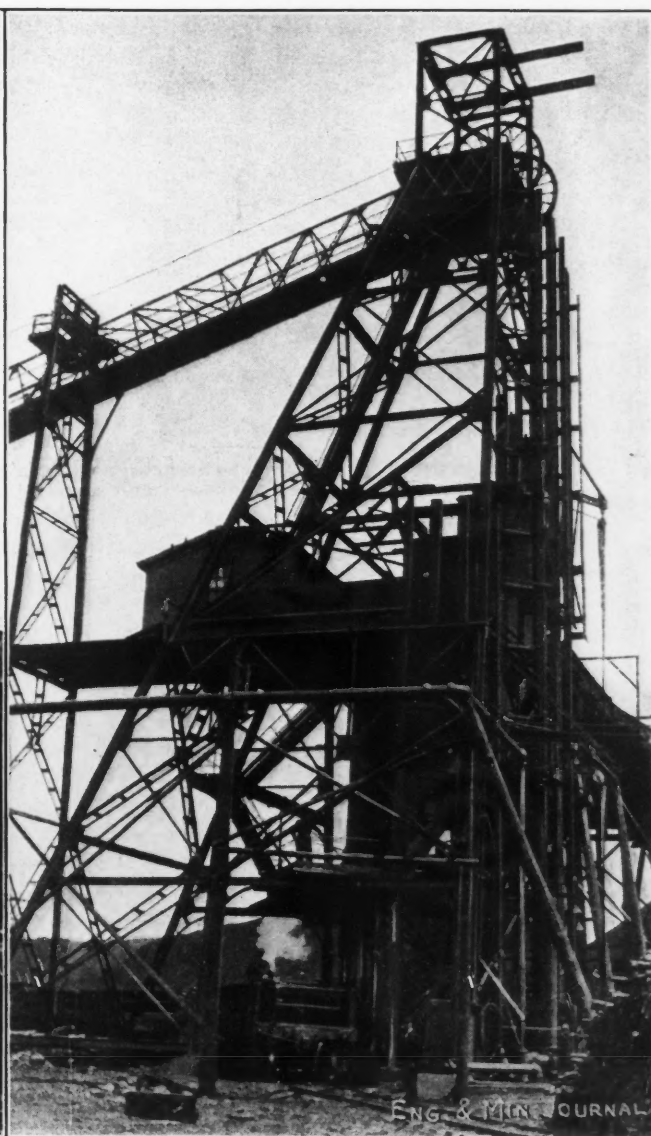
Co. The Cleveland-Cliffs Iron Co., the largest shipper on the range, is developing the Morris, Lloyd and Chase mines, situated near North Lake, four miles west of Ishpeming. Development work at new properties is carried on by the different departments of the company, according to standard designs carefully prepared. Two large hoisting shafts are usually sunk, and equipped with standard steel headframes. Concrete-lined shafts, sunk by the caisson method, are used when necessary, and steel and brick buildings are erected. Electrically operated compressors, hoists and pumps are now being substituted for steam machinery, the power furnished from the com-

trifugal types; the plunger style is preferred for its higher efficiency.

The company's active mines on the Marquette range include the Imperial, at Michigamme; Chase, Morris and Lloyd, at North Lake; Cliffs Shafts, Lake and Salisbury, at Ishpeming; Negaunee, Maas, Lucy and South Jackson, at Negaunee. In addition, there are several mines producing and developing in the Gwinn or Swanzy district, a subsidiary of the Marquette range, lying 15 miles to the southeast, where the company's model town of Gwinn has been built. Here, as in the North Lake district, the ore has been traced by extensive diamond-drilling under



STEEL HEADFRAME OF VOLUNTEER MINE OF VOLUNTEER ORE CO.



HEADFRAME AT PRINCE OF WALES MINE OF OLIVER IRON MINING CO.

pany's hydro-electric plant on the Carp River, near Marquette. An electrically driven Ingersoll-Rand compressor, in use at North Lake, was one of the first installed in the Lake Superior district. The electric equipment recently completed at the company's Negaunee mine, including a costly motor-generator set, direct-connected skip-hoist, and geared cage-hoist, is probably the finest on the iron ranges. The electric pumps being installed underground in the company's mines are of both plunger and cen-

the direction of the company's efficient geological department. The ore at North Lake lay unknown for years, only a few feet under the soil, until someone pointed out that the strike of the ore formation was in that direction.

The Cleveland-Cliffs Iron Co. is noted for the care shown in looking after the welfare of its employees, a special department being maintained for that purpose. Company dwelling houses and other buildings are well constructed and maintained, prizes are given for attrac-

tive gardens and lawns, and a night-school to train miners into foremen was recently started, with a Michigan College of Mines graduate in charge. A safety department is maintained for inspection of all dangerous machinery and stopes and mine-rescue crews are trained and supplied with apparatus. Frequent meetings of foremen and department heads are arranged. The company plans to ship 3,000,000 tons of ore in 1913.

The Breitung-Kaufman companies, operating the Mary Charlotte, Breitung-Hematite and Milwaukee-Davis mines, at Negaunee, and the Barron mine, at Humboldt, and developing the Lucky Star mine, at Negaunee, have only recently become important in the iron-ore business. They shipped about 500,000 tons in 1911, and the same in 1912. Their ores at Negaunee are soft and of good grade. These companies, controlled by E. N. Breitung, of Marquette, have the advantage of owning their Negaunee mines outright and thus have to pay no royalties.

M. A. Hanna & Co., of Cleveland, is one of the largest of the "independent" companies. Its Marquette range mines are the American, west of Ishpeming, and the Richmond, in the Cascade district, the latter a low-grade proposition. The American is an old mine that was supposed to be worked out. However, with J. R. Thompson as manager, the mine has found ore, both high grade and low grade, and is also developing extensive lands lying to the west, explored with the diamond drill by George Maas, of Negaunee. The interest of mining men has been aroused by the thorough attempt being made to concentrate the low-grade ore of the American mine. A large concentrating mill, equipped with Richards pulsator jigs and Deister tables, is now operated, and although minor difficulties are being encountered, it is expected to concentrate commercially a 40-45% to a 60-65% material. Many mining men predict that concentration of iron ore will soon become more important than at present, and several far-sighted companies are inserting in their leases of ore lands a clause giving "the right to concentrate."

The Cascade Mining Co., a new corporation organized by the Pillsbury-Bennett-Longyear interests, of Minneapolis, is developing a large mine in the Cascade district of the Marquette range. This section was supposed to contain only low-grade, siliceous ores, of which it has hundreds of millions of tons, until the Volunteer Ore Co. and the Cascade Mining Co. began operations on high-grade deposits. Developments are being watched with interest.

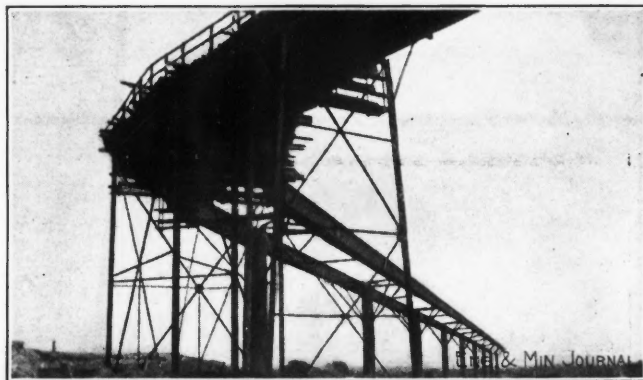
The Oliver Iron Mining Co., the iron-mining department of the U. S. Steel Corporation, has not been especially active on the Marquette range during recent years, as it owns most of its properties there and attention is being directed to leased mines elsewhere. The Republic Iron & Steel Co., and Jones & Laughlin operate several mines in the district, but have been conservative about expansion, although the latter company has lately been increasing its exploration facilities.

#### GOGEBIC RANGE A HEAVY PRODUCER

Iron ore was not produced on the Gogebic range until 1884, when 1022 tons were shipped. It has, however, been a heavy producer during late years, as its mines are large and deep and are nearly all well developed. The mines are the deepest on the iron ranges, their depths varying up to 2200 ft., which is the distance reached in the Newport. The iron-bearing formation was traced out

early in the history of the range, being consistent and easily followed. Little diamond drilling has been done, although this method of exploration has been gaining in favor recently. The operating companies have devoted themselves to mining, and much of the exploration has been to determine the depths of the orebodies. Lately there has been some exploration in the Wakefield section by M. A. Hanna & Co., R. S. Rose, of Marquette, and others. On the extreme eastern end of the range, near Marinessco, the Presque Isle Iron Co., composed of R. J. Whiteside, W. G. LaRue and W. H. Cole, of Duluth, is developing the Copps property.

The Cleveland-Cliffs Iron Co. lately abandoned Gogebic range operations by relinquishing the Ashland mine. The Oliver Iron Mining operates the Atlantic, near Hurley, Wis.; Tilden, at Bessemer, Mich.; and the Pabst, Aurora, Norrie, Davis, Geneva and Puritan, at Ironwood, Mich. The Newport Mining Co. operates the big Newport mine, and also the Anvil and Palms mines, where a new deep shaft is being sunk. The Newport mine ranks in magnificence of equipment with the Negaunee mine of the Cleveland-Cliffs Iron Co., on the Marquette range. Pickands, Mather & Co. operates the Cary, Mikado, Brotherton and Sunday Lake mines, the first at Hurley, Wis.,



PART OF STEEL STOCKPILE TRESTLE, NEGAUNEE MINE.  
ALL OTHERS ON IRON RANGE ARE OF WOOD

the other three in the Wakefield district; all large mines. Corrigan, McKinney & Co. operates the Ironton and Colby mines, at Bessemer. Oglebay, Norton & Co. operates the Castle mine, at Wakefield, the Eureka and Asteroid mines at Ramsay, and the Ottawa and Montreal mines, near Hurley, Wis. The Yale mine, at Bessemer, is now controlled by the Lake Superior Iron & Chemical Co., which uses the ore in its charcoal-furnace plants in Michigan and Wisconsin. The Norrie group of the Oliver Iron Mining Co. (including the Norrie, Aurora and Pabst mines), together with the Newport mine, owned by Ferdinand Schlessinger, of Milwaukee, have shipped 60% of the entire output of the range, and are credited with 80% of the ore reserves.

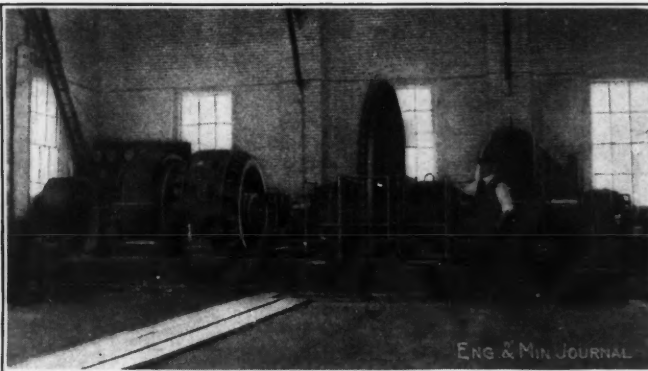
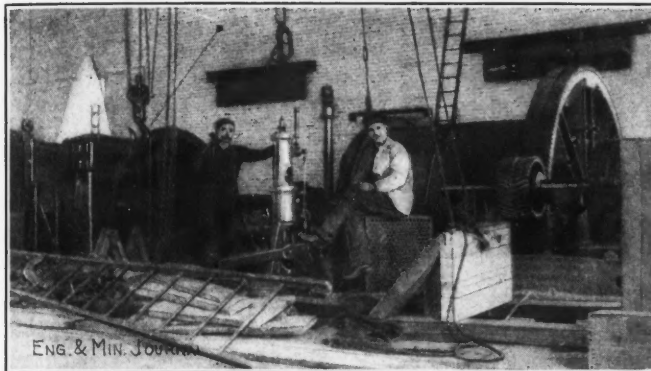
The eastern portion of the Menominee range, with mines centering around Iron Mountain and Norway, is much like the Gogebic range, in that a number of large, established mines are operating, with comparatively little exploration and new development taking place. The Oliver Iron Mining Co. is the largest producer at Iron Mountain, where its famous Chapin mine is situated, and the Penn Iron Mining Co. is the dominant interest at Norway, where the Aragon mine of the Oliver Iron

Mining Co. is also situated. J. R. Finlay states that this district is the least promising in Michigan for the future.

The Crystal Falls district of the Menominee range resembles its neighbor, the Iron River district, in many respects, and is starting on a period of expansion. For many years it was a medium producer of non-bessemer ores, with Corrigan, McKinney & Co. the dominant interest. Recently M. A. Hanna & Co. and the Longyear interests have made large finds on lands previously overlooked or discredited. The new Carpenter mine, being developed by M. A. Hanna & Co., is to be a good-sized producer, and the big Mastodon find of the Longyear interests is

terests from Cleveland, Pittsburgh, Buffalo or Chicago. The iron-ore business is a moderately profitable one, due to the large scale of the operations and the general good practice prevalent. There are few blast furnaces and only a few concentrating mills in the Lake Superior iron region, and mining is the chief industry. Miners include Cornishmen, Finns, Austrians, Poles, Italians and Balkans.

The Cornish are the best miners and are usually found as foremen or "mining captains;" the Finns are numerous and have a large tendency toward socialism. Austrians, Poles and some of the Italians make good miners. The old Cornish type of Michigan iron miner,



INSTALLING ELECTRIC CAGE-HOIST WITH WUEST GEARS, NEGAUNEE MINE

MOTOR-GENERATOR SET FOR NEGAUNEE MINE

PRINCIPAL MINING COMPANIES IN IRON RIVER DISTRICT

Company	Operating name	Mines shipping ore	Tons of ore shipped 1912	Mines developing	Orebodies proven
Pickands, Mather & Co.	Verona Mining Co.	Baltic	100,736	Bengal	
		Caspian	306,913		
		Fogarty	84,074		
			491,723 total		
Rogers, Brown Iron Co.	Munro Iron Mining Co.	Hiawatha	220,106	Rogers	
		Chicago	149,619		
			369,725 total		
Oglebay, Norton & Co.	Brule Mining Co.	Chatham	134,079		
		Berkshire	33,419		
			167,498 total		
U. S. Steel Corporation	Oliver Iron Mining Co.	Dober (including Isabella)	177,496	Tully	Blair-Michaels
Corrigan, McKinney & Co.				Baker	
Wickwire Steel Co.	Wickwire Mining Co.	Wickwire	40,417		
		Cortland	17,498		
		Virgil	2,996		
			60,911 total		
McGreevy Steel Co.	Buffalo Iron Mining Co.			Homer	Parell
				Sheridan	
Spring Valley Iron Co.		Zimmerman	189,482		
Huron Iron Mining Co.		Youngs	83,528		
Mineral Mining Co.		James Konwinski	75,702		
Jones & Laughlin				Forbes	
New York State Steel Co.	Davidson Ore Mining Co.	Davidson	126,207		
Ladenburg, Thalmann & Co.	Bates Iron Co.			Bates	
Cleveland-Cliffs Iron Co.					Erickson
Republic Iron & Steel Co.					Sherwood

now recognized as one of the largest orebodies on the Menominee range, with probably 10,000,000 tons of ore. A number of diamond drills are at work in the Crystal Falls district, including those of the Oliver Iron Mining Co., Cleveland-Cliffs Iron Co., Florence Iron Co., and Nevada Land Co., the latter a Longyear subsidiary.

Many additions to the known iron formation are being made, and large stretches of country are recognized as favorable for exploration, which is, however, expensive, due to the thick overburden and irregular geological structure.

MANY NATIONS REPRESENTED IN LABORING CLASS

The iron mines are practically all operated by close corporations, most of which are affiliated with furnace in-

such as is seen to best advantage on the Marquette range, has always been in demand by mining companies elsewhere throughout the country, and a great many of the mining men in the southwest, at Butte, and in Canada were originally from the Lake Superior region.

Because the iron-ore deposits are large, irregular, oxidized and usually wet and soft, mining methods of nearly all kinds have been necessary. The caving and sub-level systems have reached a high state of perfection. The question of equipment and machinery has of late years undergone radical changes, as it is recognized that innovations such as hydro-electric power, steel headframes, underground electrical tramming systems, machine shops, drill sharpeners, concrete shafts, etc., are economical installations where the orebody is of good size.

## Repairing a California Gold Dredge

By L. H. EDDY

Natoma No. 6 dredge, operated in the Natoma field of American River district by the Natomas Consolidated of California, has been overhauled and a new hull constructed. Some important improvements have been added and some of the machinery parts renewed. The boat had been in operation from March, 1908, to May, 1913. This is not a long life for a wooden-hull dredge, but the repairing was begun before that period of deterioration when the boat would be entirely useless. There had been no serious direct damage done to the hull, nor to any of the machinery parts, but a general wearing out of the hull and of some of the machinery. The boat was digging in fairly good order at the time it was taken out of commission to be placed in the dry-dock. The repairs were completed and the dredge resumed digging on July 31, working as smoothly as an old boat and digging with the capacity of a new one.

This dredge is equipped with 86 close-connected 9-cu.ft. buckets and was designed to dig 60 ft. below the water line. It was built by the Western Engineering & Construction Co. for the Folsom Development Co. in 1907-8. The boat was taken over with others of the Folsom Development Co. by the Natomas Consolidated in 1909. It was built and initially operated under the supervision of R. G. Hanford, who directed construction and operation of all except one dredging company (the Eldorado Gold Dredging Co.) in the American River field for 10 years prior to the organization of the Natomas Consolidated. The buckets and machinery are of the Bucyrus type. The hull is 120 ft. long, 46 ft. 7 in. wide, 10 ft. 3 in. deep, and 6 ft. 10 in. draft. The digging ladder is of the plate-girder type. The stacker is of the lattice-girder type, 142 ft. centers, equipped with a 38-in. belt 292 ft. long. The revolving screen is 36 ft. 9½ in. long, 7 ft. diameter. The steel spud is 75 ft. long, 34x54-in. section, and weighs 76,000 lb. The wooden spud is 78 ft. long, 35x54-in. section, and was one of the largest single sticks of timber handled on the Pacific Coast up to that time. The upper tumbler weighs 20,000 lb., the lower tumbler 16,000 lb. The digging ladder weighs 144,000 lb., and the revolving screen 46,410 lb. The total weight of the machinery is 1,275,700 lb., and the total weight of the lumber in the hull and deck and the superstructure is about 1,142,000 lb., or a total weight of about 1100 tons.

The motor equipment has a rated capacity of 790 hp. The average power consumed in full operation is 572 hp., or 428.3 kw. Westinghouse motors are used. Electric power is furnished by the Western States Gas & Electric Co. The old wood in the hull of No. 6 was, at the time of its dismantling, rotten from bow to stern. The side walls were made new the full length of the boat. The well hole was made new two-thirds of the way back from the bow end. The outside walls of the hull are made of 4x12-in. planks; the well hole of 6x12-in. planks. New verticals were placed in both outside walls one-fourth of the length of the boat from the bow end toward the stern; and new verticals in the well hole from the bow end to the well-hole bulkhead. The deck beams to starboard are all new the entire length of the boat. To the port side the deck beams are all new one-third of the length of the boat from the bow end. There are also new deck beams under the tables over the middle well hole.

About one-half of the main deck was made new with 4x6-in. planks. The deck was rotted on both bows, and badly rotted under the main operating winch. All of the bow gantry posts and stern gantry posts were spliced from above the deck down. The auxiliary posts from the main gantry were spliced and new foundations put in. The main truss athwartship at the main gantry beam and the auxiliary braces running over from the main gantry were spliced. Four posts from the main truss chord running through the deck into the hull on each side of the well hole were also spliced. A new foundation was placed under the main operating winch. There were numerous other timbers replaced because of rot.

The new machinery parts installed are: One new shaft at the ladder winch, a new speed shaft on the main drive of the upper tumbler, new bull-wheel wheels and pinions, and new dump-chute at the hopper. The revolving screen was repaired and some of the old plates replaced with new. The gold-saving tables were increased in area to 5000 sq.ft., and there were some repairs on the distributing box.

There were four new features added in the reconstruction: An extensive save-all was installed; the old brackets supporting the deck overhang were displaced by beams; a bucket idler was installed; a set of fire-protection boxes for the main transformer and automatic switches, were especially designed and installed by the electrical department of the Natomas Consolidated.

The dredge was especially built for digging in tightly cemented gravel on Sulkey flat, and was equipped with two monitors which were operated singly or together and supplied from 150-ft. head, centrifugal, direct-connected pumps driven by 150-hp. motors.

In its present condition of reconstruction the dredge is practically as good as a new boat. In fact, close inspection of the repairs and new construction warrant the belief that the present hull and machinery may be continued in operation a longer period than the original boat was operated. But, considering the conditions and available material and machinery for dredge construction in 1907 and in 1913, the old hull had a reasonably long life. There are other wooden hulls that have had longer life than this one by two or three years, but in most cases the digging has not been as tight as in Sulky flat.

The repairing of No. 6 dredge was in charge of W. R. Bean, a construction superintendent, who has had experience in construction and reconstruction of dredges in various parts of the world. The work was done by the Natomas Consolidated in the shops at Natoma, under L. D. Hopfield, general superintendent.

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## Metallic Glucinum

Metallic glucinum has been obtained by Fichter and K. Jablezynski (*Ber.*, p. 1604, 1913), by the electrolysis of a fused mixture of the fluorides of glucinum and sodium (2 mols. : 1 mol.). The product was purified from adherent oxides by centrifuging the fine powder in a mixture of ethylene bromide and alcohol of 1.95 sp.gr. It was then compressed into cylinders and fused. The metal after fusion is of 1.842 sp.gr., melts at 1280° C., and does not volatilize at 1900° C. Its electric conductivity at 20° C. is  $5.41 \times 10^4$  reciprocal microhms per c.c., and its hardness 6—7 on Mohs' scale. Its apparent inertness toward water is due to a film of oxide.

# New Smeltery of United Verde Copper Co.—II

BY RICHARD H. VAIL

*SYNOPSIS*—Some of the details of the old smelting and converting plant of the United Verde company, and some of the ingenious devices in use at the old works. What is being done in the mines to get ready for the new large-scale production, including working in the fire zone.

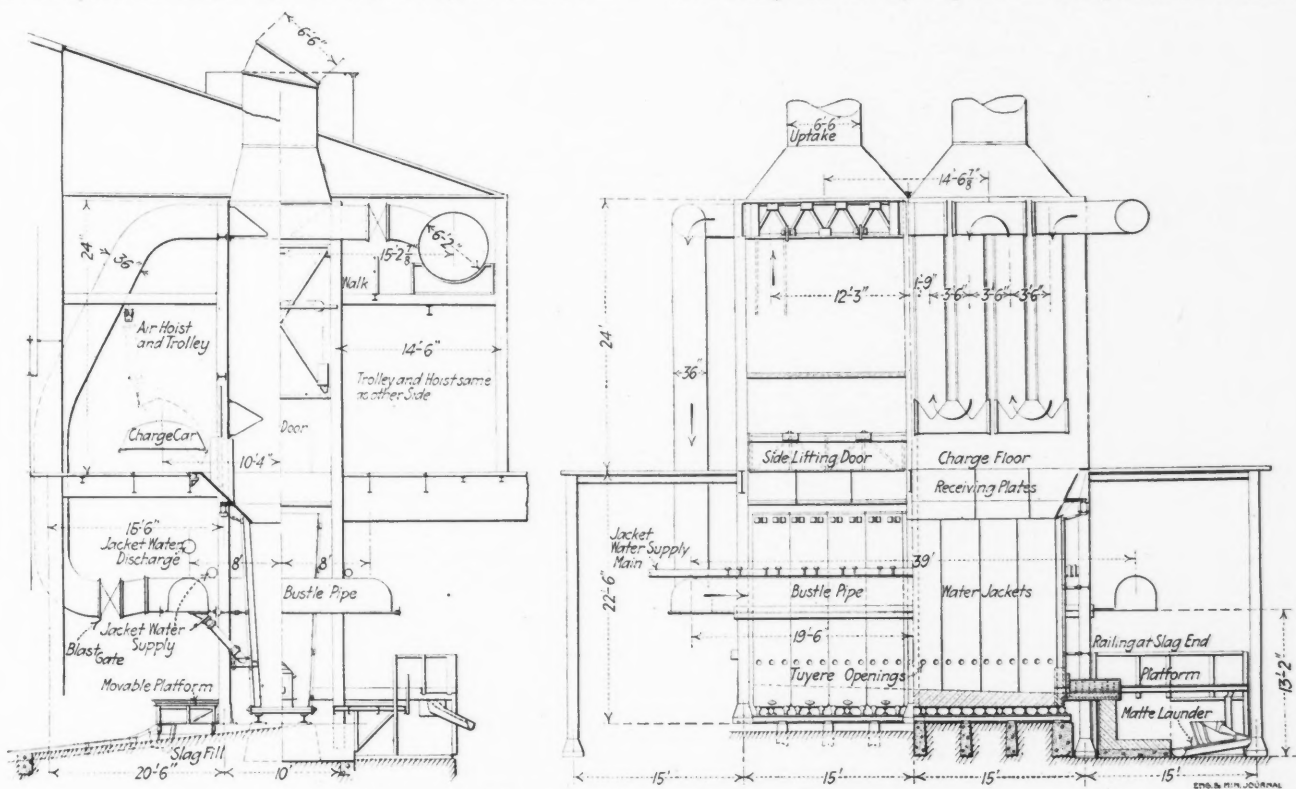


The plant now comprises four blast furnaces and four stands of converters using basic lining. Three of the furnaces are 48x240 in. and one is 56x180 in. Three furnaces are kept in blast, the smelting capacity on this basis is from 1000 to 1200 tons per day. All the furnaces have Giroux hot-blast tops that heat the blast to about 200° F.; the blast is supplied to the furnaces at from 26- to 28-oz. pressure. The larger furnaces have 40 five-inch tuyeres and each receives about 33,000 cu.ft. of air

entering the settler. In making the tap block, a short-headed end of a bar is cast in the upper portion of the block and allowed to project a few inches; when it is desired to change the block, a chain block is attached to this projection, which permits the ready removal of the block. Frozen settler holes are opened by means of an air-hammer drill using a cross bit; little trouble, however, is experienced from this cause.

### LITTLE FLUX REQUIRED

The regular furnace charge consists of: (1) Oxide (surface) ore; (2) heavy iron sulphide; (3) more-siliceous sulphide ore; (4) lime rock. About 40% of the charge is fine—under 1/2 in. No weighing is done, the ores being sufficiently regular in composition to enable



DESIGN OF BLAST FURNACES, UNITED VERDE PLANT

per minute. A rectangular cast-iron spout is lined with magnesite brick, "discards" from basic-converter repairs being largely used; the spout is sufficiently filled with clay to trap the blast eight inches, the clay requiring renewal about twice per shift. The use of water-jacketed spouts was discontinued owing to the smeltery water containing much lime.

The furnaces have cast-iron cruebles, supported on a steel framework. For the large furnaces, 16-ft. circular settlers are used, with a solid-copper tapping block. The tap block has an untapered 2-in. hole, and is held in position by plates or bars clamping against it at the sides and bolting to the settler shell. Between taps a spray of water is kept on the block, the water being run off through an opening in the side of the launder; the top and bottom of the block are cemented to keep water from

the superintendent or furnace foremen to regulate the furnaces. Only a small amount of lime rock is required on the charge, the ores being nearly self-fluxing. It is stated that about 6 1/2 to 7% of Segundo coke is used.

The furnace charges are dumped on inclined plates, except in the case of the coke, which is shoveled in, being wheeled to the charge plates from small service bins beside each furnace. The charges are brought to the furnaces by electric locomotives in Anaconda-type charge cars, holding four tons each, and are tilted by compressed-air cylinders. Twelve-ton charges are used, three cars being dumped to a charge. The gates of the mine-storage bins are all operated by compressed air so that the gathering of the charges is much facilitated at the bins, though the entrance to and exit from the feed floor is restricted to a single track.

A typical weekly slag analysis shows the following composition for the furnace slag: Cu, 0.3%; SiO<sub>2</sub>, 36.9; FeO, 46.8; Al<sub>2</sub>O<sub>3</sub>, 6.3; CaO, 3.2; MgO, 1.2%. The slag is removed in side-dumping pots by electric locomotives. A furnace crew consists of a feeder and two helpers, a furnaceman and helper, and a man to keep the settler slag spout open.

#### FOUR STANDS OF BASIC-LINED CONVERTERS

The matte runs from 21 to 26% copper and is converted in four stands of basic-lined converters, 96x138 in., electrically operated. Since the adoption of basic lining for the converters, experiments with a Knudsen furnace have been abandoned as the basic converters will handle low-grade mattes satisfactorily and, in combination with blast furnaces, with vastly greater expedition. The converters here were first lined with magnesite brick in 1894; at the beginning silica was tamped in over the basic lining, but this was later discontinued, silica being fed as at present. For fluxing the converters, siliceous company and custom ore is used, drying being unnecessary on account of the climatic conditions. The monthly copper production is usually from 3,000,000 to 3,250,000 lb., the yearly output averaging about 36,000,000 pounds.

#### SOME INGENIOUS DEVICES

The old works contains several ingenious devices developed by Supt. Thomas Taylor, an old Swansea smelter of long practical experience in this country. For example, the floor of the furnace building is here practically free of shovelers cleaning up accumulations of old slag "chips" and breaking slag skulls. These men have been dispensed with by dumping all slag skulls from the converter ladles into a large heavily built steel trough or "boat." After dumping the slag skulls on this boat, the craneman then drops an iron ball on the slag shell, breaking same but keeping all the particles within the boat, which is then tilted so that the contents empty directly into the foul-slag skip. This delivers the product to a steel bin convenient to the charge trains. The skip has an automatic-switch arrangement permitting one man to operate the skip by a knife switch, this attendant also looking after any spilling that may take place. Thus in place of two to four shovelers usually seen on the floor of furnace buildings of this size, one man only is employed.

Another interesting device developed by Mr. Taylor is a hook for pulling converter collars, this operation requiring only three to five minutes. The device consists of a heavy cast-iron hook having a steel tool projecting therefrom to "bite" into the converter incrustation. This hook was made at the company's shops; its efficiency is dependent upon the improved bite obtained by the 4-in. square steel tool protruding from the cast-iron hook and upon the use of a sufficient amount of cast iron so that the metal does not become heated and lose its strength. Most of the early forms of converter-collar hooks failed when a particularly obdurate collar was encountered and the hook kept in the converter mouth until it became red hot, straightening out if used further.

#### DIESEL ENGINES USED

At the old works, the company has had in use for several years a number of interesting power units, one being a Diesel-engine installation. This comprises two

three-cylinder, 16x24-in., Busch-Sulzer, Diesel engines, mounted as a double unit and driving by rope transmission a No. 11 Roots blower. This unit has given excellent service and delivers by actual test a brake horsepower on 0.6 lb. of oil; during two years' service the total cost has been about one cent per brake horsepower. Another interesting machine in one of the power houses is a Rateau-Smoot turbo-blower furnishing converter air at 16-lb. pressure; it operates at 2500 r.p.m. and supplies 25,000 cu.ft. of free air per minute.

On account of the company's comparative isolation, it has a complete equipment of mechanical shops, all repairs for the United Verde & Pacific Ry. being made here. The Jerome terminus of this narrow-gage road is being removed from the United Verde mine to a point around the mountain about 2000 ft. to the north. Hereafter on entering the district by this road, the visitor alighting at the station will neither see the town of Jerome nor the United Verde mine, over the workings of which he was formerly landed.

#### PREPARING THE MINE FOR THE NEW SMELTERY

While all the details of preparing the mine for the increased output that will be required by the new smelting plant have not yet been settled, it will be of interest to note in a general way the plans for doubling the mine tonnage. When the new smelting plant is in operation all ore will leave the mine at the 1000-ft. level, where the main haulage adit will be established. The present Hopewell tunnel, an adit 6593 ft. long, connecting with this level, will be extended 1500 ft. into the mine, with a section approximately 9x10 ft. This adit will have a standard-gage track on which the ore will be delivered by electric haulage to storage bins at the mouth of the adit, where a sorting belt will also be established.

When these plans have matured, all ore from the upper levels will be dumped into chutes and gravitate to four storage bins at the 1000-ft. level, while ore from the lower levels will be raised in two 6-ton skips operated by an underground hoist. This hoist, having a capacity of 3000 tons in 16 hr. from 1500 ft., will be stationed at a suitable place on the 1000-ft. level and a three-compartment shaft will be raised from the 1500-ft. level, the lowest working of the mine, to a point near the 900-ft. level, thus giving sufficient height for the establishment of two storage bins and short raises leading to the skip dumping pockets. From the top of the other four storage bins raises will be extended to the levels above but will be slightly offset at each level. The top of the raises will have a grizzly to control the size of the rock fed at that level, and at the bottom a gate will permit the ore to gravitate slowly to the bin below. All this work will be done in carefully selected ground so that difficulties from caving will be avoided. Each of the six mine storage bins will have a capacity of 500 tons or more.

#### LENTICULAR OREBODIES

The orebodies occur in lenticular masses of various sizes and grades. The strike is approximately N.30°W. The dip is about 20° from the vertical but varies in direction in different parts of the mine. The footwall is usually well defined, but the limits of mining in the east wall have to be determined by sampling. All of the ore carries gold and silver in varying proportions. The United Verde mine contains three different types

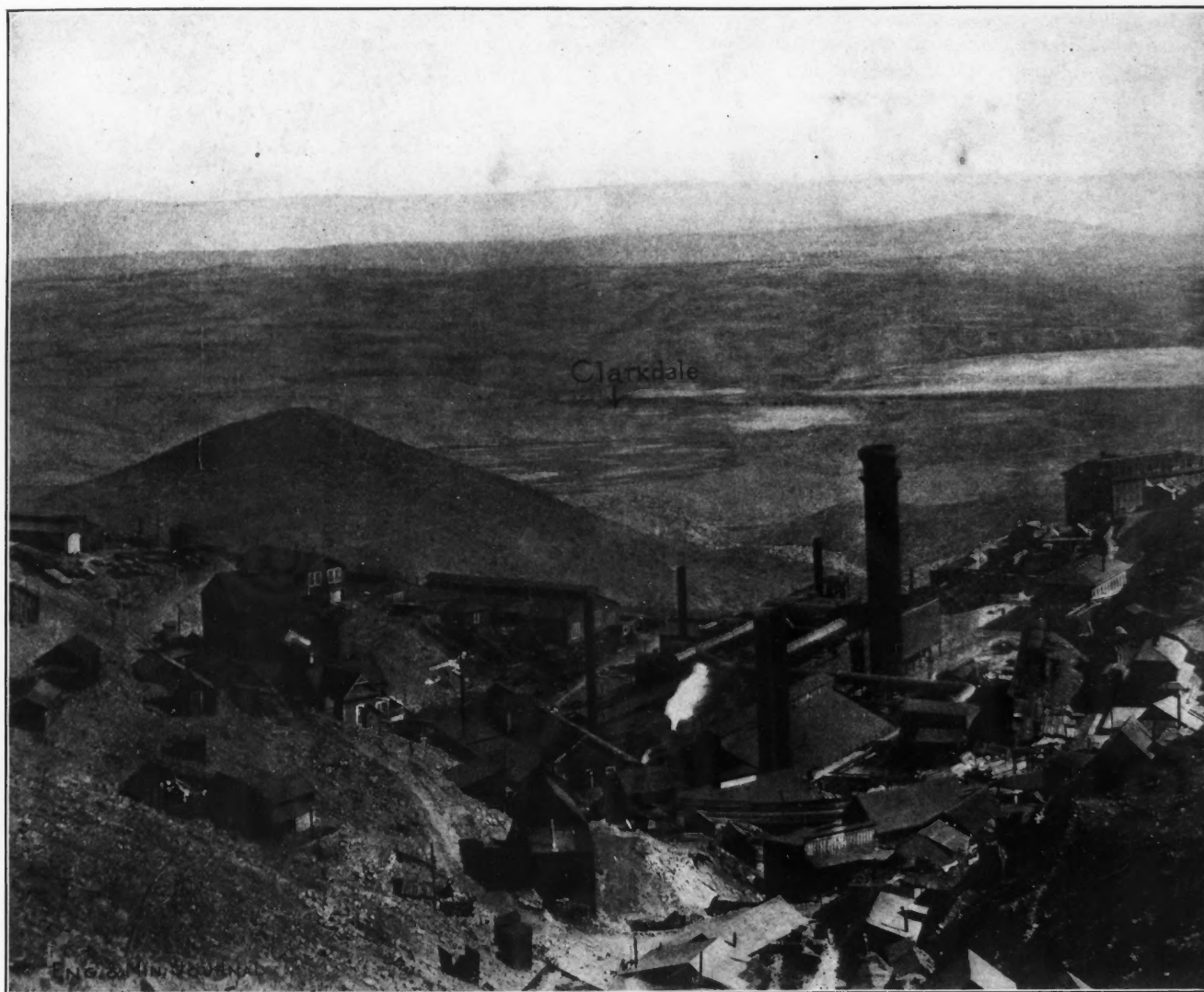


of sulphide orebodies, the most important of which consists of a chalcopryrite ore in pyrite. This pyrite is in the form of a large lens with its commercial orebodies along the line of contact with porphyry and schist and along the water courses and faults. The other sulphide orebodies also contain the copper in the form of chalcopryrite, but in a schist gangue, and in a quartz and quartz-porphry gangue. The capping over the pyrite lens consists of an oxidized ore containing gold and silver, most of the copper having been leached out. The capping of

than the others so that if it should be found desirable the smeltery ore trains might be run directly into this to the mine-storage bins situated along the adit. If timbered, it will have clear dimensions as follows: Height,  $7\frac{1}{2}$  ft.; width at top,  $6\frac{1}{2}$  ft.; width at bottom,  $8\frac{1}{2}$  feet.

#### ORE NOW HOISTED THROUGH TWO SHAFTS

The principal hoisting for the mine is done through No. 3 shaft, which is a vertical three-compartment shaft



LOOKING EAST TOWARD CLARKDALE FROM THE UNITED VERDE MINE AND WORKS

the chalcopryrite ores, occurring in the quartz and quartz-porphry gangue, is a quartz containing gold and silver in commercial quantities. The schist ores, as a rule, extend to the surface.

The mine has numerous openings, the most important of which are No. 3 and No. 4 shafts and three adits at the 300-, 500- and 1000-ft. levels. The latter are at present the main haulage levels, but a new motor-haulage equipment is also being installed on the 1200 level. The 300 and 500 levels were originally driven for "roast grades" as well as for drainage and ventilation, heap roasting having been practised until about five years ago. The 1000-ft. adit was driven since the new reduction works have been in contemplation and was made larger

extending to the 1500-ft. level. It is equipped with a steel headframe and a 20x48-in. Webster, Camp & Lane double-reel engine hoists ore in double-deck cages in two compartments of the shaft; in the third, men and tools are hoisted by a 16x30-in. Webster, Camp & Lane engine. The No. 4 shaft has two compartments and is used for hoisting oxidized ore, and ore from the "fire country." The shaft is now down 500 ft. and will be deepened by raising from the 1000-ft. level. It is a vertical shaft and is not likely to be sunk deeper as the orebodies pitch away from this shaft to the north. No. 4 shaft is equipped with a steel headframe and hoisting is done with double-deck cages by an E. P. Allis 20x48-in. double-reel engine.

No. 1 shaft was abandoned 10 to 15 years ago. No. 2 has been practically discontinued as a hoisting shaft, but is now used above the 500 level for ventilation; below that point, the timbering has been removed and the shaft is utilized as a waste-storage chute, connection being made to gloryholes where waste may be economically mined.

Four classifications are now made of the ore hoisted from the mine. These comprise: (1) An oxidized gold ore, mined partly by open cut and partly by mill holes; (2) "iron ore," a heavy iron-sulphide ore carrying chalcopyrite with about 38% S, 42% Fe, and 5 to 10% SiO<sub>2</sub>; (3) a sulphide ore, but with less iron and more silica than the preceding; (4) a siliceous ore, used for converter flux.

#### SQUARE SETTING SUPERSEDED BY BOTTOM SLICING · WHERE THE GROUND PERMITS

The mine is opened to the 1500-ft. level, but no stoping is being done below the 1200, though the 1350- and 1500-ft. levels are being prepared for extraction. The level intervals vary from 100 to 200 ft., but in the lower levels 150 ft. has now been adopted as the standard level interval. The orebodies were formerly mined by the square-set method exclusively. This method is at present used only in the older portions of the mine—in the fire zone or where ground is unusually heavy. The oxidized ore is mined principally by open cutting and by milling—the milling system will probably be extended when the smelting operations and the United Verde & Pacific Railway station now over the mine have been removed. In the newer workings and in some of the older parts of the mine where the character of the ground will permit, bottom slicing has been introduced by Mine Supt. Robert E. Tally, and about 60% of the ore is now won in this way. This method or the shrinkage system will be used exclusively in the lower levels of the mine. Timber is only used along the drifts and for the manways and raises down which the ore is sent. These raises have timber cribbing and a 4-in. lining made up of 2-in. plank, the inside plank taking the wear and being replaced when worn. These ore chutes are placed at about every fourth set and much of the ore can be shoveled directly into the chutes. As fast as the ore and flooring are removed from the stope, waste is drawn from a chute at the side and the stope filled to within about 7 ft. of the back, when another slice is started. Except for an occasional stull, there is no timbering to be seen in these stopes. It is now the practice to keep all stopes filled with waste as fast as the ore is removed. Waste for filling is obtained from development work and also from surface gloryholes.

#### THE FIRE ZONE

Portions of the mine extending from the 700 level to the surface have been on fire for the last 15 years or more. The fire is not confined to the sulphide zone, but extends into the old timbered stopes of the oxidized ore. The fire, however, is now kept under control by the plenum system, maintaining a slight positive pressure to hold the fire and gases in check and blowing in a sufficient volume of air to make agreeable working conditions.

With the numerous improvements and precautions that have been taken, the "fire stopes" are almost as

comfortable to work in as the other parts of the mine. The mean temperature in the newer portion of the mine is about 70°, while in the "fire stopes" the temperature averages about 78°. This is only possible by the complete system of ventilation and ventilation control that has been established in this part of the mine. The above mentioned temperature is maintained only in the working stopes of the fire country; the openings not in actual use merely receive a volume of air sufficient to prevent fire.

#### VENTILATING A "FIRE STOPE"

In working a fire stope, the first step is to segregate that particular section and to arrange the ventilation control. The system of ventilation consists in bringing the air in at one end of the stope, passing it over the entire working and outletting it at the opposite end, thus making conditions good where required. To control the air satisfactorily doors and curtains are necessary at various places in the stope. In ventilating the fire stopes, it is of prime importance to have an outlet in solid ground so that if a fire should take place the smoke and heat therefrom would not burn the timber of the outlet and cause the caving of that opening. These outlets must be controlled with doors to keep the pressure in balance. If too large a volume of air be sent through the fire district a suction of the gases from different points is caused and a fire results.

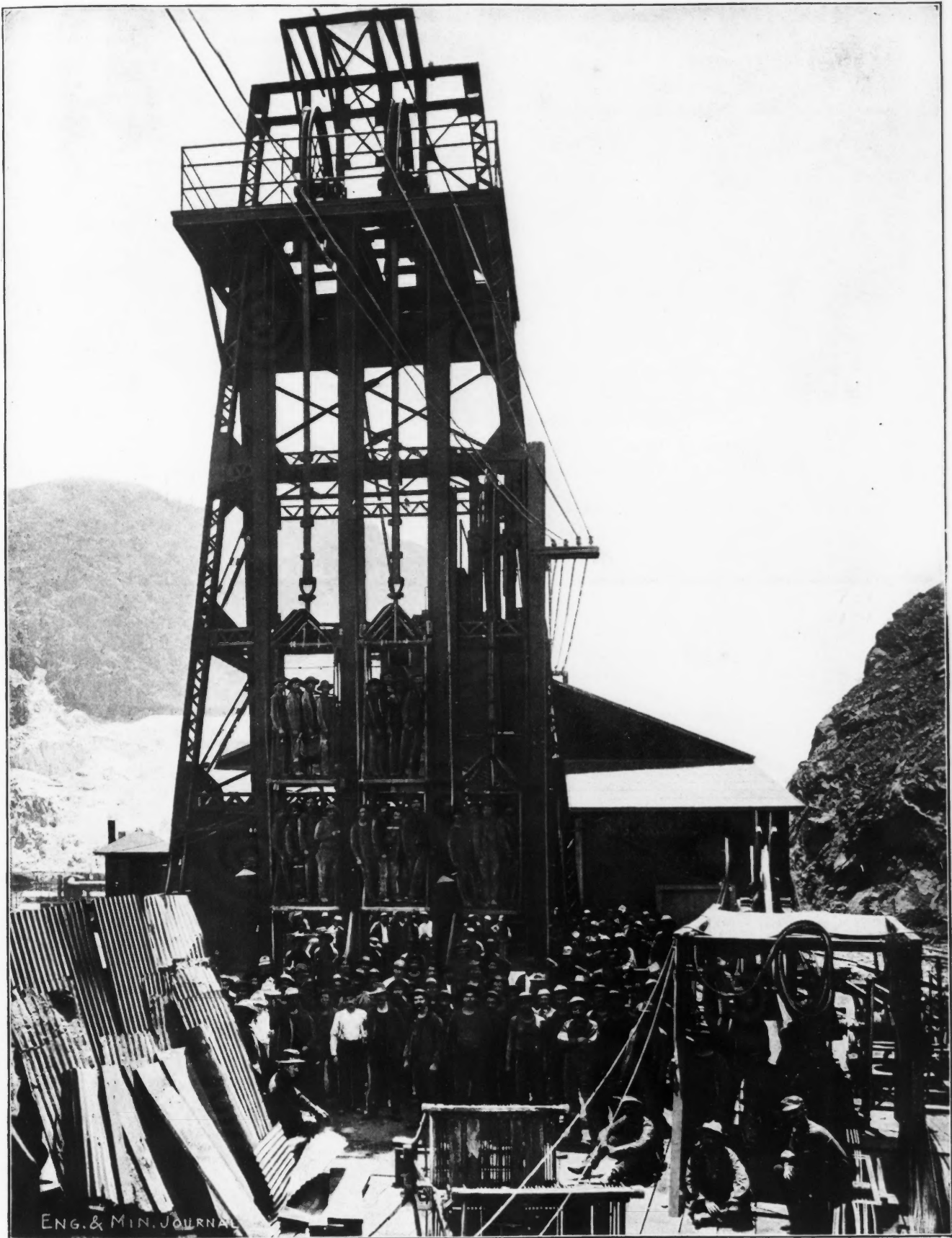
When it is found too expensive to maintain gangways and raises for ventilation of a certain section and the burning of such an area would not interfere with other workings, the openings are sometimes bulkheaded with concrete and a limited amount of air fed, thus permitting it to burn slowly with a single outlet to the surface for the gases.

To prepare for subsequent working of fire areas now bulkheaded off, a lateral is driven outside the orebody and from this lateral, crosscuts to the fire area. The lateral connects with an outlet raise and the exhaust air from other workings is forced through this fire district; after the combustion of any inflammable material, the area is gradually cooled.

#### FIGHTING THE FIRE

An outbreak of fire in this section of the mine is not the serious matter that it is in mines where the ventilation system is not under such close control. Careful inspection is maintained, however, and if a fire is found at any point, a minimum quantity of water or of a chemical solution is forced upon the fire and the ventilation so arranged as to have the least interference from smoke. Little difficulty is experienced in keeping sulphide-ore fires in check, timber fires being the most difficult to extinguish.

In fighting bad fires, Draeger oxygen helmets and Anaconda hoods are used and each shift boss has six men trained in the use of the helmets. The fire signal consists of nine bells, which are indicated in the engine room on the level annunciator. The engineer, on receiving these bells, signals nine flashes of the electric lights through the entire mine three times, and then flashes the signal of the level from which the fire was reported. Blue-and-white enameled signs, posted in the various workings, instruct the carmen and others to notify those working in the stopes and other places where there are



No. 3. HOISTING SHAFT, UNITED VERDE COMPANY

Note flat hoisting cable and multiple-deck cages.

no lights. The regular firemen take charge of the fire fighting. The fire signs specifically remind the miners that "the first consideration will be for the safety of the men, then for the extinguishing of the fire and protection of property."

#### MINE WORK DONE BY CONTRACT, EXCEPT IN THE FIRE ZONE

The fire section of the mine is operated practically as a separate department having its own foremen and shift bosses. Most of the work in this section of the mine is on day's pay. Three shifts are worked, and the painstaking and important nature of the work makes it impractical under present conditions to contract the work, as is done in the rest of the mine. The ground in the fire district is badly broken and heavy. At present it is worked by the overhead square-set system, the filling being kept up to the back. It is the intention after the removal of smelting operations, to work these stopes by a modification of the top-slicing, or underhand, system, which will be more economical.

Two shifts are worked in the mine, except in the fire district, and so far as possible all work is done by the contract system; the basis of pay in development work is for footage, and in stoping, for the cubic feet extracted. The stope contractors pay all regular charges as well as for timbering, filling and tramping. The mining costs are not as high as generally supposed. While expenses in the fire zone are heavy, the total mine operating costs, exclusive of taxes, general expenses, etc., in 1912 were \$3.245 per ton of ore. There are six shift bosses, three on each shift, distributed in the upper, the middle and the lower levels. Some of the ground is extremely hard; water Leyner drills are employed, air being supplied at 100-lb. pressure at the machines; for raising, a wide variety of stoping drills are used. In blasting 40% dynamite is regularly used, though 60% is employed occasionally for blockholing. Maple City and Baldwin acetylene mine lamps have superseded candles to a large extent, though a few candles of Perry and of Standard Oil make are used.

The mine makes comparatively little water, but more water is coming in at depth. An Aldrich quintuplex pump having a capacity of 500 gal. per min. against a head of 1000 ft. is now being installed on the 1500 level to raise the water to the 1000-ft. adit, after which the pump on the 1200-ft. level will be removed. All the mine water is precipitated, the principal precipitating flumes being at the mouth of the 500- and 1000-ft. adits. The water at the 500 level is much richer in copper than at the 1000, the former carrying from 100 to 150 grains per gallon while the heads at the lower flume carry only 11 to 12 grains. The precipitation is efficient, the tails running from a trace to 1.4 grains per gallon. About 2500 lb. of precipitate is recovered per day.

One is impressed by the great care that is being taken at this mine both in the matter of comfortable working conditions and in the safety of the men. Notwithstanding the fire in the mine, there are few mines of this size and depth that are more comfortable, by reason of the exceptional ventilation and the absence of water and dust. Not only in the fire district, but throughout the mine fire doors consisting of concrete frames and iron doors are placed near stations and at other places which it is of importance to protect. A new modern change house

with overhead chain "lockers" of the Continental type is about to be constructed at the mouth of the 50-ft. adit, which will eventually become the main entrance for the miners. Accommodations will be provided in the new change house for 800 miners.

About 1500 men are now on the United Verde payroll in the different departments, which include the mine, smeltery, railroad, mechanical shops, new works and townsite and a number of ranches in the Verde Valley north and south of Clarkdale. The various United Verde operations are under the general management of Charles W. Clark, and Will L. Clark is manager at the property.

### Arizona Mine Taxes

Arizona mine taxes are levied on the basis of an assessed valuation of one-eighth of the gross output plus four times the net profit, plus the value of improvements. The following is the official list of mine valuations as computed for tax-assessment purposes, as furnished by Secretary Jesse L. Bryce, of the Arizona State Tax Commission.

#### VALUATIONS OF ARIZONA MINING CLAIMS, OR GROUPS OF CLAIMS, FOR 1913

COCHISE COUNTY	
Bonanza Belt Copper Co.	\$19,762.17
Calumet & Arizona Mining Co.	5,209,878.48
Superior & Pittsburg Copper Co.	15,837,256.61
Copper Queen Con. Mining Co.	28,505,865.37
Copper Queen Con. Mining Co. (Group B)	23,508.33
Great Western Copper Co.	695,515.31
Leonard Copper Co., Owner—Shannon Copper Co., Lessee	164,261.82
Shattuck Arizona Copper Co.	671,888.77
Tombstone Con. Mines Co., Ltd. (Bankrupt)	113,953.04
Wolverine & Arizona Mining Co.	33,334.35
Total	\$51,275,224.25
GILA COUNTY	
Miami Copper Co.	\$8,992,636.84
Old Dominion Copper M. & S. Co.	3,618,882.37
United Globe Mines Co.	2,122,553.53
Total	\$14,734,072.74
GREENLEE COUNTY	
Arizona Copper Co., Ltd.	\$9,908,711.75
Coronado Mining Co.	3,268.83
Detroit Copper Mining Co. of Arizona	8,197,962.98
Shannon Copper Co.	3,082,778.96
Total	\$21,192,722.52
MARICOPA COUNTY	
Red Rover Copper Co.	\$22,466.99
Total	\$22,466.96
MOHAVE COUNTY	
Frisco Gold Mines Co.	\$105,899.17
Gold Road Mines Co.	419,023.35
Grand Guleh Mining Co.	29,198.54
The Needles M. & S. Co.	31,553.79
Tom Reed Gold Mines Co.	3,032,518.94
Union Basin Mining Co.	449,736.03
Total	\$4,067,929.82
PIMA COUNTY	
Pioneer Smelting Co.	\$56,230.25
Twin Buttes M. & S. Co.	167,873.69
Total	\$224,103.94
PINAL COUNTY	
Magma Copper Co.	\$74,443.24
Ray Con. Copper Co.	8,403,567.04
Total	\$8,478,010.28
SANTA CRUZ COUNTY	
Duquesne Mining & Reduction Co.	\$66,223.45
R. R. Richardson & A. E. Crepin, Owners, N. L. Amster, Operator under Option	127,855.25
Total	\$194,078.70
YAVAPAI COUNTY	
Commercial Mining Co.	\$51,362.56
John Lawler & Ed. Wells	20,063.70
Swastika Development Co.	45,030.92
Yavapai Consolidated Co.—Gold-Silver Copper Co.	21,898.45
United Verde Copper Co.	13,386,188.70
Total	\$13,524,544.33
Total for state	\$113,713,153.57

# Internal Combustion Mine Locomotives

BY JOHN TYSSOWSKI\*

**SYNOPSIS**—Describes features of construction of principal American-made gasoline locomotives. Self-contained transportation units suitable and economic for mining purposes. Gasoline consumption 0.1 gal. per horsepower-hour. Haulage costs in many operations average less than 2c. per ton moved.

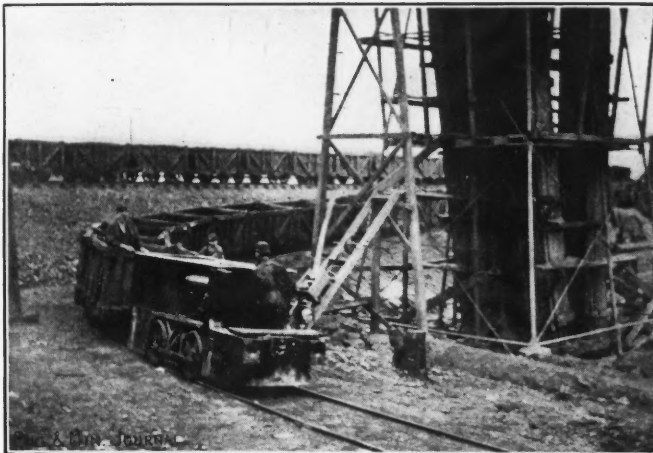
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Development of industrial locomotives, propelled by internal-combustion motors, is in keeping with the continued improvement and universal use of automobiles and trucks. The operating conditions about mines impose the severest possible test upon the haulage equipment, and for this reason it is only now that the gasoline motor has reached a high state of perfection that its use is becoming a factor in solving the problems of mining transportation.

The conditions of mine haulage are peculiar and severe. A large and constant output must be transported

motives in the United States are: Milwaukee Locomotive Manufacturing Co., Milwaukee, Wis.; George D. Whitcomb Co., Rochelle, Ill.; the Baldwin Locomotive Works, Philadelphia, Penn.; Vulcan Iron Works, Wilkes-Barre, Penn., and Jeffrey Manufacturing Co., Columbus, Ohio.

The essential points in the design and construction of the gasoline locomotive for mining purposes are in general as here noted: (1) A heavy, rugged, medium-speed engine, simple in construction, giving maximum power from minimum space and having no exposed flywheels or moving parts; (2) a simple transmission system that can be operated by inexperienced men of ordinary intelligence without danger to fellow workmen or machinery in slipping gears, etc.; (3) forward and reverse motion instantly available, preferably two speeds forward; (4) drive on all four wheels to secure maximum traction; (5) efficient cooling system; (6) safe system



MOVING CARS ON SHARP CURVE



HAULING 6-TON LOAD UP 12½% GRADE

from the workings with ease and dispatch, and the system must be economical, reliable, safe and flexible. This in many instances, in regions where water is scarce or the cost of coal prohibitive. The advantages of the internal-combustion locomotives over those propelled by steam, electricity or compressed air, particularly in isolated regions, are patent. Each gasoline locomotive is a self-contained transportation unit, the radius of operation being only limited by the capacity of the fuel tank. This means the elimination of expensive power-house installations, overhead wiring, and special tracks. Furthermore, no fuel is consumed while the engine is idle. Finally, gasoline locomotives of approved design are practically fool-proof, or at least can be safely operated by men of ordinary intelligence. It is also claimed that they may be used with security in safety-lamp mines, where sparks from steam engines or from electric wires might be dangerous. In any case, however, the selection of the most desirable haulage systems must involve a consideration of the operating requirements and a full knowledge of the particular conditions to be met.

The chief manufacturers of internal-combustion loco-

for handling gasoline. How the various manufacturers meet the requirements, is best brought out by noting the essential points of the several designs.

## SCOTCH YOKE SIDE RODS USED ON BALDWIN LOCOMOTIVES

The Baldwin gasoline locomotive is manufactured under the patents of A. H. Ehle, in four standard sizes, 3½, 5, 7 and 9 tons, respectively. A vertical four-cylinder, four-cycle engine drives a small bevel-pinion construction, which meshes with two large bevel gears on an intermediate countershaft. When the engine flywheel is engaged by a friction clutch, the large bevels run in opposite directions. The large bevels run loose on the intermediate shaft, except when one or the other is engaged by the forward or reverse jaw clutch, located midway between the bevel gears.

Two spur gears of different diameters are keyed fast on the intermediate shaft and constantly meshed with corresponding high- and low-speed gears on the jack or driving shaft, which run loose except when one or the other is engaged by a high- and low-speed jaw clutch, placed centrally on the jackshaft. Two driving cranks,

\*Mining engineer, Home Life Building, Washington, D. C.

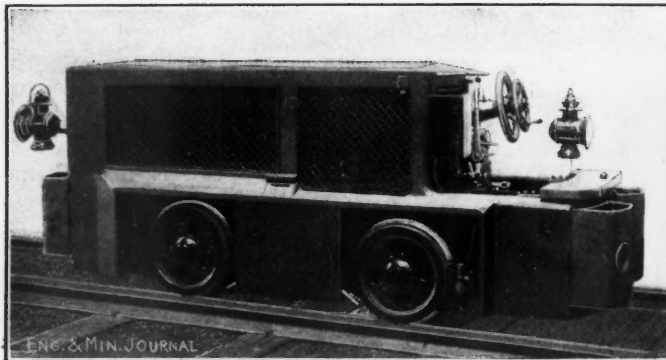
set 90° apart on the jackshaft, are connected with both pairs of driving wheels by Scotch-yoke side rods, one on each side. This method of drive in the Baldwin gasoline locomotive is the logical development of well established steam-locomotive practice and is worthy of especial note as it is positive, yet allows free vertical motion for the driving wheels and complete spring suspension of the entire locomotive. Driving chains are eliminated from this design.

All parts of the Baldwin locomotive are ruggedly constructed of the most suitable material and gears are accurately machined with wide faces. Transmission parts are inclosed in oil-tight cast-steel housing. The main friction clutch is of the multiple-disk type. The main

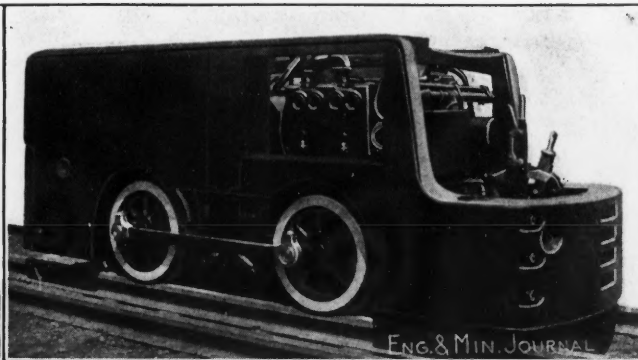
shaft to bevel gear on the jackshaft. Drive from the jackshaft to the axle is through a series of heavy spur gears running in oil.

Exhaust gases enter a large muffler and pass through a series of baffle plates and screens over a body of water. The locomotives are built in five sizes from four to 12 tons in weight.

Two types of gasoline motor-driven locomotives for mine and industrial service are built by the Milwaukee Locomotive Manufacturing Co. Type M, having vertical cylinders, is built in 4½-, 5-, 7- and 9½-ton models. Type E, designed to meet the demand for a locomotive of limited height, differs from Type M in general construction only in having cylinders placed horizontally.



MILWAUKEE LOCOMOTIVE



VULCAN LOCOMOTIVE

frames are of the cast-steel bar type, and in general similar to those used in steam-locomotive practice.

MOTORS RATED ON HIGH-GEAR DRAW-BAR PULL

The performance, rating and dimensions of the four standard sizes of Baldwin gasoline locomotives are given in the accompanying table. The locomotives are rated on the draw-bar pull obtained with high gear, which, under normal conditions, is only about half that developed by the low gear. The average resistance of rolling stock on industrial railways varies from 7 to 60 lb. per ton and averages about 30 lb. This resistance, multiplied by the number of tons to be hauled, gives the draw-bar

pull on level track. It is only built in the 4-ton size. Measured from top of rail to the top of locomotive frame, it is only 34 in. high, which makes it especially adapted for gathering cars from mine rooms of restricted area, and in low workings.

GOVERNOR TO PREVENT RACING OF ENGINE PROVIDED ON MILWAUKEE MOTORS

The Milwaukee mining-type locomotive is a powerful, compact unit of simple design and rugged construction, not only in the side and end sills, but also in the engine, transmission gears, chains and sprockets. All engines are designed to be run at low speeds to insure long life

PERFORMANCE, RATING AND DIMENSIONS OF BALDWIN GASOLINE LOCOMOTIVES

Weight of Locomotive in Pounds	No. of Cylinders	Diameter of Cylinders in Inches	Stroke in Inches	Draw-bar Pull in Pounds with High Gear on Level Track	Low-Gear Speed in Miles per Hour	High-Gear Speed in Miles per Hour	Diameter of Driving wheels in Inches	Wheel-base		Height without Cab or Canopy		Height over Cab or Canopy		Length over Frames		For Over-all Width add to Gauge in Inches	Minimum Gauge in Inches
								Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.		
7,000	25	4	4½	750	5	10	24	3	0	4	2	6	10	9	5	14	30
10,000	35	4	5	900	5	10	26	3	6	4	4	7	0	10	5	16	36
14,000	50	4	6	1300	5	10	30	4	0	5	0	7	6	12	2	18	35
18,000	65	4	6½	1700	5	10	36	4	6	5	6	8	0	13	2	20	36

pull on level track. For each per cent. of grade there is an additional resistance of 20 lb. per ton, and on curves of short radius a further increase. Running under normal or rated load, the gasoline consumption is stated to be about 0.1 gal. per horsepower-hour, and for most requirements the fuel consumption may be figured on an average development of one-half the rated horsepower of the engine throughout the working day.

VULCAN MOTOR HAS HORIZONTAL CYLINDERS

The gasoline locomotive, built by the Vulcan Iron Works, has four horizontal cylinders, placed two on each side of the crank shaft. Transmission is effected through two large multiple-disk clutches on the engine

and low maintenance cost. Furthermore, a governor is provided with each engine, which makes it impossible for the operator to race his engine when running the locomotive by releasing the clutch.

The transmission gears are inclosed and run in oil, speed changes being effected by jaw clutches with all gears in mesh. A lever engages the clutches, thus securing either high- or low-gear speed. The reversing mechanism is of standard design as used in automobile and marine practice.

DEODORIZING TANKS ON MOTORS FOR UNDERGROUND USE

In examining the fuel-supply system, it should be noted that the gasoline tanks are removable and are provided

with stop safety valves, which seal the tanks when the locomotive is not in use. The locomotives intended for underground work are equipped with deodorizing tanks in which the exhaust from the engine is forced through a series of parallel perforated pipes, which pass through the solution in the tanks. Other locomotives are supplied with mufflers. Wheels are provided with removable steel tires, shrunk on cast-iron centers. The axles are made of steel and according to standard construction. Journal boxes of the M. C. B. type are made of open-hearth steel.

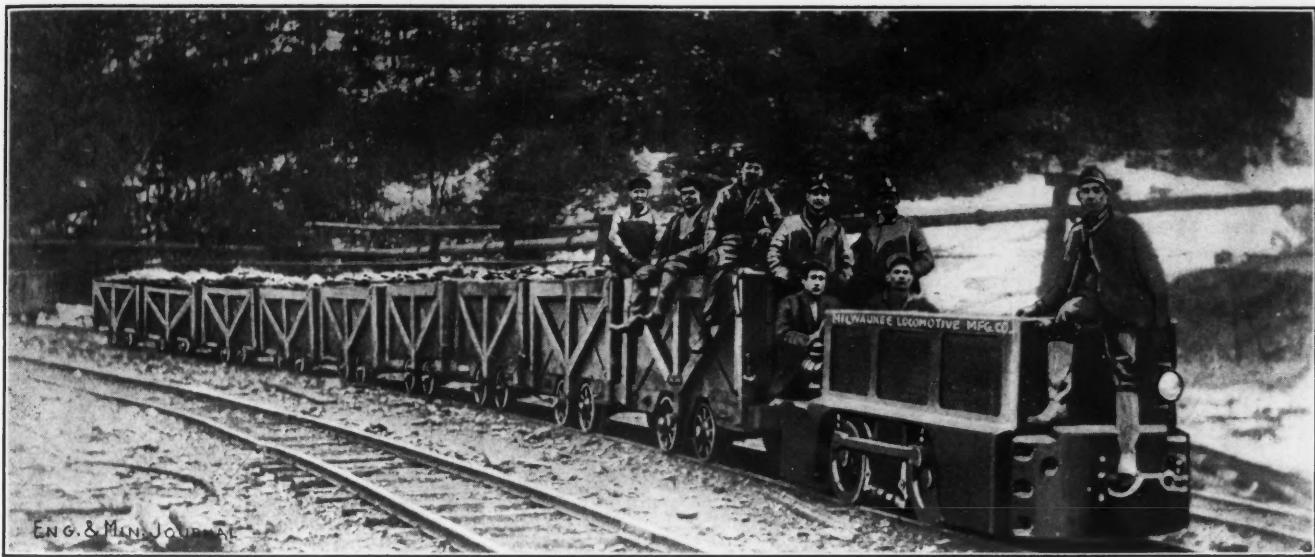
General dimensions of the Type M locomotives are: Gage, 18-56½ in.; length, 113-150 in.; width, 42-70 in.; height, 46-61 in.; wheel base, 29-48 in., and wheels 18-24 in. diameter. These locomotives are built in 4½-ton, 20-hp.; 5-ton, 25-hp.; 7-ton, 35-hp., and 9½-ton, 50-hp.

est. One set of friction clutches controls the forward and reverse motions, while clutches of the jaw type are so provided for shifting from low to high speed. There is an interlocking system between the two sets of clutches, so that the jaw clutches cannot be thrown from one speed to another, except when the forward and reverse clutches are both disengaged. Two straight levers provide control of the clutches, which operate within the transmission case and are kept flooded with oil by an oil-circulating pump.

#### CHAIN DRIVE TO ALL FOUR WHEELS

The drive from the high- and low-speed shaft to the front axle is by means of a double chain drive and from the front axle to the rear axle by a single chain drive. All of the weight of the motor rests on the four wheels.

Two detachable fuel tanks are used on each motor.



GASOLINE LOCOMOTIVE WITH STRING OF CARS

sizes. The Type E, 4-ton, 20-hp. locomotives are built according to the following specifications: Gage, 18-48 in.; length, 134, 130 and 127 in.; width, 46 and 50 in.; height, 34 in.; wheel base, 34 in.; wheel diameter, 16 inches.

It is stated that brake tests indicate the fuel consumption of these locomotives as not to exceed 0.1 gal. gasoline per horsepower hour, or 0.125 gal. when alcohol, naphtha, kerosene or California distillate is used. The average daily fuel consumption is given as 8 to 10 gal. for a 25-hp. and 16 to 20 gal. for a 50-hp. locomotive.

The Geo. D. Whitcomb Co. builds a complete line of gasoline motors, including 10 sizes and 17 models, ranging from 4 to 16 tons in weight. This company, as is true of the others, has made a specialty of coal-mining work, but has also supplied a number of locomotives to metal mines.

#### TWO-SPEED FORWARD AND REVERSE ON WHITCOMB MOTORS

The Whitcomb gasoline mine motor has the approved large and heavy crankshaft, connecting rods, camshafts and sturdy frame. The engines are provided with two speeds forward and reverse, change of direction and speed being effected by clutches instead of shifting gears.

The system of control by clutches is of especial inter-

These are connected to the main frame by large swivel nuts. After the tanks are connected, a valve in the tank is opened, admitting fuel to the engine. Check valves are also provided in the pipe system between each tank and the engine.

#### OPERATING DATA FROM MINES INSTRUCTIVE

Some data relative to the operation of Whitcomb mine motors, although incomplete, will indicate the possibilities of their use. At the mines of the Roane Iron Co., Rockwood, Tenn., cars weighing 1400 lb. empty, 3640 lb. loaded, are hauled 1½ miles over a 1½% grade. An average of ten 20-car trips are made each day. The haulage cost with mules was 4.95c. per ton, as against 2.48c. with the motor. Daily costs of operating motor are given: Motorman, \$2.05; coupler, \$1.65; 13 gal. gasoline at 11c., \$1.43; 2 lb. carbide at 4c., \$0.08; ½ gal. oil, \$0.12; 1 gal. transmission-case oil, \$0.24; total, \$5.57. The Southern Coal & Coke Co., Gatliff, Tenn., with a 5-ton motor, hauls 500 tons, or about 354 cars, in 9 hours. Cars are hauled from sidetracks an average distance of 2500 ft. on grades up to 1½%, against and 3½% in favor of the loads. The daily saving in using motor, as against the use of mules, is figured as \$10.52. Operating costs on motors for one year are given as: Labor (including \$51.34 for tearing down wheels), \$129.60; cost of material used in repairs.

\$120.51; motorman, \$581.20; oil, gas and carbide, \$591.19; total, \$1422.50. In the period under review, 115,484 tons were handled an average distance of 3000 feet.

Maintenance costs on two 6-ton locomotives operated at No. 40 mine of the Pennsylvania Coal & Coke Corporation, at Arcadia, Penn., are given for a period of one year as follows: Repair parts, \$103.47; gasoline and oils, \$1515.10; labor for repairs, \$120; labor overhauling, \$137.76; total, \$1876.33. The two motors handled about 400 tons each a distance of over a mile. The haulage cost per ton is 1.07c. Data from the Shilch mine, of the Southern Coal & Mining Co., show that two 6-ton motors handled an average of 1680 tons per day, the daily run of the two machines being approximately 53 miles. The haulage cost per ton is given: Labor, 1.05c.; lubricating oil, 0.07c.; gasoline, 0.23c.; repairs, 0.07c.; total, 1.42c. Information received from a number of other operations show daily fuel consumption for 5-ton locomotives as about 15 gal. The amount of oil used varies from one to three gallons.

Little information is at hand regarding the construction or operation of the gasoline locomotive manufactured by the Jeffrey Manufacturing Co. This company has, however, recently perfected a 7-ton gasoline locomotive, which is claimed to develop a draw-bar pull of 3500 lb. at three or six miles per hour. The working parts of the locomotive are inclosed and it is designed so as to be easy to operate and maintain.

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### Electric Furnace for Brass Melting

One kilowatt-hour in the form of heat derived from various sources, costs, as stated by G. H. Clamer and Carl Hering in a paper before the American Institute of Metals, as follows:

Electric power at 1c. per horsepower-hour.....	1.34c.
Water power at \$20 per kilowatt-year (Niagara Falls).....	0.228c.
Water power at \$6 per kilowatt-year (Norway).....	0.0670c.
Wood at \$4 per cord.....	0.0525c.
Coke at \$4 per long ton.....	0.0479c.
Crude oil at 2c. per gal.....	0.0457c.
Coal at \$3 per ton.....	0.0292c.

With such differences in original cost, it is evident that electricity must have important advantages to overbalance its cost, in order to be used. These differences are the great stack losses in heating by coal or other fuel. Other objections to fuel heating are: Oxidation, volatilization of the zinc and absorption of sulphur, although these do not begin to make themselves apparent until a fairly high temperature is reached. Preheating with fuel and developing higher temperatures with electric energy will probably be economical procedure when electric energy is expensive.

One of the most important advantages of electricity is that in a good electric furnace nearly all of the energy is converted into useful heat in the metal, while in fuel furnaces by far the greater part, probably about 90%, goes up the chimney as waste. In some electric furnaces nearly all of the heat goes into the metal directly, being generated in it, no matter whether the temperature is high or low; hence the efficiency of this part of the operation is nearly perfect.

The accompanying data deduced from presumably reliable figures for the specific and latent heats, gives the energy required to melt and superheat (about 10%) 100

lb. of the corresponding metal, assuming there are no losses of heat. This should be accepted only as an approximation.

Metal	Kilowatt-hour per 100 lb.
Aluminum.....	13.9
Nickel.....	12.0
Copper.....	8.7
Brass, 80 : 20.....	8.2
Brass, 2 : 1.....	6.9
Bronze.....	6.9
Platinum.....	5.6
Zinc.....	4.1
Tin.....	1.6
Lead.....	0.91

The apparently large discrepancy between aluminum and platinum is due to the fact that the former is a light metal and the latter a heavy one. Although no precision is claimed for these figures, yet they are believed to be sufficiently accurate that any claims made for melting with appreciably less than these theoretical minimums may safely be taken as impossibilities. Such claims have been published to advertise furnaces.

Electric furnaces may be divided into two general classes, arc and resistance. In the former the heat is generated in an electric arc formed in a short space between an electrode, usually of carbon or graphite, and either the metal, the slag, or another electrode. The heat is generated mostly in the arc itself and only partly at the electrode; hence the heating is entirely from the top and must therefore flow down into the liquid metal by conduction, which takes time. It may be said that heat does not like to flow down in liquids. Moreover, the heating is mostly by radiation from the arc or by contact of vapors from the arc, hence the transmission of heat to the metal is limited and cannot be forced. The roof of the hearth is also subjected to these very high temperatures, which will increase the amount spent in furnace repairs. The temperature of the electric arc is extremely high, over 3000° C. or 5432° F., which is excessive and the metals ought not to be directly subjected to it.

In a type of resistance furnace with which the writers have been experimenting, small portions of the liquid metal are heated with great rapidity in cylindrical holes in the bottom of the hearth, and are then immediately ejected with considerable force into the main body of the molten liquid, fresh metal being continuously sucked into these holes. This ejecting is produced by a peculiar recently discovered electromagnetic force called the "pinch effect."

All the heat in the furnace is therefore generated directly in the metal itself, exactly where it is wanted, hence with no initial loss at all, that is, with perfect efficiency. It therefore reaches the metal instantaneously instead of by the slow process of conduction and radiation. The highest temperature is moreover in the liquid metal itself where it is wanted, as distinguished from being above it or in the slag. Heating is done at the bottom of the liquid, which is the more rational place as heated metal always rises. The only losses occur after the heat has been in the metal, being those through the walls and the top surface. There should be no loss of furnace heat through the electrodes, although there will be some loss of electrical energy.

Electric melting may be done in a nonoxidizing atmosphere, or even a reducing atmosphere, if charcoal is added to the furnace. Crucibles and their consequent expense are avoided when the electric furnace is used.



## DETAILS OF PRACTICAL MINING

### Churn Drill Holes for Blasting

The results of using Keystone churn drills in breaking down the face of a quarry are described by F. L. Jorgensen in the *Keystone Drill Magazine*, July, 1913. When the quarry was first begun, the face was so near the river that small blasts were necessary and tripod air- or steam-drills were used to put down 1½-in. holes 12 or 14 ft. deep. Leaving the river, the height of the bank increased 65 ft., and it became necessary to take it in benches. Besides the high cost of labor, due to using two men for each tripod drill, the mucking of the broken material off the benches was a source of great expense. It was therefore decided to install a Keystone well-drill, of a size suitable for 6-in. holes, and equipped with an electric motor.

The motor was connected to the electric conductors at three different poles on which the power line was strung, and the motor wire was rolled on a drum. An ordinary day laborer was taught how to run the machine by a man sent out by the manufacturer. He is paid 9c. per foot drilled and is able to make from 50 to 100% more than when working at his ordinary \$2 per day job. The quarry sharpens the drills for him and since the holes are relatively shallow, lost tools are merely left in the hole and blasted out later. It is stated that the total cost for drilling averages less than 15c. per ft., including repairs, oils, power, drillers, etc. The overburden is stripped and the actual drilling is through about 25% of slate and 75% of hard limestone. No trouble has been experienced with the machine. The actual reduction in the quarry pay roll is between \$12,000 and \$15,000 per year, equivalent to about 8c. per ton on the daily production of 650 tons. About \$2000 is saved in drilling costs and \$10,000 to \$13,000 is saved by avoidance of bench cleaning, track moving, etc. In addition there is the saving due to decreased labor troubles on account of using fewer men. The consumption of explosives remains the same, about 500 lb. of 40% Red Cross dynamite per hole.

With the tripod drills the 1½-in. holes were put down 6 ft. apart, 16 ft. back from the face, and 12 ft. deep; the 6-in. churn-drill holes are put down 20 ft. apart, 20 ft. back in the face, and, at present, 65 ft. deep. The rock is broken as satisfactorily as before. The chance of accident is greatly decreased. It is found that the machine has to work only one-half the time, so that the drilling is all done during the summer months.

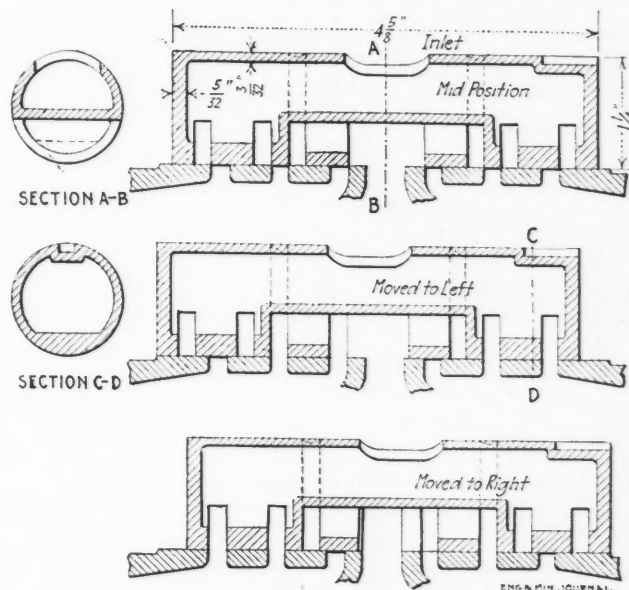
Albert B. Blakeslee, in the same publication, gives some examples of the application of churn drills to cut blasting. In one case on the Catskill aqueduct a cut about 12 ft. deep and 20 ft. wide, consisting of 6 ft. of earth on 6 ft. of slaty rock, was broken with two holes across the face 12 ft. apart. A 6-in. iron pipe was used to case the 6 ft. of soil and about 35 ft. of drilling was done in an 8-hr. shift. The ability of the churn drill to operate in the soil, thus saving stripping expense, is a noteworthy point. In another case, a rock cut for a

three-track railroad averaging 40 ft. in depth and running up to 60 ft. for a maximum, was broken with five or six churn-drill holes abreast across the face, extending about 5 ft. below grade. From 1000 to 2000 yd. of rock were broken at a blast. For this work in slaty formation one box of dynamite was used in the bottom of the wet holes and from one to two cans of black powder when the holes were dry. In the deepest, 65-ft. holes, 50 lb. of dynamite and 50 lb. of black powder were employed. The machines averaged 45 ft. per 10-hr. day.

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### Hollow, Double-Ported Spool Valve

In the hammers of the drill-sharpening machines at the Champion and Trimountain mines, Michigan, a special spool valve is used, illustrated in the accompanying drawing. The valve is hollow, being machined from a



UNUSUAL ROCK DRILL SPOOL VALVE

casting till its walls are  $\frac{3}{32}$  in. thick. The ports are double, so that a maximum port opening is obtained with the relatively small travel of  $\frac{11}{32}$  in. There is a large wearing surface and after 30 months of continuous use tool marks are still visible. The interior of the valve serves to collect scale and dirt that might otherwise clog the ports. The ratio of the area of the inlet opening on the top to the area of the ports is such that the valve is practically balanced, but is kept to its seat by a slight pressure. The circumferential groove in the exterior of the valve is for the purpose of taking care of any air leakage, and of conveying it to the exhaust, thus preventing the danger of its being imprisoned in the chest beyond the valve. In order to prevent the valves from breaking by striking the ends of the valve chest, the plugs in the latter are capped with a resilient material which acts as a cushion. This buffer lasts from six to

30 months. In about three years' run on the sharpeners, only one valve out of 10 had to be replaced. They have also been used for 20 months with good results on hammer and piston drills underground. The valve is patented by Ernest Penberthy, of Painesdale, Michigan.

## Shaking Chute Motors

BY E. M. WESTON\*

The simple shaking chute is still largely used underground on the Rand. Motors driven by compressed air, however, are now being introduced to obviate manual

chored in the stope. The air enters between the pistons when the toggle levers are straight; the outward movement bends the levers and pulls the chute upward; the advancing piston opens an exhaust port which throws over the valve and allows the chute to fall back. The toggles give a mechanical advantage with a small motor which will, when working a chute 240 ft. long, on perfectly flat ground, transport ore at a rate of 12 to 14 ft. per minute.

The chute is trapezoidal in section, 20 in. at the top, 16 in. at the bottom, and 5 in. high, made of steel plate. The sections are fastened by flanges connected, as shown at *D*, by a patent bolt and wedge which are self-tighten-

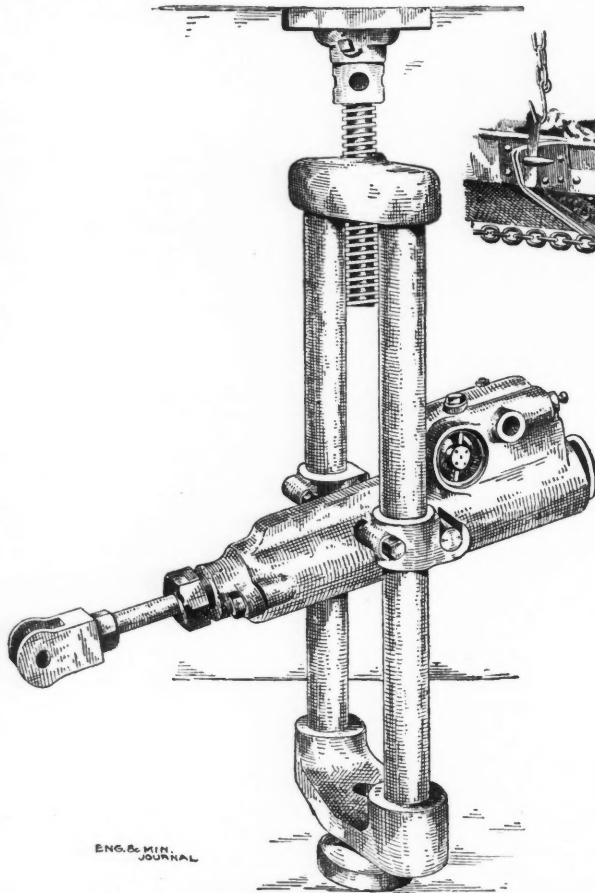


FIG. 1. MOTOR OF ROCK-DRILL TYPE

labor in reciprocating the chutes. Fig. 1 shows one manufactured by Head, Wrightson & Co., Ltd. It is similar to a rock drill, and is light and simple. The machine runs 35 to 40 strokes per min. and has a low air consumption; the length of stroke can be varied up to 18 in. on a slope of 15° to 20°.

The Flottmann Engineering Co. has introduced an entirely new style of shaking conveyor for underground work. This has its air-actuated motor, as shown in Fig. 2, beneath the chute and attached anywhere in its length. The chute may be swung on chains, as shown, or in low stopes may be pushed up and down over special shoes on the foot wall. The motor consists of a cylinder *A* open at both ends, in which move two pistons which act by means of two connecting rods on two pairs of toggle levers *B*. One end of each toggle is fixed to the chute and the other to a slide plate *C* attached to a chain an-

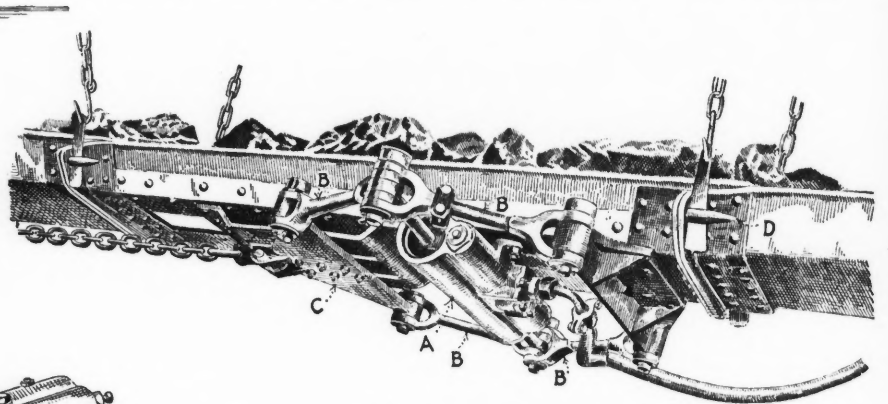


FIG. 2. TOGGLE-ACTION MOTOR

ing and can be taken apart with a hammer. The motor costs about \$250 and the chute about \$2.50 per running foot.

## Track Work in a Minnesota Mine

BY E. W. R. BUTCHER\*

The accompanying illustrations show some details of underground track work and one of the motor turns used in the mines of the Republic Iron & Steel Co., on the Mesabi range. Figs. 1 and 2 show a right and left turn. As a rule, the location of a turn is determined before the drift is driven and the necessary sets are put in place to make the turn when required. Props are placed under the ends of the two caps resting on the opening set until that turn is to be driven. A 9-ft. by 6-in. post is used under both of these caps and on either side the posts of each set are shortened six inches until an 8-ft. post is reached, which is the length of post used in motor drifts. When the opening set is placed in position, a point is placed on the set and on the 10-ft. by 9-in. set and with this line the rest of the turn is put in with the aid of the other dimensions shown.

Figs. 3, 4 and 5 show the track layout and frog details used in connection with a 25-ft. radius timber turn. The frog is designed so that it can be used for either a right or a left turn. The stub switch has given better satisfaction for underground work than the point switch. The latter caused considerable trouble by dirt getting between the wing rail and track, which interfered with its closing. Figs. 6 to 10, inclusive, showing details of switch stand and tie-rod connections, are self-explanatory.

\*Union Club, Johannesburg, South Africa.

\*Gilbert, Minn.

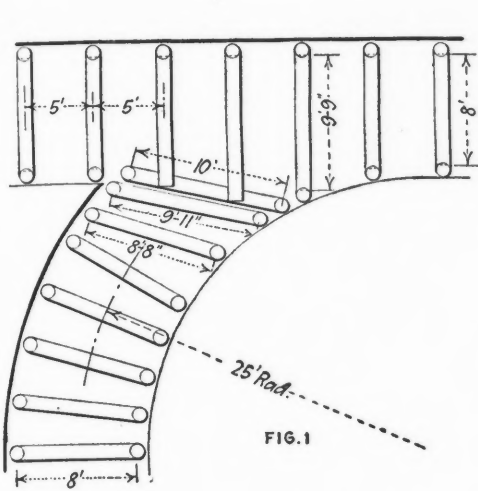


FIG. 1

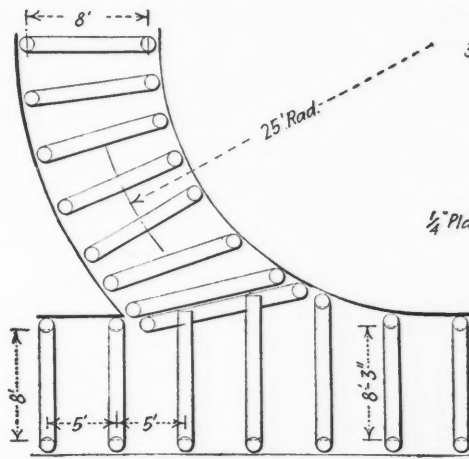


FIG. 2

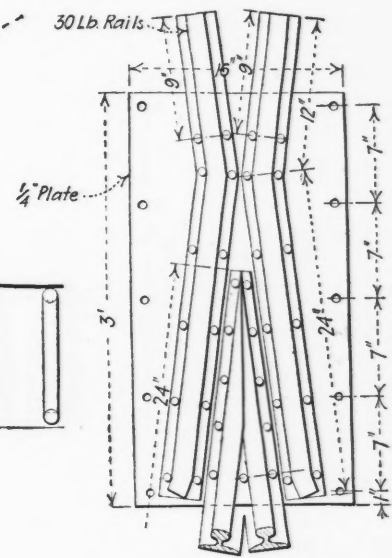


FIG. 3  
RIGHT OR LEFT FROG

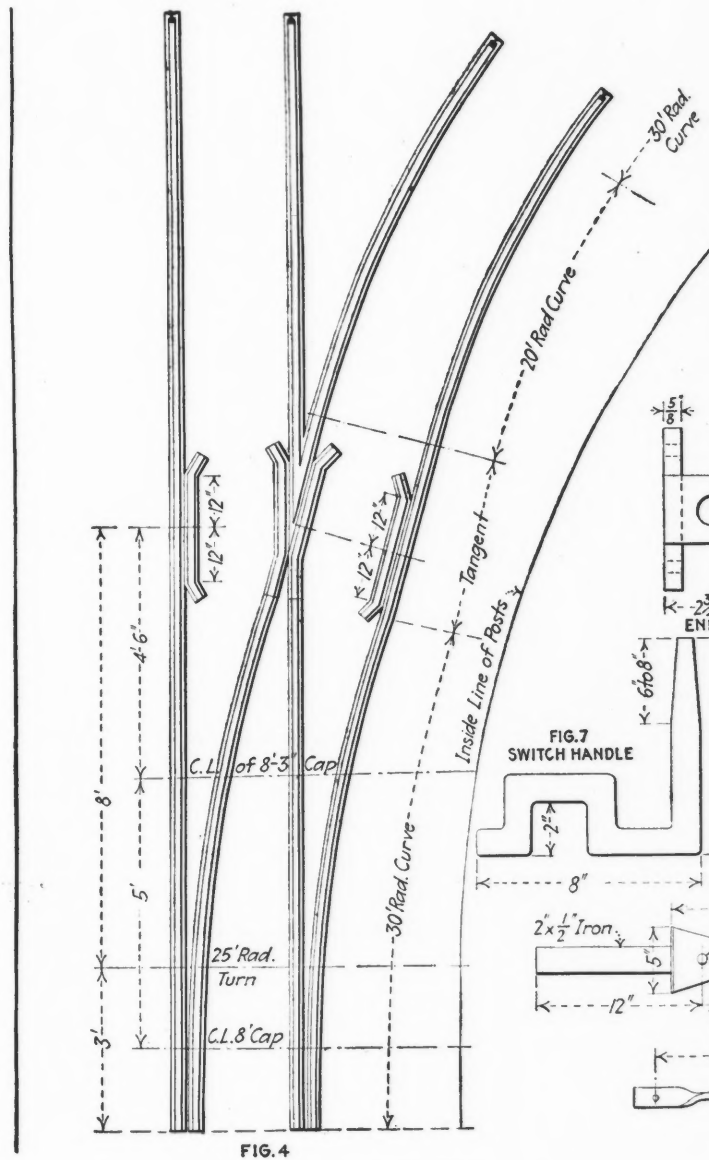


FIG. 4

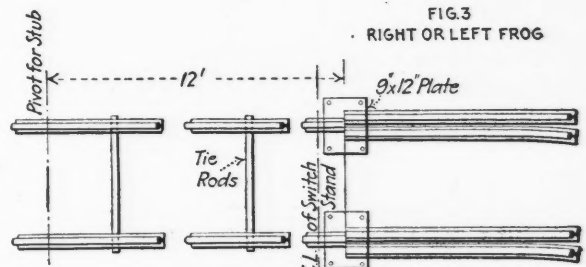


FIG. 5-STUB SWITCH

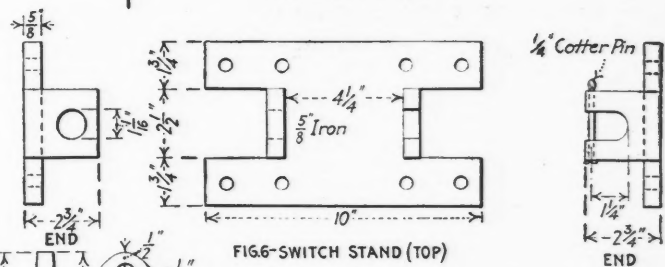


FIG. 6-SWITCH STAND (TOP)

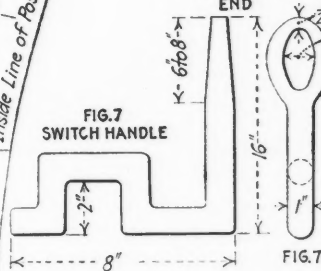


FIG. 7  
SWITCH HANDLE

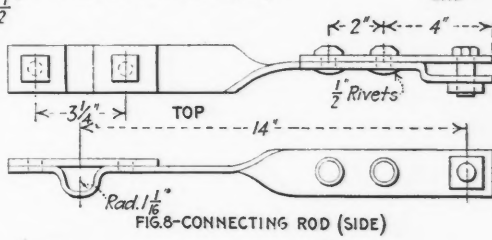


FIG. 8-CONNECTING ROD (SIDE)

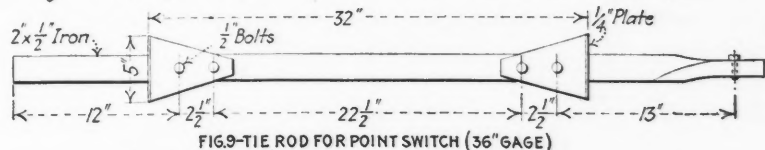


FIG. 9-TIE ROD FOR POINT SWITCH (36" GAGE)

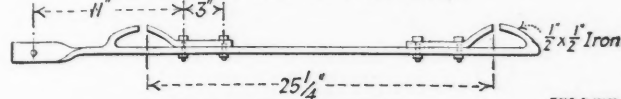


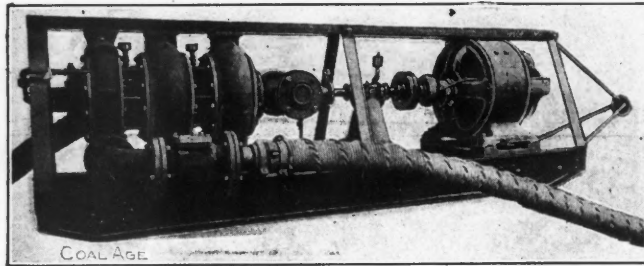
FIG. 10-TIE ROD FOR STUB SWITCH (24" GAGE)

ENGR. MIN. JOURNAL

TURNOUTS USED IN A MESABI RANGE MINE

## Centrifugal Pump Set for Incline

The accompanying illustration shows a centrifugal pump and motor arranged for operating in an inclined working up to 45° from the horizontal. The pump is a 4-in., three-phase centrifugal machine operating on heads up to 250 ft. The motor has a capacity of 30 hp. The two machines are held together in the steel framework with an eye at one end capable of attachment to the cable



PUMP AND MOTOR ON SKID FRAME

or rope for lowering or hoisting the set. The lower part of the framework acts as a skid. Special arrangements are made for oiling, the lubricating device for the lower bearing, visible between the coupling and the bearing housing, being fed with oil from the upper end.

The pump was made by the United Iron Works, of San Francisco, and the motor is a Westinghouse machine. Several sets of this type are said to be in successful operation.

✽

## Electricity Underground in Relation to Safety

The principal dangers resulting from the use of electricity in mines are shocks, fires and explosions. Bare trolley wires are the most fruitful source of electrical shock underground. There is in addition the danger due to the charging of parts of equipment not supposed to carry current. For instance, if a locomotive loses its round by oversanding, while motor or lights are in operation, the frame becomes charged to the potential of the trolley wire, and is capable of giving a severe shock. Danger from fires arises from defective installation, careless upkeep, or injuries due to falls of rock. Short-circuits, the blowing of open fuses, and incandescent lamps are capable of igniting adjacent combustible material. Explosions in metal mines are limited to the ignition of explosives, which may be due to contact with electrical circuits during handling and transporting, or may be incidental to detonation by electricity. Explosives may be brought into contact with an electric circuit, so as to carry the current and be exploded without any spark or outside ignition. For instance, explosives in metallic packages on cars drawn by electric motors may accidentally form part of a circuit, due to inefficient grounding, and be thus detonated. Accidents from electric firing are due either to the accidental discharge of detonators in the vicinity of explosives, or to the premature ignition of charged holes. Premature ignition

is more likely if the detonating circuit includes an earth return; because if the other side of the circuit be accidentally grounded, differences of potential existing in the earth may be sufficient to cause detonation.

Electrical installations underground are made in the face of adverse conditions, such as dampness, dust, acid water and possible falls of rock. Cramped quarters and the lack of sufficient illumination operate to prevent suitable installations and also are likely to cause accidental contact later. The temporary nature of mining operations renders it inadvisable to expend a great amount on the first cost of an installation.

It is probable that the dangers of electricity would be more largely guarded against if electrical accidents did not form so small a percentage of the accidents underground. For instance, during the first eight months of 1912 only 3% of the men killed in and about United States coal mines, met their death from electrical causes. The electrical danger is thus overshadowed by those sources of accident which are responsible for a larger loss of life.

### ADVISABLE PRECAUTIONS

Abundant electrical light underground should be provided in dangerous places, thus making the current protect itself. Electricity is dangerous only when it breaks from its proper channels, and it should be kept in these channels by proper insulation. The argument that insulated coverings are a source of danger, because they deteriorate and appear efficient when actually not so, is not universally applicable, as it depends upon the kind of insulation and the conditions of service. When bare conductors are necessary, they should be protected and well supported mechanically. Proper selection, in the first place, and suitable protection for electrical machinery, result both in increased safety and decreased cost of upkeep. Inflammable material should not be allowed where it may be affected by heat or fire due to electrical causes. The dead metallic parts of electrical apparatus should be grounded, and the bodies of men working upon such apparatus properly insulated. Efficient inspection by the mine electrician is the best means of obtaining a high factor of safety.

It should be noted that electricity, while a source of danger underground, can also be made use of to promote safety. Its most important application in such respects is the telephone. In addition there is the portable electric lamp and the firing of shots by electrical means. The use of storage-battery locomotives is advantageous from the point of safety, and has also other advantages, such as the elimination of cable-reel locomotives; the possibility of satisfactory voltage regulation with less copper, and the elimination of trolley wires and rail bondings.

[To the list of means by which electricity may be utilized to promote safety, we can add the use of electric light as affording better illumination and protection against many sources of accident underground, and the use of electric signals, both flash and bell, as promoting more efficient hoisting. The advantages of electric firing in blasting operations, from the point of view of safety, are still questionable. It seems as if the storage-battery electric locomotive would eventually offer so many advantages, in spite of increased cost of operation, as to become the accepted type.—EDITOR.]

Note—Abstract of a paper by H. H. Clark, presented at the Pittsburgh meeting of the American Institute of Electrical Engineers, Apr. 18-19, 1913.

## DETAILS OF METALLURGICAL PRACTICE

### Iron Castings to Resist Corrosion

Some practical rules laid down by the American Foundrymen's Association for obtaining castings resistant to corrosion are as follows (*Canadian Eng.*, July 17, 1913): (1) Use white iron if possible (white irons are especially useful where any acidity is to be encountered); (2) if not practicable to use white-iron castings, chill those surfaces which are to be in contact with corrosive conditions; (3) if grey iron must be used, get dense, close-grained castings through the use of steel scrap or otherwise; (4) avoid oxidized metal; use pig irons of good quality, together with good cupola practice. If possible, use deoxidizing agents, such as titanium or vanadium; (5) keep the sulphur as low as possible.

❖

### Weighing Light Material on Ordinary Scales

It is often desirable to weigh with some accuracy articles or material of light weight when only the ordinary platform scale, used for heavy weights, is at hand. In such cases a method devised by W. B. Crowe (*Met. and Chem. Eng.*, June, 1913) is available and is a great convenience.

The method is based on the relation of the beam weight to the platform weight. In many ordinary scales this proportion is 1:100, 1 lb. on the beam balancing 100 lb. on the platform, and this proportion can be used as an example, any other proportion being treatable in the same way. To find the weight of an article too light for weighing in the usual way on the platform, it is attached instead of the beam weight and a convenient material placed on the platform until equilibrium is reached. Then the article is detached and the material is weighed as usual. The weight of the material used, divided by 100, equals the weight of the light article hung for the beam weight. With scales accurate to 0.25 lb. on the platform, the sensibility to objects on the beam would be 0.04 oz., or 1.133 grams. This ingenious expedient should be of use in metallurgical plants, as by it small amounts of precipitate, bullion, flux, etc., can be weighed with sufficient accuracy for ordinary purposes.

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### Safety Rules—Boiler Erection\*

(1) Boilers shall be numbered at both ends and on top. The number should be placed so as to designate the boiler to which it applies and should be large enough to be plainly seen. Numbers perforated in steel plates are recommended.

(2) Seamless tubing should be used in all boilers.

(3) Guards should be provided for water-gage glasses.

(4) Relief (safety pop) valves of ample capacity should be provided and piped through the roof or out-

side of building. No stop valve should be placed between the safety valve and the boiler.

(5) To relieve pressure in the blowoff line, for each battery of eight boilers, or fraction thereof, a vertical pipe should be connected with the blowoff line and run up through the roof, or outside of building.

(6) Two stop valves should be provided in the blowoff connection.

(7) Two valves should be placed in feed-water connections of each boiler, one on each side of check valve.

(8) To avoid untrue indication of water level, and possibly an explosion, no valves should be placed in connections between water columns and boilers, or if valves are so placed they should be locked open when not in use.

(9) One of the two valves in the connection between the boiler and the steam header should be a nonreturn valve.

(10) Suitable drains should be provided where necessary on all steam lines.

(11) Walks on platforms, equipped with suitable stairs or ladders, should be provided, wherever possible, on boilers, steam header and other places where men have to work.

(12) When boilers are not equipped with nonreturn valves, a guard provided with a lock, designed to lock the steam-valve wheel, should be provided and used when men are working in the boilers, to prevent anyone from turning in steam.

(13) Plank covering over exhaust pits should be frequently inspected and kept in good repair.

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### Care of Rubber Belts

Methods of handling and splicing rubber belts are of interest to the mining industry. Some valuable kinks are given by Robert Moore in *Power*, July 22, 1913. Care must be taken in putting on a new belt to stretch it as much as possible before splicing.

In placing a 36-in. eight-ply rubber belt on pulleys 50 ft. between centers, allow  $\frac{1}{8}$  in. per running foot for stretch. Put on the clamps, as shown in Fig. 2, and draw them tight. Do not be afraid of breaking the belt, as even a five-ply 10-in. belt will stand a strain of 10,000 lb. and larger ones in proportion; the pulley will collapse first. Take all the tension the bearings will stand, then turn the shaft slowly back and forth until the clamps touch the pulleys; taking up the slack as it is recovered from the upper half. Neglect to do this will stretch only one-half of the belt, and is apt to cause it to run out of line.

After thoroughly stretching, proceed with the lap, which in this case should be 45 in. long. It should always point in the direction of travel over the pulley, as in Fig. 1. Thus any slip of the pulley will have a tendency to smooth down the lap. Place a board on the clamp rods on which to rest the splice and draw a line squarely

\*From Inland Steel Co.'s book of rules.

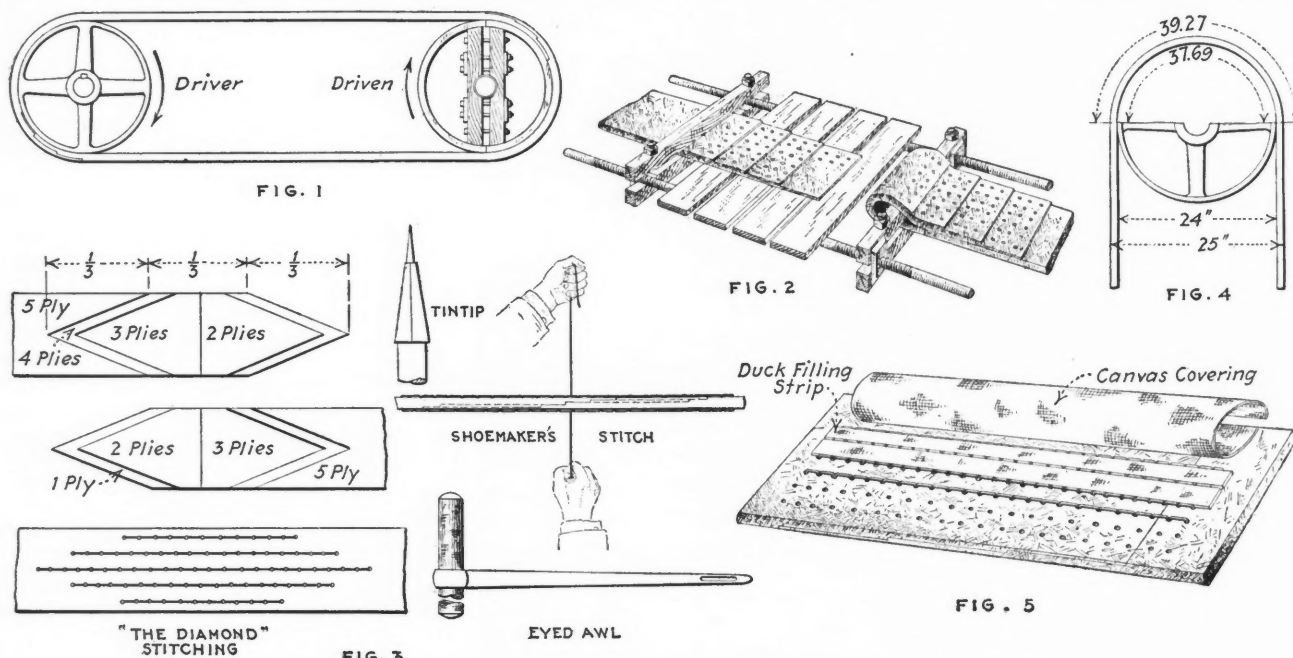
across the belt 47 in. from the end. Lay the section off in 2-in. squares, starting 1 in. from the outer edge, as in Fig. 2. Punch  $\frac{1}{4}$ -in. holes where the lines cross. As there are eight plies, there will be three cuts or scarfs. Cut a line just the depth of two plies at the 45-in. line and peel off these two thicknesses; do the same at the 15- and 30-in. lines.

Scarf the other end, place the halves together and punch holes in the lower half, inserting the punch in the holes in the upper half. By so doing, the holes will be directly opposite each other. Cleanse the surfaces with naphtha and apply a liberal coating of the best rubber cement. Allow this to dry until it will not stick to the fingers, then place the laps together, starting at the edge and rolling the upper one out as it is being cemented, so that air may not be entrapped between the surfaces. Sew the outer edges, using the shoemaker's stitch, shown in Fig. 3. Alternately roll and pound the joint

splice." Belts on grindstones, saws, rattlers, etc., where shippers are used will wear on the corners where they are butted, and the outer lace hole will soon tear away, if this form of joint is not used. Shippers for belts of this kind should always be of the roller type. In joining canvas belts always stagger the holes and do not have them less than  $1\frac{1}{4}$  in. apart as the fabric is apt to crack across in cold weather.

Another form of joint, known as the "diamond splice," is used on generators with small pulleys, as there is less shock when the lap passes over the pulley, eliminating all flicker of the lamps. The diamond splice is made in much the same manner as the lap splice except that the scarfs are divided into three equal parts and cut as shown in Fig. 3; it is not so strong a joint as the lap splice, but is more flexible and, therefore, better adapted to small pulleys.

Increasing the diameter of the pulley lengthens the life



STITCHINGS, SPLICES AND TOOLS USED IN REPAIRING RUBBER BELTS

until it is perfectly flat, then sew each row of holes as was done with the outer ones.

Cut filling strips of duck the width of the space between lacings (most belt companies sell this duck all prepared) and give them several coats of rubber cement on each side. Clean the face of the belt between the lacings with naphtha and give it a liberal coating of cement. When each surface is dry, that is, when the finger placed lightly to the surface will not adhere, place the strips between the lacing and roll them down. Now take a piece of duck, the width of the splice, but 4 in. longer, and cement this to the face of the belt, covering the joint. By so doing the lacings are protected and, except for the occasional renewal of the outer covering the joint is as durable as the belt itself. The manner of this is shown in Fig. 5.

For sewing, tip the laces like a shoe string by bending a V-shaped piece of tin around the ends, as illustrated, or use the eyed awl shown, to pull the lace through.

Belts smaller than 10 in. are butted and have a butt strap on the outer surface; this is known as the "back

of a belt, as the stretch and compression are less per foot. As the thickness of the belt increases, so should the diameter of the pulley increase. For instance, the arc of a belt  $\frac{1}{4}$  in. thick on a 2-ft. pulley would measure 37.69 in. next the pulley face, while the outer edge would measure 38.48 in., a total distortion of 0.79 in. If the belt were  $\frac{1}{2}$  in. thick the outer edge would measure 39.27 in., giving a total distortion of 1.58, just twice as much (Fig. 4). When more power is wanted and it is not advisable to increase the size of the pulley, better results are obtained by widening the belt and pulley face than by increasing the thickness of the belt. To increase the diameter of the pulley to 48 in. would give a total distortion of 1.58 in. when using a  $\frac{1}{2}$ -in. belt, but as the arc would measure 75.4 in., the distortion for each lineal foot would be halved.

Animal fats and grease should never be used on rubber belts. Boiled linseed oil is good; also equal parts of black lead, red lead, French yellow, litharge and enough japan dryer to make it dry quickly. This will give a smooth polished surface.

## COMPANY REPORTS

### Isle Royale Copper Co.

In the year ended Dec. 31, 1912, the Isle Royale Copper Co., Houghton, Mich., produced 8,186,957 lb. of refined copper for 11.89c. per lb. The costs given in the report were as shown in the following table:

	Per ton ore stamped	Per lb. copper produced, c.
Running expenses at mine and mill.....	\$1.54	10.01
Construction.....	0.034	0.20
No. 7 shaft.....	0.023	0.15
Explorations.....	0.008	0.05
Unwatering Huron mine.....	0.013	0.08
Smelting, freight, commissions, eastern office, etc.....	0.202	1.31
Interest paid.....	0.015	0.09
<b>Totals.....</b>	<b>\$1.835</b>	<b>11.89</b>

The total tonnage treated was 531,105, secured from 622,485 tons of rock hoisted, 14.7% of which was discarded as waste of sorting. The average yield was 15.4 lb. of refined copper per ton. The ratio of concentration at the mill was about 93 tons of ore into one ton of mineral which yielded 71.43% of fine copper. There was a net increase of \$419,767 in assets during the year, making a net balance of \$557,743 on hand at Dec. 31, 1912. Development work consisted of 941 ft. of shaft sinking and 19,106 ft. of drifting, drift-stopping and cross-cutting. Total depth of shafts at Dec. 31 follows: No. 2 shaft, 3162 ft. from surface; No. 4, 1939.5 ft.; No. 5, 1206 ft.; No. 6, 1553.5 ft. and shaft A, 972 ft. below surface.

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### Nevada Consolidated

The Nevada Consolidated Copper Co., of Ely, Nev., submits a statement for the second quarter of the fiscal year ended June 30, 1913. The production of copper was 17,928,746 lb., divided thus: April, 5,650,608 lb.; May, 5,933,275 lb., and June, 6,344,863 lb. The Nevada Consolidated ore milled during the quarter was 762,880 tons, of which 91% was supplied from the pits and 9% from the underground workings of the Veteran mine.

The grade of ore treated averaged 1.76%, which is in excess of the mine average of 1.67%. This is due to the fact that 70% of the steam-shovel tonnage came from the Eureka pit, where it was possible to mine the higher-grade ore. During the balance of the year the pit tonnage will be almost equally divided between the Eureka and Liberty-Hecla areas. The cost per pound of copper produced, including Steptoe plant, depreciation and all charges except ore extinguishment, was 8.95c. The overburden stripped during the quarter was 701,807 cu.yd., costing \$290,484, of which \$126,824 was charged to operating costs, balance deferred.

The net credit to undivided profits for the quarter was \$98,422, after payment of the fifteenth quarterly dividend, and the further payment to the Steptoe company of \$131,653 for depreciation, and the charging off of \$126,916 for ore extinguishment. This net credit was reduced because the unsold excess copper was written down to 14c. per lb. from the 15c. at which it had been car-

ried. The normal tonnage on hand unsold is carried at 12 $\frac{1}{4}$ c. per lb. as heretofore.

The copper on hand and in transit (sold and unsold) at the end of the quarter was 22,439,864 lb., inventoried at 13.313c. per lb. The earnings for the quarter are computed on the basis of 14.392c. per lb.

The Nevada Northern Railway Co. during the quarter, purchased from the Nevada Consolidated, for the investment of its sinking fund, \$500,000 par value of railway bonds held by the copper company, and the investment account is correspondingly decreased. In connection with the contract between the Steptoe Valley S. & M. Co. and the Giroux Consolidated Mines Co., for the treatment of the ores of the latter, which contract was made for a 5-year period, subject to cancellation on one year's notice, the Giroux company has given notice of the cancellation of the contract, which will become effective early in June, 1914.

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### Copper Range Consolidated

The Copper Range Consolidated Co., Houghton, Mich., operates the Baltic, Champion, Tri-Mountain and the Atlantic mines, also the Copper Range Railroad. The combined production of the operating companies for 1912 was as follows: 37,584,647 lb. of refined copper sold at an average price of 16.16c. per lb. The net income from all sources was \$1,692,566 out of which \$788,429 in dividends were paid, not including \$625,810, being one-half of profit from operating the Champion mine which is paid over to the St. Mary's Mineral Land Co. All income amounted to \$6,228,364 and disbursements, \$5,324,225, leaving a surplus of \$904,138 for the year. The income was derived from the following sources: Sale of copper, \$6,071,095; interest receipts, \$13,107; net earnings from Copper Range Railroad, \$103,775; and net receipts from Atlantic Mining Co., \$40,385. The disbursements were made up of: Net mining, smelting, freight, marketing, etc., after deducting sundry credits, \$3,661,837; Houghton County taxes, \$164,157; taxes and general expenses of Copper Range Consolidated Co., \$83,992; St. Mary's Mineral Land Co.'s share of Champion mine earnings, \$625,810; and dividends, \$788,429. The total dividends of the company amount to \$12,902,249 at Dec. 31, 1912.

There were 1,784,402 tons stamped in 1912, an increase of 5330 tons over 1911. The average yield was 21.07 lb. of fine copper per ton, an increase of 0.20 lb. per ton over the previous year. The profit from the Atlantic Mining Co. came mostly from operating its stamp mill on custom work. A statement of available quick assets shows \$1,094,262 on hand in the form of cash, copper and first-mortgage bonds of the Copper Range R.R. Co., after deducting all liabilities.

At the Baltic considerable progress has been made in carrying out modifications of the underground practice. Over 1700 ft. of raises were put up to facilitate the

handling of filling material and to permit the use of old fill over again. All the old stopes near the surface have been filled as far as practicable with the waste rock hoisted and now underground dumps have been installed so that waste from new openings can be used where wanted. The same system is being carried out at the

PRODUCTION AND COSTS  
BAL TIC, CHAMPION AND TRIMOUNTAIN MINES, 1912

	Baltic Mine	Champion Mine	Trimountain Mine
Tons rock hoisted.....	705,281	804,994	403,089
Rock sorted out.....	7.49%	4.9%	9%
Tons rock stamped.....	652,433	765,306	366,663
Pounds mineral produced.....	22,444,810	28,490,500	12,417,575
Ratio of ore to mineral.....	58.2 to 1	54 to 1	59 to 1
Pounds refined copper.....	13,373,961	17,225,508	6,980,713
Yield in copper per ton.....	20.50 lb.	22.508 lb.	19.04 lb.
Costs			
Mining:			
Superintendence and labor.....	\$1.0500	\$0.900	\$0.961
Rock house expense.....	0.0535	0.057	0.053
Hoisting expense.....	0.0755	0.052	0.088
Power drills.....	0.0770	0.081	0.143
Powder and supplies.....	0.1660	0.153	0.175
Total mine costs.....	\$1.422	\$1.24	\$1.42
Surface:			
Superintendence and labor.....	0.072	0.0595	0.158
Supplies.....	0.112	0.0591	0.077
Teaming.....	.....	0.0018	.....
Insurance.....	0.004	0.0045	0.006
Electric lights and telephones.....	.....	0.0012	.....
Purchasing department.....	0.005	0.0058	0.006
Library maintenance.....	.....	0.0023	.....
Legal and general.....	0.012	0.0068	0.004
Transporting ore to mill.....	0.136	0.1370	0.112
Stamping.....	0.214	0.2020	0.187
Total mine and surface.....	\$1.98	\$1.72	\$1.97
Less rents received.....	0.01	0.02	0.02
Net mine and surface cost.....	\$1.97	\$1.70	\$1.95
Taxes.....	0.097	0.081	0.11
Smelting, refining, selling, etc.....	0.197	0.219	0.19
Total all charges.....	\$2.264	\$2.000	\$2.25
Less interest received.....	0.007	0.004	0.01
Net cost per ton.....	\$2.25	\$1.996	\$2.24
Development Work Performed			
Feet sinking.....	464	429	263
Feet drifting.....	10,547	9,343	7,746
Feet crosscutting.....	679	1,209	401
Feet raises.....	1,172	1,740	1,770
Total development work, feet.....	13,462	12,721	10,180
Net cost per lb. copper.....	10.94c.	8.88c.	11.73c.

other mines. Improved drilling machines have also been introduced at the mines. The old mill of the Atlantic company is to be closed down after cleaning up all accumulations of copper rock and mineral.

## Kyshtim Corporation

The Kyshtim Corporation, London, owns and operates the Kyshtim Mining Works Co., Kyshtim, Perm, Russia. The lands of this corporation approximate 2198 square miles of 1,406,700 acres, including iron mines, copper mines and gold deposits. However, a large part of this acreage consists of forests and grazing lands. The company smelts copper and iron ores, operates an iron works and a copper refinery. Its annual report for year ended Jan. 13, 1913, shows an operating profit of \$2,276,428 before allowing for depreciation and income tax. After allowing for these charges apparently only \$1,440,000 of the profit, as stated, was applicable to dividends. In addition to these costs, the expenses of the Kyshtim Corporation have to be deducted before its net profit can be obtained. The affairs of the concern are complicated and it is hard to check its costs. The figures reported are so extremely low that it is doubtful if they represent all charges.

The production amounted to 7547 tons of electrolytic copper, 11,298 tons of sheet iron, 4763 tons of cast iron and 15 tons of art castings. The company also sold 19,577 tons of barren pyrites for sulphuric-acid manufac-

ture. The output of copper in 1913 is expected to reach 8000 tons. The three mines operated produced 347,850 long tons of ore, averaging 3% Cu, 0.10 oz. Au, and 1.1 oz. Ag, of which 18% came from development work. Of the total tonnage mined, the Koniukhoff mine produced 39.6%; the Smirnoff, 43.7% and the Tissoff, 16.7%. The Tissoff also produced 21,000 tons of barren pyrites. The development work consisted of 4653 ft. of drifts, 2843 ft. of raises, 1397 ft. of crosscuts and 458 ft. of main shafts; total, 9351 ft., or about one foot for every 37 tons of ore mined.

At the Karabash smeltery, the heightening of the main stack was carried on to 75 ft., making the total height from the foundation 200 ft. and from feed floor 250 ft. There is now under construction a 19x100-ft. regenerative gas-fired reverberatory furnace with suitable calciners. This has been made imperative by the accumulation of fine ore, which is being produced in quantities considerably in excess of the capacity of the Martin furnaces at Kyshtim. It is hoped this plant will be in operation by the middle of 1914, at which time it is estimated that the stock of fines will total 100,000 tons. The reverberatory furnaces at Kyshtim continued normal operations, producing 5 to 6% matte for treatment at Karabash; it has been decided, however, to install three mechanical calciners to allow the production of higher-grade matte. Further tank-house capacity is being provided at the refinery, for the present only four series of tanks will be added, bringing the annual capacity up to 10,000 tons. The ultimate capacity will be 13,000 tons of copper per annum. At the Karabash works during 797 furnace days the following charge was run:

	Long tons in charge	Per Cent. Copper	Oz. Gold per ton	Oz. Silver per ton
Ore to blast furnaces.....	300,100	3	0.10	1.1
Kyshtim matte.....	21,599	5.52	0.23	2.1
Kyshtim cleanings.....	759	3	0.12	1.2
Refinery slags.....	568	28	0.84	7.9
Flue dust recovered.....	27,007	3.08	0.12	1.2
Quartz charged.....	77,090	.....	.....	.....
Limestone.....	29,603	.....	.....	.....
Gross blister copper.....	7,180.7	98.98	3.79	33.1
Less copper in refinery slag already reported as blister.....	150.7	.....	.....	.....
Net blister produced.....	7,030	.....	.....	.....

The recovery on metals charged to blast furnaces was: 75.2% copper, 81% gold, 69.80% silver.

The summarized operating costs are given in the following table:

	Per ton Ore	Per L. ton Blister
Mining.....	\$1.46	\$66.39
Smelting.....	1.94	86.46
Transporting.....	0.13	5.10
Overhead expense.....	0.19	8.15
Total.....	\$3.72	\$166.10

As compared with 1911, the cost per ton is slightly higher, but per ton of blister, lower, due to the high ratio of recovery in smelting. The refinery cost, when reduced to terms of blister, was about \$19.70, and transport from Karabash to the refinery about \$1.22, bringing the total cost to approximately \$187 per long ton of blister. Reducing this to terms of refined copper delivered on the railway, it becomes 8.5c. per lb.; by crediting the copper with the gold and silver produced the cost appears to be 4.8c. per lb. of refined copper.

The ore reserves at May 1, 1913, were estimated to contain 2,069,000 long tons of ore, assured by development and bore holes, and 496,000 long tons, estimated in extensions beyond limits of exploration, total of both estimates, 2,565,000 tons. There is an additional reserve of 380,000 tons, blocked out and available for immediate stoping.



# Historical Note on Copper Smelting

*SYNOPSIS*—A review of copper smelting from its appearance among the Egyptians, about 6500 years ago, to the time of Agricola.

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The discoverer of the reduction of copper by fusion, and his method, like the discoverer of tin and iron, will never be known, because he lived long before humanity began to make records of its discoveries and doings. Moreover, as different races passed independently and at different times through the so called "Bronze Age," there may have been several independent discoverers. Upon the metallurgy of prehistoric man we have some evidence in the many "founders' hoards" or "smelters' hoards" of the Bronze Age which have been found, and they indicate a simple shallow pit in the ground into which the ore was placed, underlaid with charcoal. Rude round copper cakes eight to 10 in. in diameter resulted from the cooling of the metal in the bottom of the pit.

Analyses of such Bronze Age copper by Professor Gowland and others show a small percentage of sulphur, and this is possible only by smelting oxidized ores. Copper objects appear in the prehistoric remains in Egypt, are common throughout the first three dynasties, and bronze articles have been found as early as the IV Dynasty (from 3800 to 4700 B.C., according to the authority adopted). The question of the origin of this bronze, whether from ores containing copper and tin or by alloying the two metals, is one of wide difference of opinion, and we further discuss the question under "Tin." It is also interesting to note that the crucible is the emblem of copper in the hieroglyphics. The earliest source of Egyptian copper was probably the Sinai Peninsula, where there are reliefs as early as Seneferu (about 3700 B.C.), indicating that he worked the copper mines. Various other evidences exist of active copper mining prior to 2500 B.C. (Petrie, "Researches in Sinai," London, 1906, p. 51, etc.). The finding of crucibles here would indicate some form of refining. Our knowledge of Egyptian copper metallurgy is limited to deductions from their products, to a few pictures of crude furnaces and bellows, and to the minor remains on the Sinai Peninsula; none of the pictures were, so far as we are aware, prior to 2300 B.C., but they indicate a considerable advance over the crude hearth, for they depict small furnaces with forced draught—first a blow-pipe, and in the XVIII Dynasty (about 1500 B.C.) the bellows appear. Many copper articles have been found scattered over the Eastern Mediterranean and Asia Minor of pre-Mycenæan Age, some probably as early as 3000 B.C.

This metal is mentioned in the "Tribute of Yü" in the Shoo King (2500 B.C.?) ; but even less is known of early Chinese metallurgy than of the Egyptian. The remains of Mycenæan, Phœnician, Babylonian, and Assyrian civilizations, stretching over the period from 1800 to 500 B.C., have yielded endless copper and bronze objects, the former of considerable purity, and the latter a fairly constant proportion of from 10% to 14% tin. The copper supply of the pre-Roman world seems to have

come largely, first from Sinai, and later from Cyprus, and from the latter comes our word copper, by way of the Romans shortening *aes cyprium* (Cyprian copper) to *cuprum*. Research in this island shows that it produced copper from 3000 B.C., and largely because of its copper it passed successively under the domination of the Egyptians, Assyrians, Phœnicians, Greeks, Persians, and Romans. The bronze objects found in Cyprus show 2% to 10% of tin, although tin does not, so far as modern research goes, occur on that island. There can be no doubt that the Greeks obtained their metallurgy from the Egyptians, either direct or second-hand—possibly through Mycenæ or Phœnicia. Their metallurgical gods and the tradition of Cadmus indicate this much.

By way of literary evidences, the lines from Homer (*Iliad*, xviii) have interest as being the first preserved description in any language of a metallurgical works, when Thetis came to Hephæstus to secure a shield for Achilles. Even if we place the siege of Troy at any of the various dates from 1350 to 1100 B.C., it does not follow that the epic received its final form for many centuries later, probably 900-800 B.C.; and the experience of the race in metallurgy at a much later period than Troy may have been drawn upon to fill in details. It is possible to fill a volume with indirect allusion to metallurgical facts and to the origins of the art, from Greek mythology, from Greek poetry, from the works of the grammarians, and from the Bible. But they are of no more technical value than the metaphors from our own tongue.

Greek literature in general is singularly lacking in metallurgical description of technical value, and it is not until Dioscorides (1st Century A.D.) that anything of much importance can be adduced. Aristotle, however, does make an interesting reference to what may be brass, and there can be no doubt that if we had the lost work of Aristotle's successor, Theophrastus (372-288 B.C.), on metals, we should be in possession of the first adequate work on metallurgy. As it is, we find the green and blue copper minerals from Cyprus mentioned in his "Stones." And this is the first mention of any particular copper ore. He also mentions (ix) pyrites "which melt," but whether it was a copper variety cannot be determined. Theophrastus further describes the making of verdigris.

From Dioscorides we get a good deal of light on copper treatment, but as his objective was to describe medicinal preparations, the information is very indirect. He states (v, 100) that "pyrites is a stone from which copper is made." He mentions *chalcitis* (copper sulphide), while his *misys*, *sory*, *melantheria*, *caeruleum*, and *chrysocolla* were all oxidation copper or iron minerals. In giving a method of securing *pompholyx* (zinc oxide), "the soot flies up when the copper refiners sprinkle powdered *cadmia* over the molten metal," he indirectly gives us the first definite indication of making brass, and further gives some details as to the furnaces there employed, which embraced bellows and dust chambers. In describing the making of flowers of copper he states that in refining copper, when the "molten metal flows through its tube into a receptacle, the workmen pour cold water

Note—This is one of the historical notes from Hoovers' translation of Book IX of Agricola. That on lead smelting is given in the "Journal" of July 26, 1913.

on it, the copper spits and throws off the flowers." He gives the first description of vitriol, and describes the pieces as "shaped like dice which stick together in bunches like grapes." Altogether, from Dioscorides we learn for the first time of copper made from sulphide ores, and of the recovery of zinc oxides from furnace fumes; and he gives us the first certain description of making brass, and finally the first notice of blue vitriol.

The next author we have who gives any technical detail of copper work is Pliny (23-79 A.D.), and while his statements carry us a little further than Dioscorides, they are not so complete as the same number of words could have afforded had he ever had practical contact with the subject, and one is driven to the conclusion that he was not himself much of a metallurgist. Pliny indicates that copper ores were obtained from veins by underground mining. He gives the same minerals as Dioscorides, but is a good deal confused over *chrysocola* and *chalcitis*. He gives no description of the shapes of furnaces, but frequently mentions the bellows, and speaks of the *cadmia* and *pompholyx* which adhered to the walls and arches of the furnaces. He has nothing to say as to whether fluxes are used or not. As to fuel, he says (xxxiii, 30) that "for smelting copper and iron, pine wood is the best." The following (xxxiv, 20) is of the greatest interest on the subject:

Cyprian copper is known as *coronarium* and *regulare*; both are ductile. . . . In other mines are made that known as *regulare* and *caldarium*. These differ, because the *caldarium* is only melted, and is brittle to the hammer; whereas the *regulare* is malleable or ductile. All Cyprian copper is this latter kind. But in other mines with care the difference can be eliminated from *caldarium*, the impurities being carefully purged away by smelting with fire, it is made into *regulare*. Among the remaining kinds of copper the best is that of Campania, which is most esteemed for vessels and utensils. This kind is made in several ways. At Capua it is melted with wood, not with charcoal, after which it is sprinkled with water and washed through an oak sieve. After it is melted a number of times Spanish *plumbum argentum* (probably pewter) is added to it in proportion of 10 lb. of the lead to 100 lb. of copper, and thereby it is made pliable and assumes that pleasing color which in other kinds of copper is effected by oil and the sun. In many parts of the Italian provinces they make a similar kind of metal; but there they add 8 lb. of lead, and it is remelted over charcoal because of the scarcity of wood. Very different is the method carried on in Gaul, particularly where the ore is smelted between red hot stones, for this burns the metal and renders it black and brittle. Moreover, it is remelted only a single time, whereas the oftener this operation is repeated the better the quality becomes. It is well to remark that all copper fuses best when the weather is intensely cold.

The red-hot stones in Gaul were probably as much figments of imagination as was the assumption of one commentator that they were a reverberatory furnace. Apart from the above, Pliny says nothing very direct on refining copper. It is obvious that more than one melting was practiced, but that anything was known of the nature of oxidation by a blast and reduction by poling is uncertain. We produce the three following statements in connection with some byproducts used for medicinal purposes, which at least indicate operations subsequent to the original melting. As to whether they represent this species of refining or not, we leave it to the metallurgical profession (xxxiv, 24):

The flowers of copper are used in medicine; they are made by fusing copper and moving it to another furnace, where the rapid blast separates it into a thousand particles, which are called flowers. These scales are also made when the copper cakes are cooled in water (xxxiv, 35). *Smega* is prepared in the copper works; when the metal is melted and thoroughly smelted charcoal is added to it and gradually

kindled; after this, being blown upon by a powerful bellows, it spits out, as it were, copper chaff (xxxiv, 37). There is another product of these works easily distinguished from *smega*, which the Greeks call *diphrygum*. This substance has three different origins. . . . A third way of making it is from the residues which fall to the bottom in copper furnaces. The difference between the different substances (in the furnace) is that the copper itself flows into a receiver; the slag makes its escape from the furnace; the flowers float on the top (of the copper?), and the *diphrygum* remains behind. Some say that in the furnace there are certain masses of stone which, being smelted, become soldered together, and that the copper fuses around it, the mass not becoming liquid unless it is transferred to another furnace. It thus forms a sort of knot, as it were, in the metal.

Pliny is a good deal confused over the copper alloys, failing to recognize *aurichalcum* as the same product as that made by mixing *cadmia* and molten copper. Further, there is always the difficulty in translation arising from the fact that the Latin *aes* was indiscriminately copper, brass, and bronze. He does not, except in one instance (xxxiv, 2) directly describe the mixture of *cadmia* and copper. "Next to Livian (copper) this kind (*corduban*, from Spain) most readily absorbs *cadmia*, and becomes almost as excellent as *aurichalcum* for making *sesterces*." As to bronze, there is no very definite statement; but the *argentatum* given in the quotation above from xxxiv, 20, is stated in xxxiv, 48, to be a mixture of tin and lead. The Romans carried on most extensive copper mining in various parts of their empire; these activities extended from Egypt through Cyprus, Central Europe, the Spanish Peninsula, and Britain. The activity of such works is abundantly evidenced in the mines, but little remains upon the surface to indicate the equipment; thus, while mining methods are clear enough, the metallurgy receives little help from these sources. At Rio Tinto there still remain enormous slag heaps from the Romans, and the Phœnician miners before them. Professor W. A. Carlyle informs us that the ore worked must have been almost exclusively sulphides, as only negligible quantities of carbonates exist in the deposits; they probably mixed basic and siliceous ores. There is some evidence of roasting, and the slags run from 0.2 to 0.6%. They must have run down mattes, but as to how they ultimately arrived at metallic copper there is no evidence to show.

The special processes for separating other metals from copper by liquidation and matting, or of refining by poling, etc., are none of them clearly indicated in records or remains until we reach the 12th century. Here we find very adequate descriptions of copper smelting and refining by the monk Theophilus. We reproduce two paragraphs of interest from Hendrie's excellent translation (pp. 305 and 313):

Copper is engendered in the earth. When a vein of which is found, it is acquired with the greatest labor by digging and breaking. It is a stone of a green color and most hard, and naturally mixed with lead. This stone, dug up in abundance, is placed upon a pile and burned after the manner of chalk, nor does it change color, but yet loses its hardness, so that it can be broken up. Then, being bruised small, it is placed in the furnace; coals and the bellows being applied, it is incessantly forged by day and night. This should be done carefully and with caution; that is, at first coals are placed in, then small pieces of stone are distributed over them, and again coals, and then stone anew, and it is thus arranged until it is sufficient for the size of the furnace. And when the stone has commenced to liquefy, the lead flows out through some small cavities, and the copper remains within. (313) Of the purification of copper. Take an iron dish of the size you wish, and line it inside and out with clay strongly beaten and mixed, and it is carefully dried. Then place it before a forge upon the coals, so that when the bellows act upon it the wind may issue partly within and partly above

it, and not below it. And very small coals being placed round it, place copper in it equally, and add over it a heap of coals. When, by blowing a long time, this has become melted, uncover it and cast immediately fine ashes of coals over it, and stir it with a thin and dry piece of wood as if mixing it, and you will directly see the burnt lead adhere to these ashes like a glue. Which being cast out again superpose coal, and blowing for a long time, as at first, again uncover it, and then do as you did before. You do this until at length, by cooking it, you can withdraw the lead entirely. Then pour it over the mold which you have prepared for this, and you will thus prove if it be pure. Hold it with pincers, glowing as it is, before it has become cold, and strike it with a large hammer strongly over the anvil, and if it be broken or split you must liquefy it anew as before.

The next writer of importance was Biringuccio, who was contemporaneous with Agricola, but whose book precedes *De Re Metallica* by 15 years. That author (iii, 2) is the first to describe particularly the furnace used in Saxony and the roasting prior to smelting, and the first to mention fluxes in detail. He, however, describes nothing of matte smelting; in copper refining he gives the whole process of poling, but omits the pole. It is not until we reach *De Re Metallica* that we find adequate descriptions of the copper minerals, roasting, matte smelting, liquation, and refining, with a wealth of detail which eliminates the necessity for a large amount of conjecture regarding technical methods of the time.

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### Hoisting Accident in the Coeur d'Alenes

A hoisting accident in which two men were scalded to death, occurred July 27 in an underground hoisting station of the Green Hill mine, Mace, Idaho, according to the *Press Times*, of Wallace. The exact cause of the accident is not yet known, but it appears that a heavy skip of ore being hoisted from the 1400 level got away from the engineer. It seems likely that either the clutch broke or the reel became unclutched. At all events, the skip started back down the shaft and the efforts of the engineer to stop it with the brakes were of no avail. The reel attained such speed that it burst and its pieces, together with pieces of the brake posts, were scattered about the hoisting room with terrific force. Although the engineer's platform, on which were August Storjohn and Arthur Schultze, hoisting engineer and oiler, respectively, was twisted out of shape, the men were apparently not injured until the 10-in. steam pipe between the boilers was broken by a flying piece and the steam liberated. The men made their way out of the hoist room into the tunnel, but died within a few hours after being taken to the hospital. Although hoisting was done in balance, the descending skip was brought to rest and did not fall in the shaft. The damage to the shaft has not as yet been ascertained, but is probably extensive, as the skip fell, according to report, about 2200 ft. The hoist was a Fraser & Chalmers, 20x60-in. first-motion machine.

Several points of similarity will be noticed in the accident to the one occurring at the Leonard mine in Butte, April 23<sup>1</sup>. In both cases a shaft conveyance got away and spun the reel so fast that it burst and wrecked the hoisting room. In both cases also loss of life occurred from the flying parts of the broken reel. At the Leonard, however, the heaviest loss of life occurred in the shaft. Two other accidents recently, one at the Ellison shaft of

the Homestake company in the Black Hills<sup>2</sup>, and one reported from Mexico<sup>3</sup>, makes a total of four attributable to the same cause, namely, the impossibility of stopping by brakes or safety catches a descending cage or skip that has attained a high speed. Such a succession of accidents gives strong point to the editorial recommendation of the *JOURNAL*, and to Mr. Bromly's suggestion<sup>4</sup>, that there be added to the safety equipment of the hoisting apparatus, a governor to stop automatically all motion as soon as a certain speed is exceeded by the conveyance in either compartment.

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### New Nickel and Chrome Works in New Caledonia

According to a report of the United States Consul at Noumea, an important hydro-electric plant being erected by a French company in the south of New Caledonia for the production of ferronickel and ferrochrome involves the construction of two generating stations at different levels on the Yate River. For the lower station, which is being built first, the water will be diverted from the river by a dam 13 ft. high to a tunnel 9500 ft. long, which will deliver 34,000 cu.ft. per minute, with a head of 350 ft., to the turbines. Electric smelting works will be erected in close proximity to the generating station. A similar quantity of water, with a head of 157 ft., is available for the higher plant, which will generate 7600 hp. to be converted to high-tension current for transmission to various points. A reservoir is also being constructed by means of a dam 52 ft. high. It is expected that the lower plant will be completed in about two years, and that then the other installation will be started and will take three years to complete.

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### The Chuquicamata Pictures

Through the courtesy of Pope Yeatman, a series of pictures of the Chuquicamata copper mines is reproduced in the pages, "Photographs From the Field." This great deposit, on which many mines were operated on a small scale, has been acquired by the Guggenheims, who have organized the Chile Exploration Co. to develop and operate what will be one of their greatest copper producers.

The view of the seaport of Tocopillo shows shipping conditions prevalent on the west coast of South America; ships cannot come in to docks, but anchor opposite moles or piers that run from the water's edge to deeper water beyond the surf. From the moles the freight is carried to and from the ships in lighters.

The Chuquicamata railroad station is about 4 km. from the mines. The cart in the background of the picture is used to haul water to the mines. The tank car shown just ahead of the passenger coach is used to haul water from Calama, where it is drawn from pipe lines taking supply at San Pedro. These pipe lines furnish all the water for Antofagasta, the distance from Antofagasta to San Pedro being 300 km. The Chile Exploration Co. will develop water power and obtain a supply from various sources out some distance from Chuquicamata. The other views are self-explanatory.

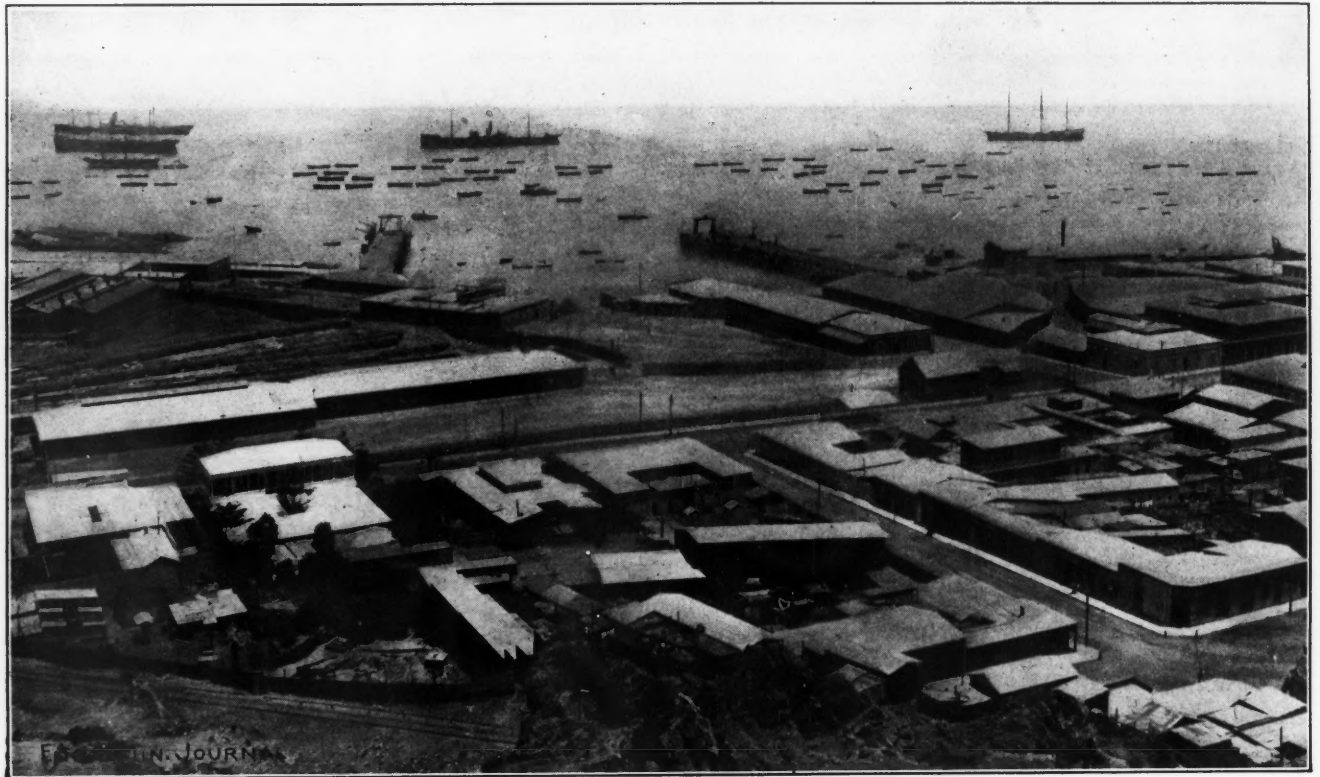
<sup>1</sup>Ibid: Apr. 19, 1913; p. 824.

<sup>2</sup>Ibid: June 7, 1913; p. 1159.

<sup>3</sup>Ibid: May 31, 1913; p. 1111.

<sup>4</sup>"Eng. and Min. Journ.," May 3, 1913, p. 922.

PHOTOGRAPHS FROM THE FIELD



TOCOTILLO, A CHILEAN SEAPORT FROM WHICH CHUQUICAMATA COPPER MAY BE SHIPPED



CHUQUICAMATA RAILWAY STATION NEAR THE COPPER MINES

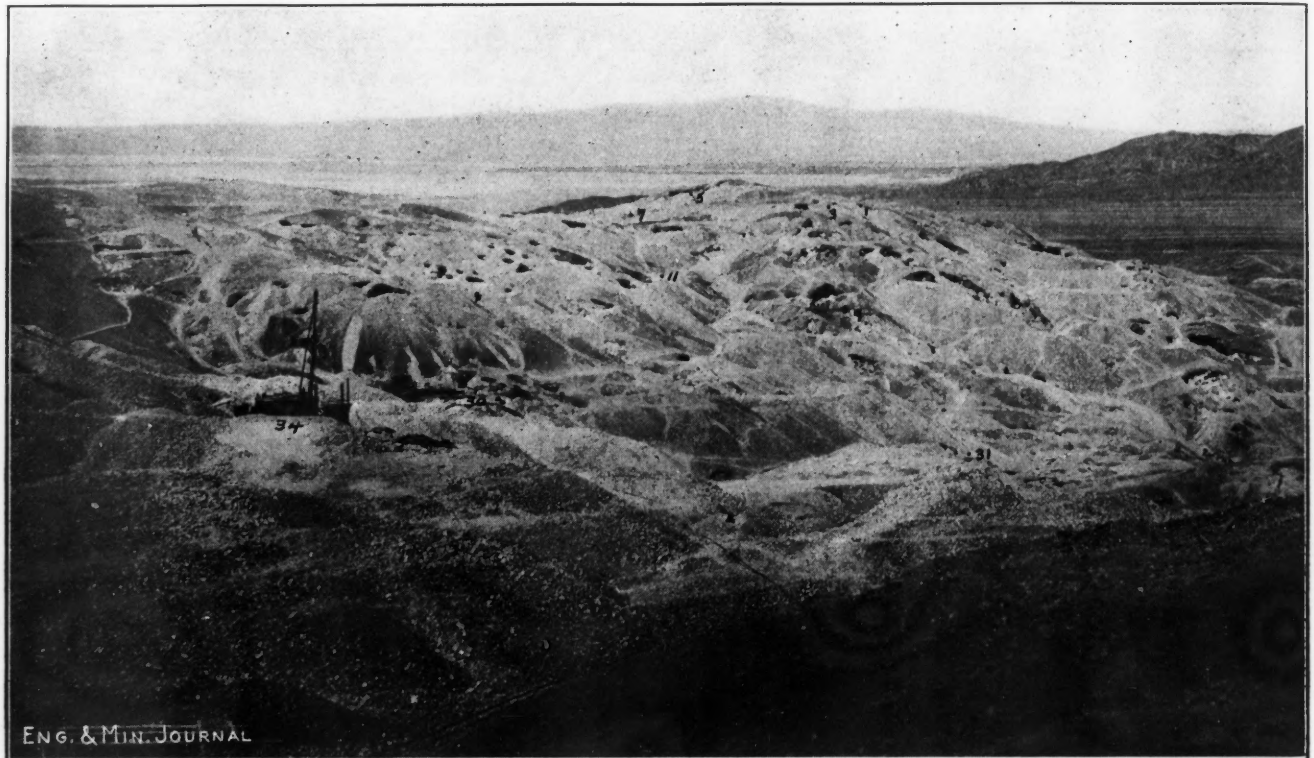


THE MILLSITE FROM THE MINE, TWO MILES AWAY



THE CONSTANCIA OPENCUT AND OLD SCREENING PLANT

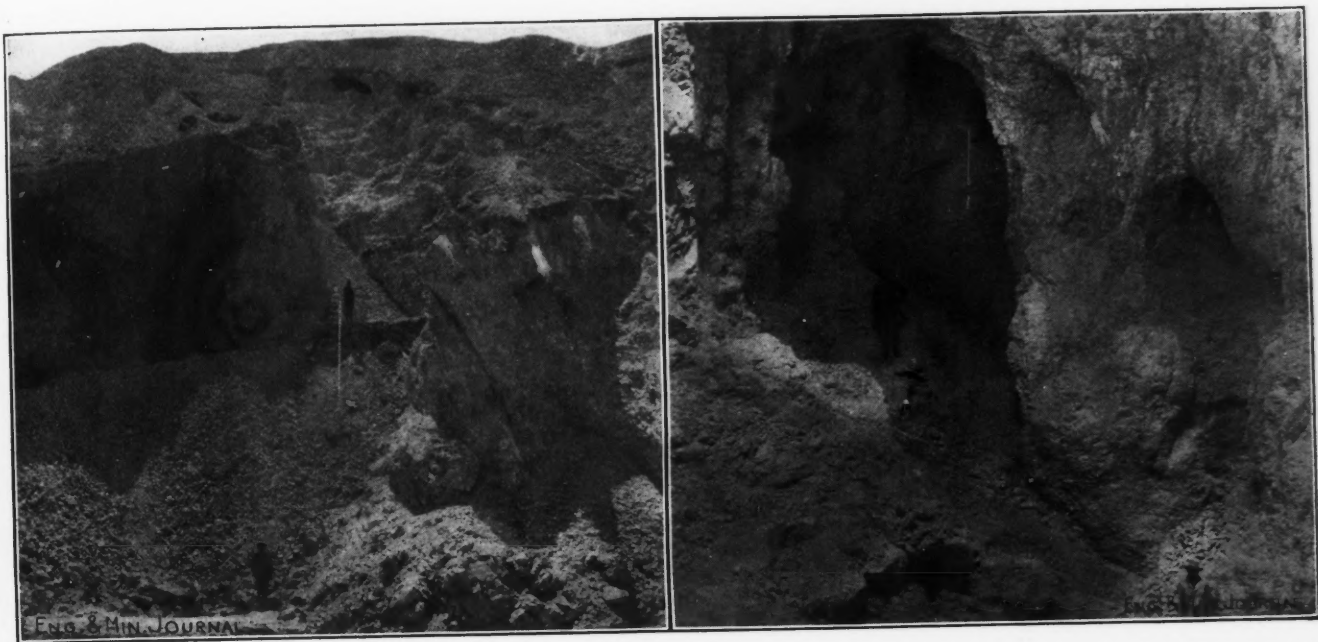
The Chuquicamata mines are being developed by the Chile Exploration Co., a Guggenheim company.



THE MINE WITH POSITION OF DRILL HOLES DESIGNATED



THE ESPANOLA OPENCUT AND OLD SCREENING PLANT



INTERIOR OF TWO OF THE OPENCUTS

These views give an idea of the size of the "holes" shown in the opposite illustration.



THE OLD CAMP AT THE MINE. NOW BEING REBUILT

## CORRESPONDENCE AND DISCUSSION

### Motor Trucks in Mining

In considering the use of motor trucks in mining work, such as that described in the *JOURNAL* of June 14, 1913, I have found the essential questions are the character of roads over which the truck will operate, the truck's capacity and its speed.

Gasoline consumption and approximate cost of upkeep, including repairs and replacements, are incidentals on which figures are of no practical value to anyone and might be misleading to an intending purchaser of a truck. One case will not apply to another. Each must be tried out in practice on its own ground. As an illustration, the consumption of gasoline in our case varies, depending on the road and engine conditions, from 7 to 11 gal. per trip, with one truck, and from 9 to 14 with another, and, singular as it may seem, the smaller truck will average the greater consumption of gasoline.

It is not the purpose of this letter nor the desire of the writer to advertise any particular make of gasoline truck or tire. It is important, however, to warn an intending purchaser against using anything but rubber tires on a motor truck. The rubber-tire cost is a fixed charge. A set of six tires costs \$600 with a 10,000-mile guarantee, which makes the cost 6c. per mile, or in our case, \$2 per trip of 33 miles. This is the best we can expect to do.

I am writing this opinion from actual experience on the ordinary roads in the foot hills of California, which link the Pocahontas Copper Mining Co.'s mines with the railroad. The work of the truck on improved highways and city streets is not considered. In the particular case in question, the road is 16.5 miles long, making the round trip 33 miles. Starting from Le Grand, Merced County, on the Santa Fé at an elevation of 280 ft., it meanders through the hills and reaches an elevation of 1050 ft. at the mine. Of this 770-ft. raise, 80% is made in the eight miles nearest the mine. The first seven miles of the road is in Merced County, is run on section lines and is graded and graveled, but has no summer care, such as oiling or sprinkling. The other 9.5 miles is in Mariposa County, where little attention is given to placing the road in the best natural position to avoid bad grades and to receive proper drainage. In this section, little or no road building is done except plowing on the side of the road where there is soil. The soil is scraped to cover the exposed rocks, and is usually blown away in dust during the hot summer months or washed away as mud during the winter. The road has no summer care. Over this road the best speed that our trucks have maintained for any length of time is five hours per round trip, including loading and unloading. We load from a double-door bin by gravity; the unloading device is simple and rapid, the front of the bed being hoisted to give a rear dump. The time consumed in loading and unloading does not exceed 15 minutes.

We commenced operation in August, 1912, with one 5-ton and one 6-ton truck. During the winter months of December, January and February, we hauled 1132 tons

of ore. In all, we have delivered over 4000 tons of ore in Le Grand and have hauled to the mine about 100 tons of supplies.

Our hauling is by contract and is 40% cheaper than the best team rate we could get at the time we commenced operation.

Last winter, being a dry season, was particularly favorable for operation of motor trucks, so that we ran steadily all winter, being laid off only a few days after each rain. The period of stoppage was less as the season advanced and the road became more packed and harder after each storm.

It would be well for an intending purchaser to buy nothing but a high-grade machine, for the best will give trouble enough. If such a first-class machine is purchased, it should be taken at the lowest possible net cash price, discounting every guarantee. In this way money will be saved. A settlement of the usual guarantee is a source of trouble and disappointment. Purchasing a machine, for instance, on a 30-day demonstration and a guarantee, is to be avoided; because the purchaser pays for this and is usually left heir to all kinds of engine trouble.

A man trained as a truck driver makes a better operator than an automobile driver. The trained truck driver usually does not have the speed mania and there are several other things that he does not have to unlearn. Driving and maintaining an auto truck is a man's job. It takes persistence, energy, care and great patience to gain a success. This is work that should not be saddled on the superintendent; for the reason that it will interfere greatly with the main issue, which is mining. There are many reasons why I advise that the hauling be done by contract, even if the mine must own the machine, and the most important is that the contract system relieves the management of the details of the operation, leaving so much more time to be devoted to mining. For economical operation, I advise the avoidance of night work, as two hours of daylight is worth three hours of darkness in average running and when it comes to road repairs, one hour of light is worth four hours of darkness.

To those contemplating the purchase of a truck, I advise the purchase of an extra engine also. This may seem an added and perhaps an unnecessary expense at the time, but it will soon prove to be a wise expenditure. The type of engine used at the present in motor trucks should be taken out and overhauled at least every 30 days. This work in the country takes from five to eight days, including removal, overhauling, repairing and re-assembling, so that it can readily be seen that the extra engine will soon pay for itself in preventing delays with the truck. The truck most suitable for this work and our character of roads is one with the load well balanced between the front and rear wheels, thus avoiding undue strain on the engine and driving chains, and distributing the weight of the load over the road surface. We have demonstrated that a 6-ton truck with load, is about the limit that the average road will hold up under, and it



seems to be about as economical as the 5-ton truck, as regards the operating expense. The construction of the bed is an important factor in the running and upkeep of a truck. It should be down as near as possible on the chassis, and should not extend far beyond the rear wheels; thus avoiding an excessive load on the rear axle. A wide bed will cause a swaying motion when loaded and traveling that will give untold tire trouble; compare a wagon in motion loaded with hay and one loaded with sand.

The auto truck, as constructed at present, is far from being perfect. The type of engine in use can best be compared to a race horse doing the work of a draft horse. It shows that the makers are not familiar with the ordinary field conditions, and it would seem that they never have taken into consideration the character of roads. The construction of the running gear is wrong, in that the rear wheels, which are double tired, are wider than the widest wagon gages. The result is excessive wear on the outer border, only avoidable by much road work; there is no apparent reason for such a wide wheel-base. The front wheels also do not track with either set of rear tires, thus causing extra friction on soft on sandy roads.

The use of the automobile engine in truck construction is a serious mistake. The work is different and requires an engine with larger and longer bearings, stronger in every part, and in every way more accessible and more flexible, if I may use the word. Flexibility is also required in the radiator for protection against vibration; as at present installed the radiator is a great cause of trouble and delay. The springs are another source of endless trouble; they need a different construction, different temper and protection against shock.

In spite of the faults which I have enumerated in all kindness, the auto truck is by far the best equipment with which I have had experience for this work.

DAVID ROSS.

Lewis, Calif., June 23, 1913.

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### The Beatty-Guggenheim Case

In the JOURNAL of Aug. 2, 1913, in my communication with reference to the Beatty-Guggenheim case, there are a number of typographical errors, some of which are important enough to justify my asking you to print a correction thereof.

On p. 225, the article as printed, reads:

As I understand it, Justice Gerard held, as a matter of law, that even if the officers of the company knew that Beatty was interested with Perry and assented to it, the company would not be bound unless those officers knew the exact amount of Perry's interest, that is, that it is not enough for an agent to say to his principal, "I have a personal interest in a transaction, are you willing to deal with me on that basis?" but that he must say, "I have a 9% or a 13% interest."

My letter to you reads:

As I understand it, Justice Gerard held, as a matter of law, that even if the officers of the company knew that Beatty was interested with Perry and assented to it, the company would not be bound unless those officers knew the exact amount of Beatty's interest, etc.

On the same page, the article reads:

As already stated, the contracts between the Guggenheim company and Treadgold and Perry were made in December, 1905.

and then, quoting from the testimony of Daniel Guggenheim, it reads:

A—Mr. Hammond told me something in 1906. I think the

end of the year, that Mr. Beatty had advanced some money in order, etc.

My letter to you, quoting from the stenographer's minutes of the trial, read:

A—Mr. Hammond told me something in 1905. I think the end of the year, that Mr. Beatty had advanced some money in order, etc.

On the previous page, referring to Perry's contract of 1904 with the Guggenheim company, the article reads:

In one finding the court finds that it was under this contract that Perry examined the Yukon properties in 1906. In another finding the court finds the contrary.

My letter to you contained the correct date of Perry's examination of the properties, which was 1905.

The importance of the dates lies in the fact that, on Mr. Beatty's behalf, we insist that Daniel Guggenheim in 1905, before the final contracts were entered into on Dec. 5, 1905, knew of Mr. Beatty's personal interest in the transaction.

HENRY WOLLMAN.

New York, Aug. 12, 1913.

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### Michigan Miners' Houses

I wish to call attention to the pictures shown in the JOURNAL of Aug. 9, 1913, in "Photographs from the field," particularly the views showing "Types of Houses Provided for Miners" and "A Miner's Family." The first two pictures were taken during the summer of 1901 and are a part of a series of six views taken from the Lake Superior stand pipe, showing a panoramic view of the Calumet & Hecla mine.

The Calumet & Hecla Mining Co. has a total of 764 houses, and out of this total there are only 34 log houses; so you can see the percentage is rather small. The company has over \$980,000 invested in houses, and the appraisal value placed on the log houses is only \$100 each.

The other picture, "A Miner's Family," I wish to call particular attention to, as these houses are situated in the village of Red Jacket and are owned, together with the land on which they stand, by a socialist of the excessively enthusiastic type, who receives the greater part of his income from real-estate rentals. This picture was taken, I understand, expressly for the purpose it conveys.

C. L. C. FICHTEL.

Calumet, Mich., Aug. 16, 1913.

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### Montana Mining Co., Ltd.

In the JOURNAL, July 26, 1913, p. 174, under the caption "Montana Mining Co., Ltd." the inference given is that by the payment of £8250, the Montana Mining Co., Ltd., became possessed of all its former holdings in Montana. This is an error. The above mentioned amount was in settlement of a deficiency judgment, sent over and collected in London, England. All known property in Montana belonging to said company, both real and mixed, embracing more than 400 acres of lode claims and mill sites, and more than 600 acres of placer ground, was sold by the U. S. marshal under execution, issued by the Federal Court of this district, to the St. Louis Mining & Milling Co. of Montana, on Mar. 7, 1910. No redemption having been made, the St. Louis Mining & Milling Co. took possession on Mar. 8, 1911, and has been in full possession and operating the property since that date.

WILLIAM MAYGER.

Helena, Mont., Aug. 4, 1913.

## The Lead Schedule

WASHINGTON CORRESPONDENCE

The final action of the Senate in practically adopting the metal schedule of the tariff bill and leaving the duty on lead upon what amounts to practically a  $\frac{3}{4}$ c. per lb. basis, is an unsatisfactory one, and in the opinion of many Senators makes it certain that there will have to be a revision and rewriting of the paragraph in conference committee after the bill has been finally acted upon by the Senate. It is now regarded as undoubted that nothing more can be done during the further discussion to obtain a revision of the rates, the present agreement being practically the outcome of a barter between lead and zinc interests in various parts of the country whose votes are essential to the adoption of this bill. The debate produced further gloomy predictions of the effect of the reduction in duty upon the Western mining industry, these being offered particularly by Senators Smoot and Sutherland, of Utah, who contended that  $1\frac{1}{2}$ c. per lb. is the lowest rate with which the industry can survive. Senator Thomas, of Colorado, unexpectedly answered the Utah Senators and in rebutting their contentions, told the Senate that:

The closing of the mines of the Rocky Mountain region in the early '90s was not due to the lowering of the tariff upon lead or to any legislative measure other than the act which repealed the purchasing clause of the Sherman law. The mints of India were closed to the coinage of silver on July 19, 1893, and within 30 days after that time practically every lead-producing mine in my state, and, I think, in the states adjoining mine, were closed down. That was caused by the sudden drop in the price of silver from 90c. to about 60c., in consequence of which the various smelters were too much alarmed about existing and future conditions to invest money in the purchase of argentiferous ores.

So I may say that, although there may be some exceptions, all the lead-producing mines of the Rocky Mountain region, and particularly those in the state which I in part represent here, are mines which are worked for their other metallic contents, the lead being in the nature of a byproduct, or wherever they are worked for lead as a principal product, the existence of byproducts, such as silver and gold, makes it possible to work them at a profit.

I may say also at this juncture that lead ores are an essential to the reduction of the gold and silver ores, particularly when they are refractory, silver ores perhaps more generally than gold, and that without lead ores as a flux, their treatment would be largely curtailed, if not diminished practically to zero.

These mines did not resume work immediately after the crushing blow which was delivered to the silver industry in 1893, but they gradually opened up here and there, until in the course of time practically all of them which produced sufficient, either directly or as a byproduct of other metals, to make it an object for them to do so. Of course, a great many other mines, so called, were being operated in the hope of profit, which sometimes was and sometimes was not disappointed.

Now, there was not so much lead produced from argentiferous ores during the existence and operation of the Wilson Act as before or since that time. But it is a fact, Mr. President, that the average annual production of lead in this country continued uninterrupted during the period of that law. . . . If it be true that the mines in the Rocky Mountain region are largely worked with lead as a byproduct, then it must necessarily follow that any change in tariff regulations will only incidentally, if at all, affect that industry. . . . There is no danger that the wage rate will fall in the mines of this country, . . . because they are kept up by the men themselves and not by any protection whatsoever. . . . The American Smelting & Refining Co. . . . practically dominates the lead industry. . . . Every plant the company has could be duplicated for less than 50% of the capitalization of the concern. . . . This company is fortunately circumstanced, in that it not only buys from the producer but it sells to the consumer, practically controlling the market in both directions. Therefore, in my judgment, it is able to fix the market price, or at least largely to control

the market price as its interests may direct. This is apparent from the nature of its more recent contracts.

The criticism upon the rate of even  $\frac{3}{4}$ c. per lb. has been increased in vigor, and it is now very generally conceded that a serious reconsideration will be necessary after the bill has passed the Upper Chamber.

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## Institute of Mining Engineers' Meeting at Butte

SPECIAL CORRESPONDENCE

The meeting of the American Institute of Mining Engineers opened at Great Falls, Mont., Aug. 16. In the morning the party examined the Missouri River power development and in the afternoon visited the smelting works. A technical session was held in the evening.

On Sunday morning the party proceeded to Helena, where it was entertained at luncheon and visited the smelting plant of the American Smelting & Refining Co. All returned to Butte the same evening. Headquarters of the institute in Butte have been established at the Silver Bow Club.

Monday was occupied by a technical session at Butte and visits to the contiguous mines, Wednesday spent in Butte, and on Thursday a visit to the Southern Cross mine, followed by a banquet in the evening. The meeting was highly successful, being attended by about 140 members. The management of affairs by the local committees, under the leadership of Charles W. Goodale, was superb.

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## Spelter Production in 1913

The U. S. Geological Survey has published figures collected by C. E. Siebenthal, purporting to give the production of spelter in the United States in the first half of 1913. In the table below, these figures are given, in comparison with those for the first half of 1912; they are in short tons:

	1912	1913	Changes
Stocks, Jan. 1.....	9,081	4,522	D. 4,559
Production .....	166,496	180,213	I. 13,717
Imports .....	3,053	5,533	I. 2,480
Total supply.....	178,630	190,268	I. 11,638
Exports .....	13,170	15,339	I. 2,169
Estimated consumption.....	159,046	153,073	D. 5,973
Total deliveries.....	172,216	168,412	D. 3,804
Stocks, July 1.....	6,414	21,856	I. 15,442

Of the production reported this year, 171,135 tons were from domestic and 9078 tons from foreign ore. The spelter made in Illinois was 53,524; in Kansas, 42,645; in Oklahoma, 43,253; in other states, 40,791 tons. Imports of zinc ore for the half year were 19,994 tons, the zinc contents being 9204. Exports of zinc ore were 9745 tons.

For the second half of 1912, the total production was 172,310 tons and imports 8062 tons. Exports were 938 tons, and estimated consumption, 181,326 tons. Stocks at the end of the year were 4522 tons. If these figures are correct, the stocks held by smelters increased 17,334 tons during the half year.

This change in stocks was more apparent than real. It was practically only a shifting, as there was at the same time a decrease in the quantities held by consumers.

## EDITORIALS

### Iron Capacity and Prospects

The production in the United States of 16,488,602 tons of pig iron in first half of 1913, as officially reported, and the implied output of an equivalent quantity of steel indicates that we are not only consuming an enormous quantity of material, but also that we are working up rather closely toward our present limits of production. It has been assumed that the existence of a number of idle blast furnaces implies the possibility of a great increase in the make of iron at any time, but a closer consideration of the facts will show that this is not the case. A number of the furnaces carried on the list are of antiquated construction and could not be seriously considered as ironmakers without reconstruction and repairs, which would involve much time and expense. Others among the older stacks are not commercially possible, owing to their situation and relation to supplies of raw material. They could be operated at a profit only under extreme conditions of demand, which are not now likely to arise. Apart from this and taking the more modern and well placed furnaces only, it must be remembered that at the most active times not far from 10% of them must be out of blast for repairs and relining at any given time. It is quite evident, therefore, that the first half of the current year showed a production that cannot be much expanded until new construction has added to capacity.

As to supplies of raw material there is no doubt that iron ore can be furnished in quantities as great as needed, with very little difficulty. The chief obstacle would be in the supply of coke, which is now in demand very nearly up to present productive capacity. A solution to this difficulty is being found in the construction of byproduct ovens, which extend considerably the range of coking coals. This work is rather slow and expensive, but is extending sufficiently to warrant a belief that the fuel will be ready when needed.

Pig iron has been taken as the base of the industry, and the remarks as to present production and its relations to actual capacity will apply to steel also in a large degree. The production of finished material cannot be greatly expanded beyond its present limit without an increase in new construction, which is for the time being on rather a moderate scale. For the rest of the year, at least, not much increase in make can be expected.

Will there be a reaction and the falling off in trade which Wall Street and some other people seem to anticipate? That is a question which seems to trouble many people more than it does the steelmakers. They are apparently quite confident that there will be no serious falling off in the trade. There has been no apparent accumulation of unsold stocks, as there was two or three years ago, and the trade is in fairly good condition. Buyers are less inclined to make contracts far ahead, perhaps, but that seems to be mainly because they do not anticipate any rush which will force prices up as in 1906-7. Nevertheless they are taking material readily in a way which indicates their belief in continued demand. Un-

less there is more crop damage than has so far appeared, our old friend, the ultimate consumer, promises to be able and willing to take iron and steel wares in sufficient quantity to keep the trade on a satisfactory basis.

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### Boiler Capacity at Altitude

The influence of high altitudes in reducing the capacity of air compressors and to a less extent their efficiency is well recognized. A similar effect in the case of internal-combustion engines is now also pretty generally known. The phenomenon in both cases, of course, is attributable to the same cause, namely, that the atmosphere being under less pressure is more highly rarefied and that in a given space less material is therefore contained. Thus for the compressors to furnish a certain amount of compressed air at a specified gage-pressure requires that more of the lighter material be taken in, and in the case of the internal-combustion engine the latent power in the explosive mixture varies as the amount of oxygen in the air, which of course becomes less as the air becomes lighter. The same influence operates to reduce the capacity of steam boilers, and though this fact is recognized and allowed for by boiler designers and manufacturers, it is not always so well understood by purchasers and operators.

This reduction in boiler capacity is of peculiar interest to the mining fraternity, since the boiler plants found operating at high altitudes are more likely to be mining installations than any other. The typical mining boiler plant uses chimney draft. The capacity of a boiler depends on the amount of fuel which can be burned, which in turn depends on the amount of oxygen passing through the furnace, and this again is determined by the draft pressure. This pressure is due to the difference in weight between the warm column of air in the chimney and the cold air outside. This absolute difference in weight will be less at high altitudes. But since the product to be passed through the boiler is lighter, the volume passed through will be the same. Hence the mere reduction in draft does not reduce the boiler capacity. However, while the volume of air is the same, it does not contain the same amount of oxygen and consequently is not capable of burning the same amount of fuel. To maintain capacity, therefore, it is necessary to use more air, either by increasing the grate area of the boiler or by increasing the velocity at which the air passes.

It is usual to obtain an increase in velocity by increasing the height of the stack. There is some difference of opinion as to how great this increase must be. It is maintained by some that it is sufficient to make it vary inversely as the barometric pressures. That is to say, the stack height is increased at the same rate as the rarefaction of the air proceeds. Others specify an increase of the stack height inversely as the square of the barometric ratios, that is, considerably faster than the rate of rarefaction of the atmosphere. Probably the best practice lies somewhere between these two figures. Along with the

increase of stack height, the diameter of the stack must be increased in order to overcome the increased friction due to the increased length of friction surface. This increased diameter is usually specified to take place inversely as the  $\frac{2}{5}$  power of the barometric pressure, so as to maintain the same friction loss at altitude as at sea level.

For very high altitudes the increase in stack height necessary is often such as to make the relation of height to diameter impracticable. In such localities it is ordinary practice to increase the grate area of the boilers and in this way maintain their capacity without an increase in draft.

It should be noted, however, that this discussion applies wholly to boilers using chimney drafts. In many cases, instead of increasing the height and diameter of the chimney, it is advisable to supplement the natural chimney draft with forced draft. When crude oil is used, as is often the case in mining practice, the operation of firing itself is more or less of a forced draft.

❖

### Measurement of Crushing Efficiency

For crushing and grinding machines of many types, noisy claims for superiority are made. The loudest note seems to make the most impression. This situation can not be otherwise than prejudicial to the best interests of the mill operators who desire to obtain a certain definite product in the most economical way. Search for the reasons governing the existing condition of counter-claims and confusion, reveals the fact that there is no unit for measuring the effective work done in such machines. Certainly it is hopeless to expect to find the best appliance for any use without a measure for its efficiency. In no other department of milling does such a complete lack of harmony exist. It is true that energetic workers have been trying to devise some satisfactory system, but different methods produce different results and there is nothing universally applicable. The classic work of Stadler outlined a method which has served as a basis for enlightening experiment, but it has not been universally accepted as representing the truth in all cases. Del Mar has advocated a classification differing somewhat from that of Stadler, and more recently A. O. Gates published in the *JOURNAL* an exhaustive study advancing another basis for calculation. The noteworthy circumstance in connection with the publication of all these studies is the exceedingly restricted amount of discussion that has followed. It is a complicated and difficult subject, no doubt, and active operators rarely are able to apply the necessary time to the mastery of so abstruse a subject. We might, however, expect the scientist to undertake the task. It is to be hoped that even now the subject is receiving serious attention and that a measure unit of universal application will be forthcoming.

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### Civil Service Appointments

We have heretofore commented on some unsatisfactory civil-service examination features. We publish in our By-the-Way column this week a notice of examination for electrometallurgist, which seems to call for further criticism. The three years' experience in electric-furnace work requested, and the fact that if a thesis is presented, it

must bear upon electric-furnace work, seem to throw undue emphasis upon this subject.

We respectfully submit that it is barely possible that two years with the electric furnace and 15 years, say, in wet electrometallurgy, might equip a man almost as well as would three years' work with the electric furnace. We also submit that a man might work five years with an electric furnace and have an absolute vacuum where his ideas of electrodeposition ought to be, and all far short of being the man the Bureau of Mines should have. Again, just why a knowledge of metal mining should be any great aid to the ore treatment is not easy to see, but this much we will take on trust.

The wide spread of the salary limits is also a peculiar matter. Doesn't the Commission know what salary it wishes to pay, or the grade of man desired? If not, it ought to be the duty of someone to sit down for 10 minutes worth of quiet thought and decide whether an \$1800 or a \$3000 man is desired. On the other hand, the advertised arrangement affords room for petty politics: we do not say that it is intended to use it thus; but it is obvious that if any one presented unusual qualifications for the place, and took unquestionably higher rank than friends of those having the appointive power, it would be possible to eliminate him by offering him the place at \$1800, and let him decline it. The next man could be offered more.

There are persons unkind enough to say that such specifications as we publish this week are drawn to allow some certain candidate to land a job. We do not say so; we are of an absolutely unsuspecting nature. We expect later to have evil-minded persons tell us, "Well, didn't I say \* \* \* \* \* would get that?" Of course, however, this will be a coincidence. But in regard to some of these Civil Service advertisements, we wish to address the Civil Service Commission in Jeff's often repeated request to Mtt, "For the love of Mike, be reasonable."

❖

The strike fever seems to be active and highly contagious at the present time. We have the Lake Superior copper strike, that in the lead mines of Missouri, on the Lake Superior ore docks, the electricians at Butte, and no end of minor troubles at various points. And now the United Mine Workers threaten a general strike in the coal mines of the Rocky Mountain region. From a mine-operator's point of view, this is a stormy season.

❖

The situation in Mexico is sufficiently grave, but it is hoped that the present crisis will pass without any serious trouble, and without forcing any hostile action on the part of either the United States or Mexico. Apparently open rupture, with all its consequences, can be avoided if the hotheads on either side are kept out—and if others will remember that most of these aggressives are actuated by self-interest.

❖

A landmark in New York, familiar to many mining men, is about to be torn down. This is the old building which has housed the New York Assay Office from its first organization, and which dates back many years before that time, having been the home of the United States Bank 90 years ago. One-half of the new Assay Office was completed some time ago and is now in use. Work on the remaining half will be begun as soon as the old building is removed.

## BY THE WAY

In the JOURNAL of July 19, 1913, we mentioned the new publication of the Furukawa Mining Co., the *Miners' Friend*, as being, so far as we knew, without an American rival. Less than two weeks later the "Employees Magazine" of the Lehigh Valley Coal Co. appeared, with similar objects and purposes, after having been in preparation for some months previous. The tables of contents of the two magazines' initial numbers are also much alike.

❖

It appears from recent Geological Survey publications that the "semiprecious" metals are copper, lead and zinc. Where quicksilver and tin get off on this classification we are not informed. Aluminium also sometimes sells higher than the three first mentioned, and antimony for more than lead and zinc. These are probably the quasi-precious metals. When we were younger the metals were classed as precious and common, we believe—now probably iron is alone in the "common" category. What is the use, anyway—if there are no privates in an army what is the joy in being a corporal, and why "semiprecious" if there is going to be only iron besides?

❖

According to a press dispatch, a bolt of lightning traveled through nearly a mile of tunnel in the Copper Reef mine at Globe, Ariz., on Aug. 5, jumped 300 ft. down a winze and nearly tore a leg off of one miner and shocked more than a score of others. The bolt was conducted through the tunnel by the steel rails. Accidents underground resulting from lightning are not without precedent. We believe there is a well authenticated case in southeastern Missouri of a headframe being struck by lightning and the current passing down pipe lines in the shaft and prematurely setting off an electric firing system in one of the stopes, the last happening in some unexplained way. If the story that comes from the Copper Reef mine is true, the rails in the tunnel must have been extraordinarily well insulated.

❖

An accident from powder gas recently occurred in the New York aqueduct workings. The published accounts in the daily press, written by reporters apparently unfamiliar with subterranean affairs, sound amusing to the initiated, and illustrate the difference in popular and technical nomenclature. In the *Evening Post*, for example, we read that immediately after the blast "the bellows were set in motion." It appears that the new shift descended too soon. "They had advanced but a short distance from the bottom of the shaft when they detected the pungent odor of glycerin. 'Back, back,' was the cry." This "glycerin," possibly, obtained its "pungent odor" by mixture with rosewater. "The charge used in the blast," it is said, "consisted of 60% du Pont gelatin black powder." This is a new brand on us. We shall be interested to observe the results of crossing gelatin with black powder. "The trip up in the elevator was made in the shortest possible time." Some class to the aqueduct shafts, elevators and all the latest con-

veniences! Of the 16 men overcome by the gas, 15 revived and one died. "This is the first time I ever heard of, witnessed or saw such a thing," said Dr. Loomis, an ambulance surgeon. "I don't know what happened or why it happened." We are somewhat in the same state of mind.

❖

The dowsing myth will not down in Cornwall. One T. Fiddick has lately published a pamphlet on the subject. In his preface he says: "Dowsing" or 'rhabdomaney,' is as old as the hills. In the past, owing to the atmosphere of magic and mystery surrounding it, and also to the trickery of charlatans, dowsing as a real and practical function has often been repudiated by scientists, and ascribed by them to the ignorance and superstitions of its votaries, and this apparently without any serious attempt to discover whether it had a basis of fact or not. But in consequence of its persistence, and the remarkable achievements accomplished by its aid, and perhaps also to the increased desire in the present day to find the true inwardness of things, divining has of late been receiving more attention from the scientific world. Although manifestly presenting many difficulties, the mists enveloping it are being vigorously attacked, and not without some success. Although we cannot say with certainty what the 'force' really is, our ignorance in this respect ought not to prevent our utilizing the 'power' in the public interest." Mr. Fiddick is himself under the impression that the force is strongly allied to electricity, as it is apparently governed by similar laws. Before serious consideration of this subject we should like to have evidence respecting (1) the present absence of charlatanry, (2) the remarkable achievements accomplished by its aid, and (3) the existence of any "force" or "power."

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The U. S. Civil Service Commission announces an examination for electrometallurgist to fill a vacancy in the Bureau of Mines, at a salary from \$1800 to \$3000 per year. His duties will be to conduct investigations into metallurgical problems, the investigation of ores with reference to their constitution and treatment, both mechanical and chemical, including smelting operations, and especially the investigation of ores with reference to the feasibility of their treatment by electrometallurgical processes. Competitors will be rated as follows: (1) General education and scientific training, 40; (2) practical experience and fitness, 40; (3) publications or thesis, 20. An educational training equivalent to graduation from a college or university of recognized standing, such training to include courses in geology, chemistry, physics, and metallurgy, and not less than three years' actual experience in electric-furnace work, are prerequisites for consideration for this position. If a thesis is submitted under Subject 3 it must present the results of original investigation in electric-furnace work. Applicants possessing a thorough knowledge of metal mining and metallurgical work, including smelting operations, will receive additional credit under Subject 2. Applicants must have reached their twenty-fifth but not their fortieth birthday. Persons desiring this examination should at once apply for Form 304, Electrometallurgist, male, No. 903, and special form to the United States Civil Service Commission, Washington, D. C.

## International Geological Congress

The Twelfth International Geological Congress was held in the Convocation Hall of Toronto University, Aug. 7-14, about 500 delegates from all parts of the world being in attendance. Many of the delegates arrived in Canada some time before the convention to avail themselves of the numerous excursions to points of geological interest, arranged in connection with the gathering. The formal opening of the convention took place at noon, on Aug. 7, when Sir Charles Fitzpatrick, administrator of the Canadian government, during the absence of the Duke of Connaught, extended a welcome to the delegates on behalf of the government. Addresses of welcome were also given by Hon. W. H. Hearst, representing the Ontario government, President Falconer, of the University of Toronto, and Controller Church, of the city of Toronto. Dr. Emil Tietze, of Austria, expressed the thanks of the delegates for the cordial welcome extended to them. R. W. Brock, of the Canadian Geological Survey, Secretary of the Congress, outlined the arrangements made for a series of excursions before, during and after the gathering, covering in all a distance of 20,000 miles, which would enable them to get an idea of the vast geological resources of the country.

At the afternoon meeting, Secretary Brock presented to the Congress the monograph on the "Coal Resources of the World," in three large volumes, and an atlas, which has been specially prepared under the direction of the Executive Committee as a companion work to "Iron Ore Resources of the World," published under the auspices of the Eleventh Congress. Its preparation was undertaken by a committee, including G. G. S. Lindsey, convener; Dr. F. D. Adams, R. W. Brock, D. B. Dowling, Charles Fergie, James McEvoy, J. B. Pater and William McInnes, the actual editing being done by William McInnes, D. B. Dowling and W. W. Leach. The main body of this monograph has reports on 64 countries.

The total coal resources of the world, as compiled from the reports received, amounted to 7,397,533,000,000 tons. Of this total, nearly 4,000,000,000,000 tons are bituminous, nearly 3,000,000,000,000 brown coals of various grades and nearly 500,000,000,000 anthracite. Of the anthracite, Asia with the great Chinese fields has by far the largest supply of any of the great continental divisions, furnishing 407,637,000,000 tons. In bituminous, America leads by a wide margin with 271,080,000,000 tons, and is also first in the various grades of brown coals. The world's production for the year 1910 was about 1145 million tons. Making due allowances for loss in mining and for areas that cannot be economically worked, it will be many hundred years before the exhaustion of the supply may be looked for, though taking individual countries the end is in sight in more than one case. The presentation of the monograph was followed by a discussion on the classification of coals.

In the evening a lecture was delivered by Emanuel de Margerie, of France, on "The Geological Map of the World," reviewing the principal maps in use and pointing out their merits and defects. The best geological map in his opinion is that of North America, prepared under the direction of Bayley Willis, director of the U. S. Geological Survey. He suggested that this map should be taken as a model and a complete map covering the other continents secured by a coöperative system.

On Friday, Aug. 8, a large number of papers were read and several commissions met for the consideration of practical questions referred to them by the Congress. In the afternoon the Congress divided into sections for readings and discussions. Magmatic differentiation was the leading topic in Section one and glaciers and glaciation in Section three. Among those who presented papers on the latter subject were G. W. Lamplugh, of England; Dr. A. P. Coleman, Toronto; N. O. Holst, Sweden; W. Wolff, Germany, and Warren Upham and William C. Alden, United States.

Among the numerous papers presented on Saturday was one of special economic interest by Dr. C. N. Gould, of Oklahoma City, on the "Occurrence of Petroleum and Natural Gas in the Mid-Continent Field." He stated that the capacity of the gas wells of that field varied up to 50,000,000 cu.ft. per day. A well recently drilled to a depth of less than 700 ft. in the field of Loco, Stephens Co., in southwestern Oklahoma, produces 25,000,000 cu.ft. of gas daily. M. F. Connor, chemist of the Canadian Mines branch, dealt with the determination of iron by the sulphuretted hydrogen method. A number of the delegates took advantage of week-end trips to Muskoka and other outside points.

On Monday, Aug. 11, the Congress considered the claims of contestants for the honor of entertaining the organization in 1916. The Argentine Republic was anxious that the gathering should be held there, but it was thought that two successive meetings should not be held in America, and Brussels, Belgium, was unanimously selected as the next place of meeting. The Spendiarioff prize awarded each Congress for the best monograph on a geological subject, was given to Emile Argant, of Paris, who dealt with rock formations in the western Alps. A discussion took place on "The Influence of Depth on the Character of Metalliferous Deposits." In the evening a civic reception in honor of the visiting geologists was held at the City Hall, the guests being received by Mayor and Mrs. Hocken. Dr. Frank D. Adams, president of the Congress, entertained a number of the delegates at dinner.

On Tuesday, the 12th inst., no session of the Congress was held, the day being devoted to excursions. A party of 60 under the guidance of Prof. A. P. Coleman, inspected the clay deposits of the Don Valley and visited Scarborough Heights. A party conducted by Dr. Parks, of Toronto University, went to the Credit River to inspect the fossils of rock formation, and others went to Niagara Falls.

"The Sub-Division, Correlation and Terminology of the Pre-Cambrian Period" was the main topic discussed at the session of Aug. 13. Dr. A. C. Lawson, of the University of California, objected to the term "Laurentian"; Dr. Coleman thought it should be retained for the granites intruded throughout the Sudbury series. Dr. Leith, of Wisconsin, was not inclined to accept the Couchiching series as necessarily older than the Keewatin. Other speakers were Dr. Sederholm, of Finland; Dr. Barlow, McGill University; Sir T. H. Golland, of the Asiatic Society of Bengal; Prof. G. A. J. Cole, Dr. Horne, Scotland, and L. Fermor, India. In the evening a banquet was held at the Armories. Dr. F. D. Adams, who presided, alluded to the liberal manner in which the Canadian government and the governments of several of the provinces had contributed to the success of the

gathering, and referred in enthusiastic terms to the resources of Canada, which rendered it "the very paradise of geologists." Among the speakers were Hon. Charles Devlin, Minister of Mines for Quebec; Hon. W. H. Hearst, Minister of Mines for Ontario; Dr. Steinman, of Germany; Dr. Tietze, of Austria; Dr. Termier, of France; and Dr. A. Strahan, of Great Britain.

At the meeting of the Council of the Congress on Aug. 14, Secretary Brock introduced a resolution that an International Committee be appointed, consisting of eight members who have had experience on the Executive Committees of the various sessions of the Congress, to consider the question of a permanent constitution and by-laws, and if possible submit a proposal thereon at the next session. The resolution was adopted. Hitherto the Congress has had no permanent organization, members joining only for the session they attend. In the afternoon, the University of Toronto conferred the degree of LL.D. upon seven of the delegates, Dr. R. Beck, of Freiberg, Germany; Dr. T. C. Chamberlain, of the United States; Dr. Willet G. Miller, provincial geologist of Ontario; J. J. Sederholm, of Finland; Dr. A. Strahan, of England; Pierre Termier, of France, and Dr. T. Tschernyschew, of Russia. The proceedings were closed with a garden party, at which the guests were received by Sir William Meredith, Chancellor of the University, and President Falconer.

In the evening, 115 of the delegates left on an extended trip to Western Canada, the leader of the party being President F. D. Adams, with J. B. Tyrrell as associate leader.



### Finished Steel Production in 1912

The latest issue of the Bureau of Statistics of the American Iron & Steel Association goes with much detail into the production of various forms of finished iron and steel in the United States in 1912. Statistics have been collected from all the manufacturers.

During 1912, or a portion of the year, 565 rolling mills and steel works were in active operation. At the close of 1912 there were 661 plants in existence, of which 96 were idle, most of these being old plants which are hardly in position to operate except under special conditions. There were 19 rolling mills abandoned and 29 new mills completed during the year; while 11 more were under construction. The active mills are situated in 33 states, and the list includes one in the Panama Canal Zone.

The production of iron and steel in rolled forms for the year was as follows, in long tons, all important articles being specified separately:

Articles	Iron	Steel	Total
Rails.....		3,327,915	3,327,915
Plates and sheets.....	75,044	5,800,036	5,875,080
Nail and spike plate.....	8,673	36,658	45,331
Wire rods.....	1,289	2,652,264	2,653,553
Structural shapes.....	5,517	2,840,970	2,846,487
Merchant bars.....	944,790	2,752,324	3,697,114
Bars for reinforced concrete.....	2,500	271,832	274,332
Skelp, fluc, etc.....	327,012	2,119,804	2,446,816
Long angle splice bars, etc.....	51,567	520,115	571,772
Hoops.....		270,007	270,007
Bands and cotton-ties.....		587,395	587,395
Sheet piling.....		22,276	22,276
Railroad ties.....		41,396	41,396
All other finished rolled products.....	220,797	966,311	1,187,108
Rolled forging blooms and billets.....	303	462,173	462,476
Exports of blooms, etc.....		347,783	347,783
<b>Total for 1912.....</b>	<b>1,637,582</b>	<b>23,019,259</b>	<b>24,656,841</b>
<b>Total for 1911.....</b>	<b>1,460,615</b>	<b>17,578,556</b>	<b>19,039,171</b>
<b>Total for 1910.....</b>	<b>1,740,156</b>	<b>19,881,123</b>	<b>21,621,279</b>

Blooms, billets, sheet bars and other half-finished articles are not included, with the exception of those exported in that form.

### MISCELLANEOUS PRODUCTS

Miscellaneous products reported included the following, various stated, as compared with similar production in the previous year:

	1911	1912	Changes
Tin and terneplates, lb.....	1,756,070,000	2,157,055,000	I 400,985,000
Finished angle splices, etc., ton.....		502,771	
Cut nails, kegs of 100 lb.....	967,636	978,415	I 10,779
Wire nails, kegs of 100 lb.....	13,437,778	14,659,700	I 1,221,922
Hammered charcoal blooms.....	64,616	65,807	I 1,191

Finished angle splices were not reported separately in 1911. Of the production of hammered blooms, billets, etc., by charcoal bloomeries last year, 65,557 tons were manufactured into other forms by the makers, only 250 tons being sold as blooms or billets.

### FORGINGS

The production of forged axles, shafting, anchors, armorplate and other hammered forms in 1912 was 392,520 long tons, of which 383,265 tons were of steel and 9155 tons of iron. The total shows an increase of 174,284 tons over 1911, and of 72,658 tons over 1910.

The following table is a general statement of the production of the United States for two years. All products have been reduced to long tons for purposes of comparison:

	1911	1912	Changes
Pig iron.....	23,649,547	29,726,937	I 6,077,390
Steel ingots.....	23,676,106	31,251,303	I 7,575,197
Finished rolled steel.....	19,039,171	24,656,841	I 5,617,671
Miscellaneous products.....	1,491,675	2,229,679	I 738,004
Forgings.....	218,236	392,520	I 174,284

Details of the pig-iron and steel-ingot production have heretofore been published so that it not necessary to repeat them here. The gain in pig-iron production was 25.6%, and in steel 31.9% over the previous year.



### California Oil Dividends

The aggregate oil dividends paid during July by the Mexican and California companies reached nearly \$1,500,000, says the *San Francisco Chronicle*, Aug. 11, 1913. They are shown by the following table:

	Rate	
Amalgamated (a).....	\$1.25	\$62,500
Amer. Pet. pfd (a).....	0.50	8,755
do common (a).....	0.39½	39,607
Central.....	0.02	21,793
Columbia.....	0.015	51,283
Fullerton.....	0.015	30,000
Home (Coalinga).....	0.01	1,000
Marieopa Queen.....	0.01	9,925
Mount Diablo.....	0.01	4,675
Pinal-Dome.....	0.01	9,000
Prod. Tras.....	1.50	105,000
Rice Ranch.....		5,000
S. F. and McKittrick.....	0.01	3,000
Sauer Dough.....	0.05	4,995
Section 25.....	0.01	2,992
State Con.....	0.25	10,000
Union Oil (a).....	0.005	2,512
United Petroleum (a).....	0.60	187,757
Union Prov. (a).....	0.60	48,551
West Coast (a).....	1.50	93,518
Western Union (a).....	0.75	15,612
W. K. Oil.....		7,500
		10,000
<b>Total California companies.....</b>		<b>\$734,771</b>
Mex. Pet. Ltd. pfd. (a).....	2.00	240,000
do preferred.....	1.50	480,000
<b>Total Mex. Pet. Ltd.....</b>		<b>\$720,000</b>
<b>Grand total.....</b>		<b>\$1,454,771</b>
(a) \$100 par value; others \$1.		



The Panama-Pacific Exposition will show copper smelting, gold milling, and niter manufacturing by full-sized working-exhibits.

## PERSONALS

The Mineral Point Zinc Co. has removed the offices of its mining department to Galena, Ill.

R. B. Lamb, of Toronto, Ont., is in Nevada, on professional work and will remain there until the end of September.

M. Gardner Talcott has resigned his position as manager of the Dome Lake Mining & Smelting Co., Ltd., Porcupine, Ontario.

Dr. Albert Fisher and F. H. Morris, of London, England, passed through New York recently on their way to study the Oklahoma oilfields.

Paul A. Cuenot has been appointed head of the boiler, locomotive and scales branches of the Pennsylvania Steel Co., at Steelton, Pennsylvania.

Richard H. Vail, assistant editor of the "Engineering and Mining Journal" has returned to New York from an extended trip through the Southwest.

Earl E. Hunner, who has been chief engineer, has been appointed general superintendent of the Hill iron-ore properties on the Mesabi range in Minnesota.

Thomas M. Kekich, formerly of the Teziutlan and Cerro de Pasco mining companies, is now assistant superintendent of the Great Western Smelting & Refining Co.'s plant in Chicago.

William Smith has been appointed general master mechanic of the Pennsylvania Steel Co. plant at Steelton, Penn. He has been with the Jones & Laughlin Steel Co. for a number of years.

Raymond A. Linton, of Buenos Aires, who has been engaged in mining and other engineering work in Ecuador, Colombia and Argentina, was married Aug. 11 to Miss Lulu Morley Sanborn, of Stevensville, Montana.

P. Eyer mann, of Witkowitz, Austria, has returned to Europe after spending several weeks in the United States and Canada, visiting steel plants and coke works and gathering data as to construction and practice in operation.

Frederick G. Clapp, managing geologist of the Associated Geological Engineers of Pittsburgh, and Alton S. Miller, of Humphreys & Miller, New York, are examining the gasfields of Hungary in company with Prof. Hugo Bockh, of that country.

T. Hagio, manager of the Sunitomo Steel Co., Osaka, Japan, and T. Yamada, an associate, are in this country inspecting iron and steel plants. Mr. Hagio is a graduate of Tokio University and took a post-graduate course at Purdue University, Lafayette, Indiana.

James D. Robertson, formerly sales manager for the Pittsburgh Valve, Foundry & Construction Co., has again assumed charge of the sales of this company, returning as second vice-president after two years' absence. Mr. Robertson in the meantime has successfully completed the organization, plant and launching in business of the Warren Tool & Forge Co., of Warren, Ohio.

Dr. L. L. Hubbard, for many years general manager of the Winona property on the Lake Superior district, has tendered his resignation with both that property and the Houghton Copper Co. He will probably be succeeded by R. R. Seeber, the present superintendent, and A. L. Dickerman, consulting engineer for Mayflower and Old Colony, will probably act in the same capacity for Winona and Houghton.

## OBITUARY

Jacob K. Dimmick, once widely known as a cast-iron pipe maker and later prominent in the iron, coal and coke trades died at the residence of his son in Wynnewood, Penn., Aug. 9, aged 67 years. He was born in Phillipsburg, N. J. After serving in the Civil War he became associated with the Addyston Pipe & Steel Co., Cincinnati, Ohio, and was connected with that concern nearly 25 years, a large part of the time being general manager. In 1889 he built the plant of the Radford Pipe & Foundry Co., Radford, Va., and served as general manager of the company for two years. He then became associated as vice-president and general manager with the Anniston Pipe & Foundry Co., Anniston, Ala., building the company's plant. On the formation of the American Pipe & Foundry Co., he became its vice-president. In 1900 he severed that connection and organized the firm of J. K.

Dimmick & Co., Philadelphia, for the sale of iron, steel, coal and coke, which business was continued until some six months ago.

J. Stephen Jeans died in London, England, July 31, aged 67 years. He was for many years editor and part proprietor of the "Iron and Coal Trades Review," of London. He was born in Scotland and his early training was in newspaper work in that country and in the coal and iron country of the north of England. In 1877 he was appointed secretary to the Iron and Steel Institute, an office which he held until he resigned it in 1893. Early in his connection therewith Mr. Jeans assumed also the secretaryship of the British Iron Trade Association, an appointment which he continued to fill until 1908. Notwithstanding the large demands upon his time which attention to the duties of these offices entailed, Mr. Jeans found opportunity to compile and publish a number of works dealing with the iron and steel and allied industries. Prominent among these is his well known book on "Steel: Its History, Manufacture and Uses," published in 1880; "England's Supremacy" (1884), "Railway Problems" (1886), "Waterways and Water Transport" (1888), "Rings, Trusts and Corners" (1893), "Industrial Conciliation" (1894), and "Canada's Resources and Possibilities" (1904). In addition Mr. Jeans organized meetings of the Iron & Steel Institute in various foreign countries, including the United States, Canada, France, Germany, Austria and Hungary. He also initiated several commissions in connection with the industry, notably one to inquire into Continental iron-making conditions in 1895 and another to inquire into American industrial conditions in 1902, and the reports of both these were mainly compiled by him. He also prepared and conducted the case of the British iron trade before the commission appointed in 1888 to inquire into the Railway and Canal Traffic Act, and before the Tariff Commission in 1904. He also read a number of papers before different societies. Mr. Jeans was well known in this country through his travels here and his valuable report on the American iron industry 10 years ago.

## SOCIETIES

**Iron and Steel Institute**—In accordance with previous announcements the autumn meeting will be held at the Palais des Académies, Brussels, Belgium, Sept. 1 to 4. The following is the list of papers that are expected to be submitted:

1. Armand Baar, Liège: "Reinforced Pile Foundations for Blast-Furnaces."
2. Prof. E. D. Campbell and F. D. Haskins, University of Michigan: "Some Experiments on the Effect of Heat Treatment on the Colorimetric Test for Carbon in a 0.32-Carbon Steel."
3. Prof. A. Campion and J. M. Ferguson, Glasgow: "A Method of Preparing Sections of Fractures of Steel for Microscopic Examination."
4. Baron E. Coppée, Brussels: "The Manufacture of Coke in Belgium."
5. Gen. L. Cubillo, Madrid: "The Manufacture of Armor-Piercing Projectiles."
6. Otto Frick, Beckenham, Kent: "The Electric Refining of Steel in an Induction Furnace of Special Type."
7. Emil Gathmann, Baltimore: "Commercial Production of Sound Steel Ingots."
8. Gevers-Orban, Liège: "The Distillation of Tar in Metallurgical Practice."
9. E. Houbaer, Liège: "The Use of Coke-Oven and Blast-Furnace Gases in Metallurgy."
10. Prof. H. Hubert, University of Liège: "Present Methods of Testing, with Special Reference to the Work of the International Association for Testing Materials."
11. Baron E. De Laveleye, Brussels: "A Historical Survey of the Metallurgy of Iron in Belgium."
12. F. Rogers, Sheffield: "So-Called 'Crystallisation through Fatigue.'"
13. Prof. A. Sauveur, Harvard University: "The Allotropic Transformations of Iron."
14. Dr. J. E. Stead, Middlesbrough: "A New Method for the Determination of the Critical Points Ac, and Ar."
15. Dr. J. E. Stead, Middlesbrough, and Prof. H. C. H. Carpenter, Manchester: "The Crystallising Properties of Electro-Deposited Iron."
16. Benjamin Talbot, Middlesbrough: "Modern Open-Hearth Steel Furnaces."
17. Gustave Trassenster, Ougrée, Belgium: "The Use of Oxygen in Blast Furnaces."
18. C. Vattier, Valparaiso: "Note on the Principal Deposits of Iron Ore in Chile."



## EDITORIAL CORRESPONDENCE

### SAN FRANCISCO—Aug. 14

**Protection of North Star Shareholders** in the East was the object of certain steps taken by Herman Zadig, president of the Tonopah-North Star. Though he still refuses to establish a transfer office in New York it is reported that he has declared his intention to appoint the Security Transfer & Register Co., 66 Broadway, as agent to authenticate certificates presented by shareholders in names other than their own. Mr. Zadig stated that only six forged certificates have been discovered and he is of the opinion that no more have been sold. W. C. Ralston has offered to attend to the transferring of all certificates sent from the East either to his own name or the name of any person designated, thus placing the certificates beyond suspicion of forgery and provide for instant delivery without question. Shareholders are advised, however, to postpone transfers until Sept. 15, on which date the company will be prepared to exchange old lithographed certificates for new ones which are engraved. For one month the company will make these exchanges free of cost to the shareholders. The shareholders have been advised to transfer their shares in their own names, as it is probable that a dividend will be declared before the end of the year, and can be sent to the addresses already on the ledger thus avoiding delay and annoyance to the shareholders. Since the Pinkertons have failed to apprehend the forger the directors are considering the advisability of offering a reward in cash for his apprehension.

**Gold and Copper Production** estimates for California for the first half of 1913, indicate a large increase over 1912. The gold production is estimated at \$11,000,000; the copper production is estimated at 18,000,000 lb. The increase in gold is largely due to an increase in the number of gold dredges in operation and to the advancement of quartz mining in the Mother Lode counties, including Tuolumne, Calaveras, Amador and Eldorado, also to a large production in Nevada County, and to hydraulic and placer mining in Siskiyou, Trinity and Sierra Counties. The gain in copper production is due chiefly to the steady operation of the Mammoth mine and smelting works in Shasta County, and the increased yield of the Mountain Copper Co. in the same county. There was also a good production of copper from Calaveras County. Yuba County maintains its position as leading gold producer in the state, the bulk of which comes from the dredging districts. Amador County, the leading county in the Mother Lode region, is a close second. There has been a general advancement in development work and in the installation of improved reduction plants. The latter part of the first half of the year was dry and thus the increase in gold production was not so great as it otherwise would have been. The beginning of the second half of the year showed a decided improvement in the water-supply in several counties owing to unusual rains. The rains in California mining districts are usually confined to the winter season, but in 1912 the Mother Lode counties received rain in a large amount as late as April, and in the present year there was rain in the Mother Lode region and in some of the northern counties, chiefly Siskiyou, as late as July.

### SALT LAKE CITY—Aug. 16

**The Utah Copper Payroll** amounts to approximately \$375,000 per month, and total expenditures for wages, supplies, etc., are said to be between two and three times this amount. The output of the company since the beginning of operations is reported to have been approximately \$65,000,000 in copper, gold and silver. The last quarterly dividend paid in June was \$1,187,000 or a little more, and total dividends to date amount to \$18,080,562. During the first six months of 1913, there were produced 5,669,915 lb. copper.

**The Value of Phosphate Rock** produced in the United States according to statistics for the year 1909 was \$10,881,869. A report on the fertilizer resources of the country made by the Bureau of Soils of the Department of Agriculture gives what are regarded as conservative estimates of the phosphate rock in 1911. Utah, Idaho, Wyoming and Montana have the largest resources, there being estimated to be in these four states combined 2,500,000,000 tons of high-grade rock, and low-grade material equivalent to an additional 6,667,000,000 tons of high-grade rock. The high-grade phosphate in these states carries 72% tri-calcium phosphate.

Tennessee, South Carolina, Kansas and Florida are the other states in which phosphate deposits are found. The combined estimated phosphate rock in the latter states amounts to 349,000,000 tons.

**The Mill at Silver City**, which is being erected by Jesse Knight will not be ready before Oct. 1. The main mill building is up, and some of the heavy equipment including crushers, etc., has been installed. The building is about 200 ft. long and 50 ft. wide, with a maximum height of 75 ft. The capacity of the first section is expected to be 100 tons daily, which may later be increased. Ore can be dumped from the cars of the Knight railroad to the bins above the crushers. Details of the milling process or method of treatment have not been made public, but it is understood that a leaching process will be used. The metallurgical work is under the direction of N. C. Christensen. Tintic low-grade ores have presented new problems in concentrating or treatment, and up to the present time it has not been possible to mill them successfully. There is a large tonnage of low-grade ore on hand.

### BUTTE—Aug. 14

**Electrical Workers Have Struck** for higher wages, all line-men working for the public-utility companies of Butte, and within a radius of 20 miles, having stopped work the morning of Aug. 12. A committee of the electrical workers appeared before the Butte Miners Union at the regular meeting and gave the assurance that no attempt would be made to close the mines or reduction plants and that the electricians employed at these places will remain at work. The electrification of the Butte, Anaconda & Pacific R.R. between Butte and Anaconda has been halted, and as a result the company has given up hope of having the line in readiness to operate by electricity this month as was recently announced. The companies immediately affected by the walkout are the Butte Electric Light & Power Co., Butte Electric St. Ry. Co., Independent and Bell Telephones, Western Union and Postal Telegraphs, and the Butte, Anaconda & Pacific R.R. The men asked for a raise in wage from \$5 to \$6 per day for journeymen and from \$6.50 to \$8 for foremen and splicers; an 8-hr. day; half holiday on Saturday and double time for holidays and overtime.

### CALUMET—Aug. 16

**A General Fight Between Deputies and Strikers** occurred Thursday, Aug. 14, in the afternoon at the Seeberville location of the Champion mine, at one of the boarding houses and resulted in the killing of two strikers and the wounding of three others. This is the most serious trouble experienced since the beginning of the strike. The deputies went to make an arrest of one of the men for threatening a guard at the Champion property. The man was approached in the yard, but refused to accompany the officers and escaped into the house, from which a shower of bottles, etc., was hurled upon the officers, accompanied by the firing of revolvers. The deputies then rushed into the house where a general mêlée ensued. Several arrests in different places in the district have been made for intimidations, and at the Kearsarge mine, one of the militia men was found by a sentry, unconscious and with a wound on his head. At the Quincy a sentry wounded a striker trying to get through the guard line. A small quantity of rock was hoisted at the Champion, of the Copper Range Consolidated, and at the Calumet & Hecla mine rock was hoisted at the No. 5 Calumet shaft and also at Red Jacket shaft. The underground force is being materially increased and in all probability hoisting will be resumed in the other shafts shortly. Much repair work is being done underground and the rock coming from this source is being hoisted and crushed. As a result of the meeting of the non-union employees of the Calumet & Hecla, when the committee received a registration of all employees who wanted to return to work, the company has a list of fully 70% of its employees, who are waiting to be notified to return to their former places. A reduction has been made in the military force and there are now about 1200 men remaining in the district, which force will probably be maintained until conditions become more settled. The sheriff has a large force of deputies who are cooperating with the military force. C. E. Mahoney, vice-president of the Western Federation of Miners, has returned, but nothing has been given out from union headquarters regarding the payment of strike benefits by the Federation.

**DULUTH—Aug. 12**

**Shipping Has Become Normal** again and the fleet of vessels that was thrown out by the strike of the ore-dock workers has been put on regular schedule. Twelve boats cleared within the 24 hr. ended Aug. 12, laden with ore for lower lake points. There are more than a dozen boats now at the Allouez docks, in Superior, but they are being loaded in good time. More than 400 men are at work, which is more than the usual number. D. M. Philbin, in charge of the Great Northern properties, offered to take back all the striking men, excepting the Finns, who have caused a lot of trouble, and to give the men free lodging and board until the strike is ended. This is the second time that the Industrial Workers of the World have been defeated here. The first was last summer when trouble was experienced at the Northern Pacific merchandise docks. Mining operations that were interrupted at the open pits on the Mesabi range are running full force again, and the ore-train crews that were laid off have returned to work.

**DEADWOOD—Aug. 12**

**The Lundberg, Dorr & Wilson Mill**, in Fantail Gulch, near Terry, in the Black Hills, South Dakota, has been permanently closed. This mill has been operating practically continuously since January, 1904, and has been a well known factor in Black Hills metallurgy. The mines of the company were opened in the early '80s, and as no recovery could be made by amalgamation or concentration, the first ore produced was shipped to Omaha, part way by wagon. The freight and treatment charge amounted to \$40 per ton. Later the ore was smelted at Deadwood. After producing more than 31,000,000 gross, the Buxton Mining Co., the original owners of the property, stopped operations and turned the property over to lessees, believing that the mine was worked out and that no further profit could be made from it. It was finally sold and the new owner leased it to John Lundberg, who mined the ore and treated it at the cyanide plant of Lundberg & Dorr, at Deadwood. Later the corporate name was changed to Lundberg, Dorr & Wilson, which firm bought the property and built a new mill to treat ore running from \$4 to \$6 per ton, of which there was believed to be a large quantity in the mine. A cyanide mill was designed to treat 75 tons per day, but its capacity was gradually increased to 110 tons, and both mining and milling costs were reduced until \$3 ore was profitably treated. The mill is of interest historically as it has passed through the whole period of American cyanide practice. When the mill was designed, sand leaching was the accepted method of operating and slime was undesirable, both on account of the difficulty of separation from sand and the recognized losses in decantation, then the accepted method of slime treatment. The necessity of retaining all mill tailing, as well as efficiency, led to the introduction of a Moore filter, which installation was the first one to remain in successful operation for any length of time. The difficulties met with in separation by hydraulic cones was overcome by the invention of the Dorr classifier, in 1904, and from this mill the use of mechanical classifiers spread to all cyanide operations. Chilean mills were used for fine grinding for the first time in the Black Hills, and belt elevators for raising pulp crushed in cyanide solution. The total amount milled was approximately 285,000 tons, three-fifths of which came from the company's mines and the rest from custom ore. The total production as estimated was \$1,500,000. As the ownership of the property is a partnership, the earnings are not of general interest beyond the fact that the net profits, after deducting the cost of the plants and all improvements, are several times as great as the estimate made before the property was bought, although the actual value of the ore has been less than estimated.

**NOME—Aug. 2**

**A Complaint by the Dredging Companies** has been made against the new Alaska mining law. Under the new law they must perform \$100 worth of labor within 90 days from discovery for every 20 acres of mineral land staked, and after next year they will have to perform \$100 worth of labor every year for every 20 acres of mineral land they desire to hold. This will make it costly to hold large areas of land. A dredging company, of course, must have a large area of land or the enterprise cannot hope to be successful. The new law, say the dredging companies, will not only put them out of business, but by forcing them from the field through excessive annual labor requirements the money they have paid for the claims and the improvements they have put into the claims during the last few years will be lost. No one can deny that the dredging companies are going to suffer by the new law, but there is hardly a change of law that does not

benefit somebody and injure somebody else. The new law was written for the benefit of the individual prospector who is willing to work and whose work is of the kind that opens a country quickly. It was aimed against the speculator-pro prospector. These speculators have gobbled up hundreds of square miles of land in the territory, in the form of association claims, without so much as making certain that the land is mineral land. Some of the land that is acquired from these speculators by large mining companies is so low-grade that it could not be worked by individual operators, but it is also true that the system reduces the field for the individual miner. Most good Alaskans would prefer Alaska to be a country of the many individual miners, rather than of a few comparatively large mining companies. The intent of the law is to give the individual a chance again, in the hope that there may return more prosperous times such as existed before the gross value of the association claim law began.

**CORDOVA, ALASKA—Aug. 7**

**The First Gold from Shushanna** or Shushanna has been shipped. The largest individually owned part of this shipment was made by Billy James, the discoverer, who sent out \$10,000 in dust with which to pay for supplies at Chitina. Since then various amounts of gold dust have been brought out to McCarthy. The gold is all coarse; the nuggets ranging from \$5 to \$35 each. None of the panning goes below \$4. The diggings are shallow, the distance to bedrock being but from 1 to 5 ft. The wash is porphyry-slate, with no boulders. Pay has been found on Bonanza, Eldorado, Coarse Gold and Johnson Creeks. Those looking for the Shushanna on the Government maps will fail to find the name, as it is there spelled Chisana (not to be confounded with Chisna, which is in the Slate Creek district). To the prospectors and Indians the river is known as the Shushanna. That this district would become one of the great mineral-bearing regions of Alaska has for years been the firm belief of many miners who have prospected in the vicinity. As far back as 1904, indications of placer gold were found on the right limit of the Shushanna from the bend of the river to the glacier, a distance of from 40 to 50 miles. The Shushanna has in the past been but superficially prospected for placer gold. In fact, little was known of the region as a placer up until the time of the stampede. The formation at the head of the Shushanna consists principally of diorite, or what is commonly called greenstone, together with limestone. Ten miles below the glacier, at the head of the Shushanna, the formation changes into slate and sedimentary rock. Thirty miles below that, near the bend of the river, the formation runs into schist, which is the formation of the Klondike, Fairbanks, Nome and other great placers. The same formation is found on the Nabesna, which is the right-hand fork of the Tanana. The mean distance between the Shushanna and the Nabesna rivers is about 40 miles, a high range of mountains dividing the two. The district is most easily reached from the States via Seattle to Cordova and from there by the Copper River R.R. to McCarthy, a distance of 190 miles and from there by trail to Scoll Pass and from there to the Shushanna, a distance of about 100 miles, or a total distance from Cordova of practically 300 miles. From Skagway the trip is made via White Horse, Lake Kluane to the White River crossing, up the Beaver to the head of the Tanana or Alder Creek, a total distance of about 350 miles. Several have sent outfits from Dawson by the way of White River. They then go from Kirkman landing, above Dawson, with horses on the trail, pole up White River to the mouth of the Snag, then "mush" overland by way of Beaver River. It is estimated that fully 5000 will winter in the new district and so far 400 have left for the strike, passing through Cordova. Many are in from Nome, Fairbanks, McCarthy, Skagway and Dawson and other camps not yet heard from. George Wolf, who made the strike with Billy James, was being grubstaked by Brady Howard. It is claimed that Wolf is taking out \$2500 a day. The best claims so far opened are on Eldorado, where with a short string of boxes, with three men working, \$500 to \$1500 is being washed out daily. Good pay has been struck on six creeks and some prospecting indicates that five others have good pay ground.

**TORONTO—Aug. 18**

**The Timiskaming & North Ontario Railway Commission** has made six surveys to locate an extension of the Elk Lake branch to or beyond Gowganda, but so far no route has been discovered that would warrant construction. The parties are still in the field and every effort will be made to find a route. The Government will build a new colonization road from the Government wharf on Lake Timiskaming into South Lorrain, and another road from Haileybury to the Montreal River, a distance of 14 miles.

# THE MINING NEWS

## ALASKA

**DROUGHT HAS HANDICAPPED MINING** on the Seward Peninsula. At Nome there are 38 dredges operating this summer, each dredge averaging 12 men, and it is estimated that the dredges provide a payroll to the Seward Peninsula of \$5000 per day. In the Fairbanks district the water shortage which has been felt on all the creeks was the worst for many years. However, this section had a steady rain about the middle of July, enabling some of the plants to again start operations.

**MATTHIESON**—This company, with only five men at work, is taking out \$500 per day. The property is in the Seward district.

**TOPOK DITCH CO.** (Nome)—The property of this company, comprising mines, ditches, machinery, etc., has been sold by the U. S. court, to Oscar Ashby; it is said that \$60,000 was the price paid.

## ARIZONA

### Cochise County

**THE LOADING PLATFORM AT BENSON** is crowded with ore from shippers on the north side of the Santa Rita Mountains. The Royal Blue is shipping ore from a recently encountered 4-ft. shoot as fast as teams can be procured. The Rosario has nearly a full carload of ore on the platform and the Blue Lead continues to be a steady shipper, having maintained its record for regular output since the inception of the company last autumn.

**WASHINGTON AND DUQUESNE** (Benson)—Shipments continue regularly from these two properties, in spite of a 21-mile wagon haul.

**GREAT WESTERN COPPER CO.** (Courtland)—This company, which recently bought the old Mammoth-Collins group of mines, on the San Pedro River, 50 miles north of Tucson, has a force of men on the ground preparing for development on a large scale. Machinery is arriving and when installed the shaft, now 750 ft. deep, will be sunk 300 ft. deeper. This mine has been one of the best producers of gold in the county. It is also rich in wolfeinite. It is reported that there is considerable good ore in sight and much promising virgin ground.

### Gila County

**MIAMI** (Miami)—The ground in the northwest section of the orebody that was injured considerably by settling of the capping in April has been restored to working condition and the mine is yielding considerably in excess of 3000 tons of ore daily. Repair work at the Red Springs shaft is almost completed and the retimbering and enlarging of the Captain shaft down to the 420-ft. level is nearing completion also. Lauanders to carry tailings to a new site east of the present tailings pond are about finished.

**INSPIRATION CONSOLIDATED** (Miami)—Grading for the flotation test mill is well under way and it should be completed within six months. Its capacity will be 600 tons daily. At the mine, work is lagging somewhat underground because of the general readjustment under the direction of General Manager C. E. Mills. The concrete bins at the mine are well along in course of construction and a separate crushing plant is being installed at the mine to reduce the rock from the Scorpion shaft to a size suitable for concrete material.

### Greenlee County

**CORONADO** (Clifton)—Nine men were killed and one probably fatally injured, Aug. 14, when a cable pin snapped and two ore cars, carrying 12 tons of ore and 13 miners, dashed down a 38° grade for a distance of 3300 feet.

### Plima County

**SAN XAVIER**—This property of the New Jersey Zinc Co. ships zinc ore, autotrucks carrying the ore from the mine to Sahuaripa station on the Nogales branch of the Southern Pacific R.R. The mine is also producing some lead-silver ore, which is shipped to El Paso.

**OLIVE**—Three cars of high-grade lead-silver ore and concentrate are produced each month. Shipments are made to El Paso. The mill is treating 40 tons per day of 8 hr. of ore that comes mainly from the old dumps. Development work is being pushed on the Olive, Swastika and Wedge claims. The shaft of the Wedge mine is 200 ft. deep with 3 ft. of ore in the bottom, assaying 15% lead and 15 oz. silver.

### Pinal County

**COPPER REEF** (Globe)—An electric furnace with a daily capacity of 50 tons is being used at Globe to test Copper Reef ore of which about 5 tons recently was brought to Globe for the test.

**CALUMET & ARIZONA** (Superior)—An unconfirmed report is to the effect that the main tunnel has encountered a well defined vein of copper ore carrying a streak of high-grade silver. Considerable silver has been extracted from shallow surface workings on the property in the past. A crew of men is at work laying the foundation of a 15-drill compressor. The pump station on the 500 has been finished and sinking resumed.

### Santa Cruz County

**R. R. R.** (Patagonia)—At this copper mine in the Patagonia district only eight men are working. A two months' extension of time has been granted for the next payment on the property.

## CALIFORNIA

### Amador County

**CENTRAL EUREKA** (Sutter Creek)—The shaft is being deepened. It is expected to sink 200 ft. below the present lowest level before the mill is again put in commission. It is believed that extensive oreshoots will be developed at 200 to 500 ft. below the lowest level.

**SOUTH JACKSON** (Jackson)—Six men were recently laid off and it was reported that the mine would close down. This report has not been corroborated. It is said that the drift west at the 500-ft. level failed to develop satisfactory ore. The drift east is reported to have cut a vein, or vein matter, immediately following the laying off of the men. It is estimated that about \$100,000 has been spent in development work, and it is believed that the mine will yet be a producer.

**ZEILA** (Jackson)—The force has been reduced, and mining is being confined to the upper levels. It is reported that a large oreshoot has been disclosed in the north end of the mine, but too far from the shaft for profitable extraction. The mine has been examined by prospective purchasers within the last two years, and there was at one time a probability of a sale. What the present action indicates is known only to the owners of the mine. It is believed that when the present supply of surface ores is exhausted the mine will either be temporarily closed down, or be sold.

### Butte County

**RUMBLE** (Oroville)—At this drift mine, on Thompson flat, the shaft was recently cleaned out and deepened. An electric hoist was installed, and a new pipe line laid.

### Calaveras County

**SOUTH CAROLINA** (Carson Hill)—Ten new stamps are now installed. The mill has now 20 stamps crushing ore.

**UTICA** (Angels)—The Stickle mill did not close down, as recently reported. The stamps are dropping on ore from the Cross shaft.

**WATERMAN** (Angels)—A cement lining is being built in the 3-compartment shaft, from bedrock to a height of 6 ft. above the collar, or a total of 26 ft. The purpose is to make the mouth of the shaft fireproof. The shaft will be deepened to 1000 ft., that depth having been reached with a 5-in. drill.

### Eldorado County

**LUCKY MARION** (Greenwood)—A grass fire west of Greenwood destroyed the stamp mill and other buildings, July 16.

**CHANNEL BEND** (Georgetown)—This old producing mine on American River, near Josephine, known in the early days as the Egie Bar mine, will be reopened by N. L. Kohn and others.

**UNION** (Eldorado)—It is reported that this mine will be reopened. The old shaft is about 1600 ft. deep. The equipment includes a 20-stamp mill, pipe line, ditch, and steam and water hoist.

**BLUE ROCK** (Georgetown)—This old gravel mine, which has been operated in a primitive way continuously for 60 years and has produced large amounts of gold, has recently been taken over on a lease by Leo and Thomas Flynn, Henry Miller, Peter Morgan and Thomas Armstrong. Improved mining methods are contemplated.

### Fresno County

**SUNNYSIDE GOLD MINING CO.** (Fresno)—This is a new incorporation organized to develop quartz claims in the Sycamore district.

### Placer County

**PROGRESSIVE PLACER CO.** (Iowa Hill)—A corporation of Ohio men has taken over this old gravel mine in Bumpus Cañon, and it is reported that improved gravel-mining machinery will be installed of 500 cu.yd. daily capacity.

**CHARLES GAWS** (Auburn)—These gravel claims on the north fork of American River, one mile below Auburn, are reported to have been bonded to a syndicate that will start prospecting with Keystone drills. If drillings show satisfactory gravel a dredge will be built. The name of the syndicate has not been made public.

### Plumas County

**COREY & WARE** (Belden)—The tunnel is expected to tap the channel 40 ft. further in.

**GOLDEN ANCIENT** (Quincy)—The pay channel has been found in a new shaft, and it is reported that a large quantity of gravel has been disclosed. L. A. & C. C. Smith, of San José, are operating the property.

### Sierra County

**NEW JERSEY** (Forest)—At this drift mine the tunnel is being extended to tap the northeast extension of the Gold Star gravel deposit.

**MIDDLE NORTH FORK** (Downieville)—The incline sunk by Morse Bros. and associates has reached bedrock, and rich prospects in coarse gravel are being taken out.

**RUBY** (Downieville)—Operations have been resumed on this drift mine by Oakland men who hold an option. The Ruby joins the Wisconsin and in early days was worked extensively, with rich returns.

**COLORADO****Clear Creek County**

**PORTLAND**—This property, on Albro Mountain, has been reopened. The shaft has been cleaned out and it is reported that the showing in the bottom justifies additional sinking, which the company contemplates doing in the near future.

**UNITED STATES MILL**—This plant, on lower Fall River, has been leased to Mason & Bartlow, who are overhauling the machinery and placing it in working order, preparatory to treating ore from the Shafter mine and other properties.

**CALVIN**—This group of properties, near the head of Virginia cañon, is being developed by the newly organized Calvin Mining Co., capitalized at \$100,000. This property has produced some pay ore in the past and it is reported that recent operations have been encouraging.

**COMBINATION MILL**—(Idaho Springs)—The tube mill which is reported to have required 40 hp. has been replaced by a Traylor pan. It is claimed that this pan grinds the pulp received from the stamp battery to 200 mesh with a consumption of 12 hp., and that the change has increased the efficiency of the mill.

**KEYSTONE**—Development has been resumed on this property on Bellevue Mountain. The work is being conducted through the Lucania tunnel and the compressed-air power is being purchased from the Restedt compressor plant on Fall River. The ore is complex, containing gold, silver, lead and zinc. It is the intention to ship to the plant of the Sutton, Steele & Steele Co., at Denver.

**DORIT**—The 50-ton mill is completed and is now in operation. It is reported that the ore delivered to the mill averages \$8 per ton in gold, silver and lead, and that the recovery is satisfactory. The company estimates a substantial reserve of milling ore in its mine and contemplates systematic development sufficient to maintain this reserve. This plant differs from the other plants in the district in that it is equipped with a Lane mill.

**BLUE RIDGE (Dumont)**—Extensive development is being done in this property, on Columbia Mountain. The upper and lower workings are being connected by a raise, which requires an extension of about 100 ft. to complete the connection. It is reported that the raise is in pay ore. The east drift from the bottom of the 100-ft. winze, sunk from the lower level, has opened a vein of smelting ore. It is reported that the ore assays 175 oz. silver per ton, and that the smelting streak is accompanied by 4 ft. of milling ore that will assay \$10 per ton.

**Eagle County**

**ELKHORN (Eagle)**—At a depth of 20 ft. rich ore has been cut by a diamond drill.

**NORTH DAKOTA (Eagle)**—This mine, adjoining the Lady Belle, is under lease to Marion Henry, of Leadville.

**LADY BELLE (Eagle)**—Up to Aug. 10, 28 carloads of ore had been shipped from this mine; two more are being loaded.

**ZARMAN RANCH (Eagle)**—Diamond drilling on this ranch is being done by a company organized by George Wilkenson, James Diltz and B. Hickman. At a depth of 75 ft. ore similar to that found at the Lady Belle was cut.

**Lake County**

**NEW MONARCH (Leadville)**—The Rainey and Nicholson leases are being equipped with two more hoists, the installation being made by the Colorado Power Co. The Rainey will have a 37-hp. hoist and the Nicholson a 15-hp. Two shafts will be sunk at once.

**Summit County**

**FRENCH GULCH DREDGING CO. (Breckenridge)**—A 46-lb. lot of retorted placer gold which was taken out of the stream-bed deposits of French Gulch by the Relling dredge, has been shipped. The value of the shipment was about \$10,000.

**MEKKA PLACER (Breckenridge)**—B. F. Hall, who has been operating the high bars of the Mekka placer, up from the Relling dredge, has shipped a 44-oz. retort to the mint. The hydraulic operations have disclosed richer pay which will no doubt result in larger clean-ups while it lasts. More gravel has been moved this season on the Hall lease than used to be moved under former operation in three seasons.

**GEORGIA****McDuffie County**

**EDMONDS**—This mine is being reopened by A. J. Overton.

**IDAHO****Cœur d'Alene District**

**MORNING (Mullan)**—It is reported that the Federal company plans to increase the zinc-slime plant. Under the new plan all mill feed will be reduced to slime.

**STEWART (Kellogg)**—The question of providing for the purchase of additional property and stock in other companies will be voted on at the annual meeting, Aug. 29. The company has made all arrangements for building a large concentrator at the mouth of Big Creek, between Wallace and Kellogg.

**YANKEE BOY**—Contractors have started work on the new tunnel at this property, which is being operated under lease. The work is now being done by hand, but machine drills will be used as soon as the new compressor is installed. Some ore is being taken from the old stopes in the upper levels, which is rich in silver.

**SNOWSTORM (Larson)**—The mill at this property is treating 7000 tons of ore per month, the extraction being good. Better results are being obtained by milling the ore than by shipping, as in the past. The company is sinking a shaft, east of the fault, in an effort to recover the vein. When the shaft is down 600 ft., a crosscut will be driven about 200 ft. to the vein. If necessary, the shaft will be sunk to the 1000-ft. level.

**LACLEDE (Burke)**—Ore has been encountered in the winze, which is being sunk from the No. 2 level. The shaft was started on the vein 1800 ft. from the portal of the tunnel and 200 ft. from where the tunnel crosscut the vein. In the past the flow of water caused considerable trouble, but at present little water is found. This is probably due to the draining of the country by the deeper workings of the Hercules and Tamarack. The Laclede lies between these two properties.

**BIG FOUR (Marcus, Wash.)**—Development work with a double shift of miners is to be begun immediately. A shaft has been sunk to a depth of 105 ft. on the orebody and a tunnel has been driven in on the vein 190 ft., showing good gold and silver ore. The new work will be the driving of crosscut tunnel 250 ft. to tap the vein 200 ft. below the present workings. The prospect comprises eight claims, including 80 acres of heavy timber, and lies only two miles from the Spokane Falls & Northern Railway.

**MICHIGAN****Iron**

**IMPERIAL (Michigamme)**—This property has been closed down for almost two years, but there has been a considerable amount of ore in stock, the shipping of which was commenced a week or two ago. A total of 54,000 tons was sent out last summer and the pile will be about gone when this season ends. The property is leased by the Cleveland-Cliffs Iron Co., and was recently put in condition for mining. The ore is limonite and not readily disposed of in the market, although it melts well with some ores.

**MINNESOTA****Cuyuna Range**

**CONSOLIDATED CUYUNA IRON CO. (Crosby)**—Drilling operations have been started on Sec. 34, 47-29. The company is newly organized by Cuyuna range men; capitalization, \$500,000.

**INLAND STEEL CO. (Crosby)**—Stripping operations have been started at the Thompson mine, one steam shovel being at work. This property was operated as an underground mine until recently.

**LOCKER-DONAHUE CO.**—This company has platted the town of Steelton, on the shore of Mahanomen Lake, near the Cuyuna-Mille Lacs mine. The Iron Mountain shaft and Duluth-Brainerd shaft are near-by.

**CUYUNA-DULUTH IRON CO. (Ironton)**—The first shipment from the property was made last week to the Lake Superior Iron & Chemical Co. at Ashland, Wis. The company has contracted to ship 50,000 tons this season.

**PITTSBURGH STEEL ORE CO. (Riverton)**—A contract has been let to the American Concentrating Co., of Philadelphia, for the erection of a concentrator at the Rowe mine. Some of the details of the process to be used have not yet been finally passed upon.

**PENNINGTON (Crosby)**—The first shipment was made from the open pit, Monday Aug. 4. This Tod-Stambaugh property will be a continuous shipper from now on. The management expects to ship 100,000 tons or more this season. This is the first open pit on the Cuyuna range.

**IRON MOUNTAIN MINING CO. (Crosby)**—Considerable difficulty is being experienced in sinking the new 3-compartment shaft, due to quicksand several feet thick, immediately above the ore formation. This is a condition not uncommon on the Cuyuna range, although usually the thickness of the bed of quicksand is not great enough to cause trouble.

**Mesabi Range**

**COLUMBIA (Virginia)**—The city of Virginia and the Interstate Iron Co. have come to terms over this mine, the council finally agreeing to vacate several streets and alleys for the sum of \$4000. The area of the tract is about equal to 70 city lots, and the company has been endeavoring for some time to get permission to remove the ore underneath. The overburden will have to be removed. The land is at the city limits and will not cause any inconvenience to the residents of the city.

**Vermilion Range**

**VERMILION (Tower)**—At this mine of the Consolidated Vermilion company an exploration shaft is 40 deep. It has been in ore from the surface, the outcrop being ore of a good grade. The ore at a depth of 40 ft. assays 60% iron. The outcrop is on the side of a large ravine, and the indications are that the deposit extends under the swamp at the bottom.

**SIBLEY (Ely)**—The Oliver Iron Mining Co. will in the near future complete at this mine a new shaft, which will be raised and timbered up from the old workings. The shaft will be 1400 ft. deep and will be 10x20 ft., with five compartments. The headframe will be of steel with a concrete backing and will be similar in design to other steel shafthouses that have been erected by this company.

**LUCKY BOY (Elk)**—At this property of the Vermilion & Mesabi Iron Co., drifting has been resumed on the 210-ft. level. Operations had to be suspended at that point for some time because of a heavy inflow of water. A large orebody was found at a depth of 90 ft., and more ore was found at a depth of 140 ft.; good ore was also found on the 210-ft. level, and the shaft will be sunk deeper and another crosscut driven at 260 ft.

### MISSOURI

#### Joplin District

A RECORD FOR SHALLOW OREBODIES in the Joplin district was made this week at Aurora, when a lead vein was encountered 5 ft. below the surface by Stratton Bros., working a lease of the U. Z. ground. Two loads of wash dirt were taken out in one day, with the shaft down only 10 feet.

ELLIOTT & CO. (Joplin)—Rich ore has been found for a distance of 57 ft. by drilling on the Sleepy Hollow land. Two other drill holes also showed zinc ore. Two shafts are to be sunk soon.

DEXTER & CO. (Joplin)—A 200-ton concentrator is being built on a lease of the Gray land southeast of Joplin. Drilling revealed a large area of mineralized ground and a shaft has been sunk into the ore.

ZENA D (Joplin)—Zinc ore has been discovered on a 40-acre lease of the Shoemaker land, southeast of the city. The ore is found from 149 ft. to 167 ft., the level now being worked; some galena also is being hoisted.

WHIRLWIND MINING CO. (Joplin)—A depth of 94 ft. in the mine at Zincite has been attained. An 18-ft. face of zinc ore is being worked. Plans for a concentrator have been made. Hand jigs now are being used.

WILSON MINES (Duenweg)—The plant has been re-modeled, increasing the capacity, and ore from two shafts will be treated. The bull jig was removed and replaced with an ordinary rougher, and a sand jig was also installed.

GERSTER & RAINES (Joplin)—Following the destruction by fire of the Red Lion mill the Red Lion lease was purchased and a 200-ton mill on this lease has just been completed. Production was resumed the first week in August.

PACIFIC (Carthage)—The mine has been drained and operations are to be started in the drifts where ore is in sight. Two pumps have been installed, one for emergency, and the operators believe constant operations now can be conducted.

TWO BOBS MINING CO. (Thoms Station)—This company has just opened up at the 108-ft. level on a lease of the Snapp land what is termed an old-fashioned lead bonanza. The ore now being hoisted is as rich as any seen in this field for several years.

WHIRLWIND MINING CO. (Carl Junction)—New steam equipment has been installed at the lease on the Budd M. Robinson land. Some good ore was developed at 60 ft., but in sinking deeper still richer dirt was found and the 94-ft. level shows exceptionally good ore.

CRAGG MINING CO. (Joplin)—A 300-ton concentrator is to be built on a lease of the James Luke land, on West Seventh St. It will be built on a lot adjoining a mill that has been operated several years. The operating of this second mill is to be continued after the new mill is completed. Zinc ore is being hoisted from sheet-ground formation.

VINEGAR HILL MINING CO. (Joplin)—This company has purchased a one-half interest in a lease of the Cooper land, at Hattenville, Okla., from the Church-Mabon Co., paying \$50,000 for it. The development on the lease consists of 16 drill holes, each said to be in ore. Drilling on the land was begun several months ago. Shafts are to be sunk to the ore formation.

BEAR CAT—(Sarcoux)—The lease of this company on the J. W. Boyd land was sold to the Grasselli Chemical Co. The lease covers a period of 20 years and includes the mine and 70 acres of land. The retiring company of Kansas City men has been in control since last February. It is the plan of the Grasselli company to improve the plant and conduct a development campaign.

#### St. Francois County

THE MINERS WENT OUT ON STRIKE Saturday, Aug. 16, as was threatened earlier last week. The mines are closed; no rioting or disorder has yet been reported.

### MONTANA

#### Butte District

ALEX SCOTT (Butte)—It has been decided to continue sinking the shaft from the 1900-ft. level, its present depth, to the 2200-ft. level, and the work will be commenced at once. The ore being hoisted at present is coming from the 600-, 1200- and 1900-ft. levels.

#### Fergus County

KENDALL (Kendall)—After thoroughly inspecting and sampling the workings, a company of mining men who were considering the advisability of reopening the property on a lease, decided that the showing was insufficient to warrant it. It is probable that no further attempts will be made to operate the mine.

#### Granite County

SWASTIKA (Philipsburg)—The shaft has nearly reached the 100-ft. level. The shaft water is carrying considerable copper in solution and the management is preparing to build precipitating tanks to recover this copper.

#### Lewis & Clark County

EUREKA—Anaconda men have taken a lease and bond on this gold property situated 12 miles east of Helena. They are preparing to instal a sinking pant and develop to a depth of 500 ft. or more.

OLD DOMINTON (Helena)—The work of concentrating the old dump at this mine in Blue Cloud gulch has been started. After screening, the residue from the screenings is to be jigged, and the resulting product shipped to the East Helena smelting works.

#### Lincoln County

KALISPELL-LINCOLN (Libby)—A bar of gold weighing 61 oz., the result of the first cleanup of the summer's work from 26 tons of ore mined at this property in the West Fisher district, has been sent to Libby. The bar is valued at \$1220.

### NEVADA

#### Humboldt County

SILVER KING (Golconda)—This property, 10 miles from Golconda, is being worked by lessees. A shaft has been sunk 60 ft., and a crosscut is being driven to cut the vein. The property is only three miles from Iron Point railroad station.

CHARLESTON NATIONAL MINING CO. (National)—This company is operating a lease on the ground of the Charleston Hill Gold Mining Co., adjoining the National Mines Co. on the south. A 60-hp. engine and a five-drill compressor have just been installed, and a 35-hp. Fairbanks-Morse hoist will be installed at once. The shaft is 250 ft. deep. When the 300-ft. level is reached a crosscut will be driven to the vein.

#### Lyon County

MONTANA YERINGTON (Yerington)—Two crosscuts from the shaft, each 200 ft. long, have cut a wide oreshoot.

RENO YERINGTON (Yerington)—The sinking of the incline shaft is progressing rapidly. The contact is being followed on its dip, and it is expected that the ore will be struck at the 200-ft. level.

MASON VALLEY MINES CO. (Thompson)—Ore receipts at the smelting plant for the week ended Aug. 7, 1913, were as follows: From Mason Valley Mines Co., 1762 tons; from Nevada-Douglas, 1283 tons; from other mines, 935 tons; total, 3980, or a daily average of 569 tons; five cars of matte were shipped.

NEVADA-DOUGLAS (Ludwig)—Development on the 8th level has opened some good-grade copper ore. At the Copper Casting shaft drifting and crosscutting are in progress, and a car of ore is being shipped every second day from this development. On Douglas Hill, crosscutting from the lowest level to cut the "spot" ore is in progress. This ore will average 5% copper. The Greenwalt concentrating process is to be tested in Denver, Colo., on a 25-ton lot, with the intention of erecting a plant at Ludwig if the experiments are successful. W. C. Orem, general manager for the company, emphatically denies the report that there will be a merger of the Nevada-Douglas and the Mason Valley Mines companies.

#### Mineral County

THE WATER SUPPLY OF LUNING is being rapidly exhausted. The situation is serious and other wells must be sunk at once.

ELECTRIC POWER FOR RAWHIDE will be supplied in the near future. The power line to Fairview passes within three miles of Rawhide, and the connecting line will be built.

TODD GOLD MINES CO. (Luning)—It is reported that operations will be resumed in the near future.

NATIONAL MILL (Rawhide)—This mill of 20 stamps and cyanide plant is nearing completion. It is expected to be in operation by Oct. 1.

AURORA (Aurora)—The foundations for the 100-stamp mill are completed, also the bunk houses, shops, etc. A delay in the delivery of material and machinery, caused by recent heavy rains, has retarded the work.

WAGNER AZURITE COPPER CO. (Luning)—A leaching plant is being erected. The ores will be treated with sulphuric acid and the copper precipitated by electrolysis. The acid will be purchased, and the power will be generated at the plant, a gasoline engine being used to drive the dynamo.

#### Nye County

PLACER MINING AT MANHATTAN is still being carried on. Recently nuggets weighing as much as an ounce have been washed out.

#### Washoe County

NEVADA-LEADVILLE MINING CO. (Leadville)—This company is operating a block of ground under lease from the Tohoqua Mining Co. A 50-ton concentrator has just been erected.

TOHOQUA MINING CO. (Leadville)—A 50-ton concentrator has been in operation for the last year, concentrates and some crude ore being shipped to Utah. This company is the first in recent years to pay a bullion tax in Washoe County.

#### White Pine County

CONSOLIDATED COPPER MINES (Kimberly)—Stockholders did not subscribe liberally to the \$2,500,000, 7% convertible bonds at par, as, it is understood, they took less than \$300,000. No attempts have yet been made to make a market for them.

NEVADA CONSOLIDATED (Ely)—This company has reconsidered its first decision not to accept the terms of the workman's compensation act passed at the last session of the Nevada legislature. The company has filed its formal acceptance of the terms of the act with the Nevada industrial commission. The acceptance of the new law, which is not compulsory, by this company means much for the success of the measure in the state at large.

### NORTH CAROLINA

#### Montgomery County

TWIN REEF (Candor)—This property is under option to W. F. Maek and associates. The shaft has been unwatered and retimbered, a headframe has been built and a steam hoist has been installed. Drifting on the vein is now in progress.

#### Randolph County

HOOVER HILL—A power dam has been built across the Uwharrie River and electric machinery, and washers for disintegration of surface gold-bearing material have been installed. Pumping out the Hoover Hill mine will soon be started; the water will be used in the washing machines.

#### Rowan County

GOLD HILL—Walter G. Newman, it is reported, will commence unwatering this mine.

**OREGON****Baker County**

**BI-METALLIC**—Operations have been started by Anthony Mohr, one of the owners. This silver mine was formerly owned by Portland people, when it was known as the Intrinsic, under which name \$50,000 was spent in development.

**IMPERIAL (Sumpter)**—This mine in the Cable Cove district has been idle, and in care of a watchman for the past six years. Local men have taken a lease on the mine, and have already started taking out pay ore. The ore is base, and is shipped to a smeltery at Salt Lake, being hauled to Sumpter by teams.

**GEM CONSOLIDATED GOLD MINING CO. (Baker)**—The first permit to a mining company under the new Oregon corporation law has been issued to this company. The property is on the site of the early mining city of Gem, which had a population of 7000 in the days when placer mining in that district was at its height. There is no trace of a city left.

**PENNSYLVANIA****Allegheny County**

**STANDARD CHEMICAL CO. (Pittsburgh)**—It is reported that this company recently exported the first shipment of radium from this country. The lot weighed 250 milligrams and was valued at \$30,000.

**Westmoreland County**

**PITTSBURGH STEEL CO. (Monessen)**—The new blast-furnace plant has been completed. The furnaces have been built at a cost of approximately \$4,000,000. They will be supplied with ore from the Rowe mine, on the Cuyuna range, Minnesota, which recently has been acquired by the company. The new furnaces are 90 ft. high and 22 ft. 9 in. in diameter. The output will be 40,000 tons of steel ingots per month, or 70 cars per day.

**SOUTH CAROLINA**

**HAILE (Kershaw)**—A cyanide plant is being built at this property.

**TEXAS****El Paso County**

**SOUTHWESTERN MINES CO. (Sierra Blanca)**—A lead-zinc vein in altered granite is being developed on an 860-acre tract nine miles from Sierra Blanca, 100 men are being employed. A concentrator is in operation, and from ore taken out in development 220 tons of 50% zinc concentrate, 60 tons of lead concentrate containing 1 oz. silver per unit of lead, and 20 tons of auriferous iron concentrate are being shipped per month. Development work totals 5000 ft. Two vertical shafts have been sunk on this vein, the deeper to a depth of 480 ft. A low-grade deposit of gold and silver bearing chalcopyrite in altered granite near a limestone contact, on another portion of the property, has been developed but little, a shaft having been sunk 100 ft.

**UTAH****Beaver County**

**CEDAR TALISMAN (Milford)**—Ore carrying lead and silver has recently been opened on the 700-ft. level. The vein is 4 ft. between walls.

**MOSCOW (Moscow)**—The monthly production is 20 cars, valued at about \$25,000. Work is in progress on the new three-compartment shaft, which is to be sunk 1000 feet.

**MAJESTIC (Milford)**—Twenty-one cars of copper ore were shipped during July, and the August production will probably show a considerable increase. New development is being done at the Hoosier Boy and Hickory.

**Juab County**

**TINTIC SHIPMENTS** for the week ended Aug. 3 were 164 cars.

**EAGLE & BLUE BELL (Eureka)**—With the new boiler in operation the total boiler capacity, three boilers, is 300 hp. Profits are said to be keeping well ahead of dividend requirements. As well as opening up ground at present productive the company is doing considerable prospecting in new ground.

**CHIEF CONSOLIDATED (Eureka)**—During the six months ended July 1, 1913, there were marketed 30,354 tons of ore, which sold for \$206,563, and net profits were \$83,792. Receipts, with \$303,023 cash on hand, Jan. 1, 1913, were \$519,336. Expenditures, including dividend No. 1 of \$87,645; operating costs of \$122,776; mining claims, \$2594; Eureka City Mining Co., \$19,000; buildings and machinery, etc., were \$237,874, leaving cash on hand July 1, 1913, \$281,462. The tonnage was nearly four times greater than that for the same period of 1912, but the grade of the ore averaged much lower, partly as a result of mining all of the quartz encountered in stoping. A large amount of development was done, in all 4064 ft. The crosscut to the Gemini, 2135 ft. in length, was completed, furnishing better air and a needed emergency outlet. The reserves of ore give assurance of steady productivity and earnings, and the regular payment of dividends.

**Salt Lake County**

**OHIO COPPER (Bingham)**—Superintendent McDonald and mill manager Kidney have resigned.

**ALTA CONSOLIDATED**—Ore running well in copper and silver has been opened 30 ft. above the main tunnel level.

**TAR BABY**—A ventilation system has recently been installed in this company's tunnel in Big Cottonwood. The tunnel is in 800 ft., and the face is mineralized with lead.

**I. S. SMELTING, REFINING & MINING CO. (Midvale)**—A demand for higher wages was made last week by foreign employees at the smelting plant. For a time a strike seemed imminent, but the matter was finally adjusted.

**CARDIFF (Salt Lake City)**—The lower tunnel is in 1250 ft. Some mineralization showing lead, copper and silver has been developed between the quartzite and the limestone. The objective point is under the 90-ft. winze sunk from the tunnel above.

**UTAH COPPER CO. (Bingham)**—The compressor plant and transformer station on level G, southwest of the junction of Carr Fork and Bingham Cañon, was struck by lightning, Aug. 3, during a thunder shower, and burnt to the ground.

The plant was equipped with a large electrically driven Nordberg compressor. It was one of several compressor plants about the workings. The transformer station will be rebuilt.

**WASHINGTON****Chelan County**

**NORTH AMERICAN ORE CO. (Leavenworth)**—This company has been incorporated to develop mica on Mad River.

**Okanogan County**

**LAKEVIEW-DIVIDEND (Oroville)**—Shipments are being made to the smelter at Grand Forks.

**MOLSON (Chesaw)**—Preparations are being made to increase the capacity of the mill at this mine to 40 tons daily.

**Stevens County**

**WASHINGTON (Chewelah)**—Copper-sulphide ore has been found on this property.

**IRON CROWN (Chewelah)**—This property is being developed under the direction of E. H. Winslow. The ore is of good grade in gold, silver and lead.

**Snohomish County**

**TRAIN SERVICE FROM SILVERTON TO MONTE CRISTO** has again been established on the Northern Pacific R.R.; 75 men are employed in the mining camps in the Monte Cristo district and the owners plan to begin making shipments early in September.

**CANADA****British Columbia**

**THE ROCHFORD GOLD DREDGE**, built for W. Hanford and associates of Seattle, by the Shaacke company of New Westminster, will be in operation on the Fraser River, near Hope, some time in August.

**SERIOUS RIOTING AT NANAIMO AND LADYSMITH**, where the coal miners, members of the United Mine Workers of America, have been on strike for some time has resulted in the calling out of the militia. Mobs practically took possession of the two towns during the afternoon and night of Aug. 12. Several have been hurt, one or two quite seriously. Special constables sent over from Vancouver were met by a mob of infuriated miners and chased back onto the boat from which they attempted to land. Reports of the rioting in various coal towns of Vancouver Island, Aug. 12 and 14, show the following results: Two mines shut down and flooding; Nanaimo River bridge blown up; hotel and strikebreakers' houses at Ladysmith and company property at Extension burned; store at Extension wrecked and looted; Nanaimo Herald forced to suspend publication.

**SULLIVAN GROUP (East Kootenay)**—This property has shipped 20,000 tons of ore in the last year. New development work was begun and water power was developed from Mark Creek.

**BLUE BIRD (Rossland)**—This mine will be operated, the deal with W. R. Foley having been consummated. The mine will be unwatered in a few weeks.

**PANAMA (Bear Lake)**—About 2000 sacks of ore are being packed down for shipment to the smelter, being the output of the mine for the last few months. The ore is rich in silver, with little or no lead. It has been decided to develop the mine on a more extensive scale and a gasoline compressor and hoist will be installed this autumn. The engine will be placed inside the mine, a chamber having been blasted out of sufficient size to give room for it.

**Ontario**

**ALEXO (Iroquois Falls)**—Twenty-two cars of nickel ore containing 1,588,500 lb. were shipped during July from this mine to the Mond Nickel Co.

**YORK ONTARIO (Cobalt)**—A rich oreshoot showing from 1 to 3 in. of high-grade has been picked up and followed for 20 ft.

**RIGHT OF WAY (Cobalt)**—Drifting is being undertaken along the Cobalt Lake fault. The shaft was put down to a depth of 365 ft. and about 100 ft. of drifting done at that level. Up to date no favorable results have followed. The company has taken an option on the Flynn claims lying south of the Tough-Oakes property in the Kirkland Lake district.

**BRITISH-AMERICAN NICKEL CORPORATION**—This company has been incorporated with a capitalization of \$30,000,000 and holds 17,000 acres in the Sudbury district. Already considerable prospecting has been undertaken and up to May 1, 6,800,000 tons of nickel ore have been blocked out. The \$30,000,000 capital stock of the corporation consists of \$10,000,000, 6% debentures and \$20,000,000 common stock, all of which has been issued. Dr. F. S. Pearson is said to be interested.

**COBALT-LAKE (Cobalt)**—A plan of operations has been decided on for the development of several acres at the north end of the lake hitherto unprospected. Work is to be done north and west of the old No. 4 shaft on the east side of the lake. A crosscut has been started at a depth of 300 ft. to pick up the fault veins. It will be driven under and across the lake and worked from by drifts from the veins when encountered. Another long crosscut will head from the 235-ft. level northward down the center of the lake, from which other workings will be started at intervals.

**MEXICO****Mexico**

**EL ORO MG. & RY. CO., LTD. (El Oro)**—In July, 23,250 tons of ore and 14,080 tons of tailings yielded \$169,880; railway profit amounted to \$13,970; total profits to \$60,800.

**Puebla**

**TEZIUTLAN COPPER CO. (Aire Libre)**—A 500-ton concentrator is being built under the direction of Franz Cazin, chief engineer.

**ASIA****India—Mysore**

**Kolar Goldfield**—The production of gold from the mines of the Kolar district in July was 49,457 oz., being 947 oz. more than in June, and 452 oz. more than in July, 1912. For the seven months ended July 31, the total was 336,618 oz. in 1912, and 339,440 oz.—or \$7,016,225—in 1913; an increase of 2322 oz. this year.

# THE MARKET REPORT

## METAL MARKETS

NEW YORK—Aug. 20

The metal markets generally have been rather strong, and prices have been firm, with some inclination to advances in price.

### Copper, Tin, Lead and Zinc

**Copper**—The market during the week of Aug. 14-20 has been rather quiet so far as the volume of sales has been concerned. This was to be expected after the heavy business of the previous two weeks and a reaction was rather in order. Prices, however, have been firm and there was no disposition to make concessions. During the past two or three days, there was an increase in demand and in inquiries from domestic consumers which was readily met by the principal sellers, although at a very slight advance. The quotations most usual were 15¼@15½c., usual terms. Producers are now well sold ahead and are having difficulty in making deliveries on time.

The strike in the Lake Superior District continues. The Calumet & Hecla is said to be making preparations to start up its mines and has secured a list of its old men who are ready to work. So far, no actual step has been taken and the mines are still closed. Business in lake copper was confined to some small lots which were on hand and the prices for that description are almost entirely nominal.

The quotation for Lake copper is nominal at 16c. At the close electrolytic copper in cakes, wirebars and ingots is quoted at 15.60@15.65c., while casting copper is quoted at 15¼@14¼c. as an average for the week.

The London market has been quiet, and transactions have been of practically small volume. On Aug. 14, spot and three months were quoted at £69 17s. 6d. and on Aug. 15 at £69 13s. 9d. On Aug. 19 the market declined to £68 15s. for both positions, but closes at £69 2s. 6d. for spot and £69 3s. 9d. for three months.

Base price of copper sheets is now 21c. for hot rolled and 22c. for cold rolled. Full extras are charged and higher prices for small quantities. Copper wire is 16¼@16½c., carload lots at mill.

Exports of copper from New York for the week were 9069 long tons. Our special correspondent gives the exports from Baltimore at 2971 tons for the week.

Visible stocks of copper in Europe on Aug. 15 are reported as follows: Great Britain, 48,130; France, 2860; Rotterdam, 3700; Hamburg, 2070; Bremen, 1800; total, 28,560 long tons, or 63,974,400 lb. This is an increase of 110 tons over the Aug. 1 report. In addition to these stocks 1700 tons are reported afloat from Chile and 4400 tons from Australia, making a total of 34,660 tons.

**Brass Prices** are announced as follows to date from Aug. 18: Sheets, high brass, 16½c. net per lb.; low brass, 18½c. Wire, high brass, 16½c.; low brass, 18½c. Rods, high brass, 16½c.; low brass, 19¼c. Tubes, brazed, or open seam, 21¼c. Angles and channels, 21¼c. Scrap allowances are 11¼c. net per lb. for high brass and 12½c. for low brass.

**Tin**—The London market remained unusually steady throughout the week. Although transactions on some days were very heavy, hardly any change in the quotations took place. There was a good deal of buying by consumers in this market for prompt and August delivery, while very little interest was shown in futures, which were frequently offered at below the importation price. The close is firm at £188 5s. for spot and £186 15s. for three months, and about 41½c. for August tin here.

Messrs. Robertson & Bense report the receipts of tin ore and concentrates at Hamburg, Germany, in July at 2309 tons, of which 2279 tons came from Bolivia and 70 tons from South Africa.

Receipts of Bolivian tin at Liverpool in July included 55 tons of bars and 1855 tons of concentrates; equivalent to a total of 1168 tons fine tin.

Tin production of the Federated Malay States in July was 3897 long tons. For the seven months ended July 31 the total was 27,394 tons, a decrease of 199 tons from last year.

**Lead**—On Friday, Aug. 15, it became known that a strike had broken out in southeastern Missouri, which closes all the mines in that district. This accentuated the strong position of the metal, and the market advanced one-quarter of a cent, to 4.75c., New York. It is reported that the question at issue in the strike is the recognition of the Western Federation of Miners in the district.

The London market is quiet and slightly lower, Spanish lead being quoted at £20 7s. 6d. and English lead 10s. higher.

**Spelter**—The market is firmer. There has not been much demand, but sellers are holding for higher prices, due to the higher cost for ore and the decreased production on account of the shortage of gas. At the close, St. Louis is quoted at 5.55@5.60c. and New York at 5.70@5.75c. The present prices of ore at Joplin leave little margin for smelters.

The London market is quoted at £20 12s. 6d. for good ordinaries and 5s. higher for specials.

Base price of zinc sheets was again advanced ¼c. on Aug. 15, and is now \$7.75 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

### DAILY PRICES OF METALS

#### NEW YORK

Aug.	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
14	4.8635	59	16	15.50 @15.60	41½	4.50	4.40 @4.45	5.60 @5.65	5.45 @5.50
15	4.8640	59½	16	15.50 15.55	41½	4.50 @4.75	4.45 @4.65	5.60 @5.65	5.45 @5.50
16	4.8645	59½	16	15.60 15.65	41½	4.75	4.65 @4.70	5.60 @5.65	5.45 @5.50
18	4.8640	59½	16	15.60 @15.65	41½	4.75	4.65 @4.70	5.65 @5.70	5.50 @5.55
19	4.8640	59½	16	15.60 @15.65	41½	4.75	4.65 @4.70	5.70 @5.75	5.55 @5.60
20	4.8645	59½	16	15.60 @15.65	41½	4.75	4.65 @4.70	5.70 @5.75	5.55 @5.60

The quotations herein given are our appraisal of the market for copper, lead spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic. We quote casting copper at 0.15c. below the price for electrolytic. The quotations for lead represent wholesale transactions in open market for good ordinary brands, both desilverized and non-desilverized; the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

#### LONDON

Aug.	Silver	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
		Spot	3 Mos	Best Sel'd	Spot	3 Mos		
14	27 ½	69 ½	69 ½	74 ½	189	187 ½	20 ½	21
15	27 ½	69 ½	69 ½	74 ½	187 ½	186 ½	20	20 ½
16	27 ½	.....	.....	.....	.....	.....	.....	.....
18	27 ½	69 ½	69 ½	74 ½	187 ½	186	19 ½	20 ½
19	27 ½	68 ½	68 ½	74 ½	187 ½	186	20	20 ½
20	27 ½	69 ½	69 ½	74 ½	188 ½	186 ½	20 ½	20 ½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c. = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21¼c.

**Imports and Exports in Great Britain** of metals other than iron and steel, are reported for the six months ended June 30, as follows, in long tons, except quicksilver, which is in pounds:

	Imports		Exports	
	1912	1913	1912	1913
Copper.....	61,130	68,023	26,981	35,677
Tin.....	21,571	23,417	25,644	22,051
Lead.....	107,445	104,779	23,703	31,846
Zinc.....	70,881	73,049	4,378	4,758
Quicksilver, lb.....	3,199,125	2,988,302	1,003,798	1,323,906
Minor metals.....	3,660	4,300	13,257	14,745
Ores, etc.:				
Tin ore.....	15,233	17,262	.....	.....
Pyrites.....	455,502	432,187	.....	.....

### Other Metals

**Aluminum**—The market continues quiet and business has been on a moderate scale. Quotations are again off a little, 22½@23c. per lb. being named for No. 1 ingots, New York. The foreign market is reported easier.

**Antimony**—The market continues dull with only small sales. Stocks are large and it seems hard to work them off. Cookson's is quoted at 8.35@8.40c. per lb.; Hallett's at 7.75@8c.; while 7.25@7.50c. is asked for Chinese, Hungarian and other outside brands.

**Quicksilver**—Business is fair and prices remain unchanged. New York quotations are \$40 per flask of 75 lb., with 58@60c. per lb. asked for small lots. San Francisco, \$39.50 for domestic orders, and \$37 for copper. The London price is £7 5s. per flask, with £7 quoted from second hands.

**Bismuth**—Quotations at New York are \$1.72 per lb. for metal produced from domestic ores; \$1.80 for imported metal. London quotation is 7s. 6d. per lb. The price is controlled by the European syndicate.

**Magnesium**—Current price of pure metal is \$1.50 per lb. for 100-lb. lots, New York.

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

Exports from Baltimore for the past week included 280 tons nickel residues to Bremen.

### Gold, Silver and Platinum

**Gold**—The price of gold on the open market in London remained at the Bank level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Some gold is being taken for India and the Bank of France is reported to be picking up small lots. The bulk of the gold arriving, however, went to the Bank of England.

Imports of gold at New York for the week were \$579,740, from Mexico, South America and Australia. There were no exports.

**Iridium**—The demand continues well up to the supply and there has been no drop in prices. Dealers continue to ask \$85 per oz. for pure metal.

**Platinum**—Prices are steadily maintained, although the market has been rather quiet. Dealers ask \$45@46 per oz. for refined platinum and \$49@52 for hard metal. The foreign market continues steady. Stocks are reported rather large, but in strong hands.

**Silver**—There is little change to report in the silver market and prices have varied but little. The Indian Bazaars have been the principal buyers but the China banks have also been in the market but their demands have been easily filled. The tone of the market continues dull.

Exports of silver from London to the East, Jan. 1 to Aug. 7, reported by Messrs. Pixley & Abell:

	1912	1913	Changes
India.....	£4,640,700	£4,354,000	D. £286,700
China.....	933,500	502,000	D. 431,500
Total.....	£5,574,200	£4,856,000	D. £718,200

Imports of silver at New York week ended Aug. 16, \$216,663 from Mexico and Central America. Exports were \$579,740, nearly all to London.

### Zinc and Lead Ore Markets

#### JOPLIN, MO.—Aug. 16

The high price of zinc blende is \$50, the base per ton of 60% zinc ranging from \$46@48 per ton for choice grades, and \$48@50 base for blende carrying in excess of 8% iron. Calamine sold on a base of \$21@23 per ton of 40% zinc. The average of all grades is \$43.24 per ton. Lead sold at \$54.50@55 per ton of 80% metal contents, with the average of all grades at \$54.14 per ton.

#### SHIPMENTS WEEK ENDED AUG. 16

	Blende	Calamine	Lead ore	Value
Totals this week...	10,682,600	652,630	1,691,650	\$290,865
Totals 33 weeks...	354,402,890	25,888,050	58,904,070	\$9,793,384
Blende value, the week...	\$236,223	33 weeks	\$7,914,761	
Calamine value, the week...	8,846	33 weeks	328,546	
Lead value, the week....	5,796	33 weeks	1,550,077	

#### PLATTEVILLE, WIS.—Aug. 16

The base price paid this week for 60% zinc ore was \$44@46 per ton. The base price paid for 80% lead ore was \$54½@55 per ton.

#### SHIPMENTS WEEK ENDED AUG. 16

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week .....	3,325,250	82,000	994,430
Year to date.....	92,823,780	4,587,990	38,374,930

Shipped during week to separating plants, 1,752,600 lb. zinc ore.

## IRON TRADE REVIEW

#### NEW YORK—Aug. 20

The iron and steel markets are in rather an uncertain condition, so far as new business is concerned. In some lines, new orders are coming in fairly well, but in others, new business is on rather a moderate scale.

Structural-steel orders have not been on an especially large scale, but in the East a number of contracts of moderate size have been closed, making altogether a considerable volume of business. Among these orders is one placed by the American Zinc & Smelting Co. for material for its new works at Langeloth, Penn. Quite a number of bridge orders have also been placed.

The outlook as to steel prices is somewhat better in respect to the fact that the current prices on wire products, representing \$3 a ton off the maximum, seem likely to prove the basis of trading for the fall movement, instead of there being any further recession. This would make prices better than a year ago.

Sheet prices are now lower than two or three weeks ago, and there is an improvement in buying, several large agricultural implement makers having contracted for their season requirements, while the current run of small sheet orders is better.

The steel-price situation on the whole is much better than was expected last May in even the most optimistic quarters. Prices have held well, the recessions to date from the top point being \$3 a ton in wire, \$2 to \$4 a ton in sheets, \$2 a ton in small sizes of pipe, with slight concessions in plates and shapes, confined to eastern territory. There may be further recessions, but probably of slight moment, before the expected fall buying movement fills the mills up again, as it is confidently expected to do.

The reduction in prices of wire has not brought out a heavy business so far, although jobbers are beginning to come into the market for their fall orders. There is rather active competition for these orders and also for others which are on the market for plates.

New business in pig iron continues to be in moderate-sized lots, but there is a good deal of it. In Eastern territory, there is rather active buying of foundry, while in the West, basic iron is in fair demand. There has been no special advance in prices, but the current quotations have been rather firmly held.

#### PITTSBURGH—Aug. 19

Shading in plates, and shading to a less extent in structural shapes, is confined to eastern territory and occurs only with the most desirable orders. Pittsburgh and more western mills must meet the competition of eastern mills if they desire to sell in the East, but only in rare instances have they done so. As to the country at large, the basis of 1.45c., Pittsburgh, on plates and shapes is well maintained. As to the steel-bar price of 1.40c., Pittsburgh, there is no question in any territory.

Operations in the steel industry are practically at full capacity, except that wire mills are running at 50 to 75% of capacity, and sheet mills are averaging, for July and August, 70 to 75% of capacity, with tin mills averaging in the same period about 90% of capacity. In bars, plates, shapes and tubular goods, mills continue to operate substantially full, while the rail mills are doing at least as well as last year. The total output of steel has been decreased only slightly.

**Pig Iron**—The market is quiet all along the line, as to sales of any round tonnage, but there is a moderate amount of prompt buying. The recent burst of buying is clearly at





Assessments

Table with columns: Company, Delinq., Sale, Amt. Lists assessments for various companies like Caledonia, Carbonate, Columbus Ext., etc.

Monthly Average Prices of Metals

SILVER

Table showing monthly average prices for Silver in New York and London from 1911 to 1913.

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

COPPER

Table showing monthly average prices for Copper in New York and London from 1912 to 1913.

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

TIN

Table showing monthly average prices for Tin in New York and London from 1912 to 1913.

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

LEAD

Table showing monthly prices for Lead in New York, St. Louis, and London from 1912 to 1913.

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

SPELTER

Table showing monthly prices for Spelter in New York, St. Louis, and London from 1912 to 1913.

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

PIG IRON IN PITTSBURG

Table showing monthly prices for Pig Iron in Bessemer, Basic, and No. 2 Foundry from 1912 to 1913.

STOCK QUOTATIONS

Table of stock quotations for Colorado Springs and Salt Lake, listing company names and bid prices.

Table of stock quotations for Toronto, listing company names and bid prices.

SAN FRANCISCO

Aug. 19

Table of stock quotations for San Francisco, listing company names and bid prices.

N. Y. EXCH.

Aug. 19

Table of stock quotations for New York Exchange, listing company names and bid prices.

N. Y. CURB

Aug. 19

Table of stock quotations for New York Curb, listing company names and bid prices.

BOSTON EXCH.

Aug. 19

Table of stock quotations for Boston Exchange, listing company names and bid prices.

BOSTON CURB

Aug. 19

Table of stock quotations for Boston Curb, listing company names and bid prices.

†Last quotation.