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The Mines of the Fairview District, Nevada

A New Silver-Gold Camp in Churchill County, Where the Chief Difficulties Are Lack of Water and a Long Haul to the Railroad

BY EDWARD R. ZALINSKI*

Reno, the largest and most important trade center in Nevada, is located on the main line of the Southern Pacific Railroad, in the foot hills of the Sierras. It is a short distance east of the Nevada-California State line, and is the natural center and outfitting point for the many camps in this region. Mining men bound for Tonopah, Goldfield, Fairview, Wonder, Ramsey, Olinghouse, the Walker river district, Yerrington, and other camps, find it convenient to stop off here either going or coming.

FROM RENO TO FAIRVIEW

Fairview is situated in the south central part of Churchill county, about 120

to Fairview. The roads in the winter are poor. Fallon is in a farming district and the road for about 10 miles passes east through a flat country intersected by large irrigating canals and ditches. This low land lies south of the Carson sink and has been irrigated under Government supervision. A change of horses is made at a ranch about 12 miles out. From here on to the station where lunch is eaten, about half way to Fairview, the roads are hard and good.

The road swings southerly and follows the north side of Salt flat. Several large basalt flows extending out on the flat are crossed, and an old borax works is seen to the right. Before reaching Sand springs

on both sides of the pass, and a black shale is crossed which is cut by light-colored dikes. The summit is reached in 3 to 4 miles from the Sand Springs station. Fairview can be seen on the opposite side of the valley at the foot of Fairview peak. A gradual descent is made with a level stretch in the bottom of the flat and up grade on the Fairview side.

The stage pulls up in front of the Hotel Fairview about 6 o'clock in the evening. Automobiles can make the trip from Hazen to Fairview over dry roads, in 5 hours.

FAIRVIEW

The town of Fairview is built on a gen-



EAGLE'S NEST KNOB, BOULDER AND BOULDER NO. 1 CLAIMS



SOUTHWEST FROM THE KNOX LEASE

miles southeast of Reno. Wonder is 18 miles north of Fairview. Leaving Reno at 8:20 a.m. on the Tonopah and Goldfield train, Hazen on the main line, is reached about 11 o'clock. The branch railroad to Tonopah turns off to the south at this point. A new branch of the Southern Pacific connects Hazen with Fallon, a distance of 16 miles. The regular passenger service is not in operation yet, and a stage makes the trip to Fallon daily. The fare is \$2.50.

The stage leaves Fallon at 7:30 in the morning for the 42-mile trip from Fallon

the road crosses a portion of the Salt flat and is soft and muddy. The wheels sink up to the hubs and freight wagons have much difficulty in getting through. Most teams are now compelled to take the longer road around the north end of the marsh.

At Sand Springs horses are again changed. Sand Springs was a station on the old Overland trail. The road to Fairview follows approximately this route. A mountain of white sand about a mile to the north, gave the station its name. This is probably of aeolian origin.

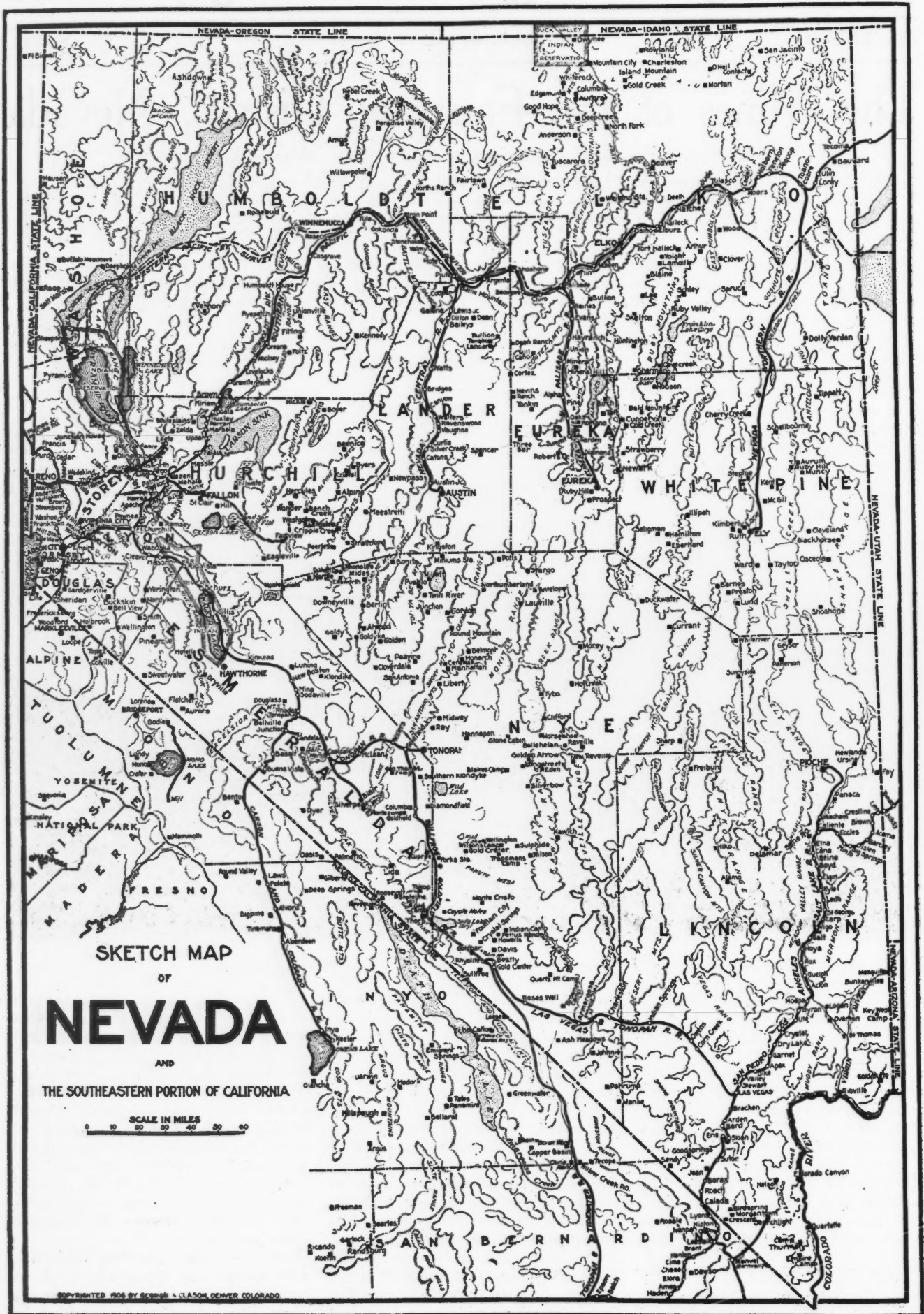
It is about 12 miles to Fairview, and the road is up-grade to the divide, which separates Fairview valley and Salt flat. Claim monuments are seen along the road

the slope leading from the foot hills north of Fairview peak to the valley. The situation is good, water only being lacking. The town has grown rapidly. It is only a few months since the townsite was laid out and frame buildings are already replacing tents. Lots are selling at good prices. The town has a population of more than 1000 and about 200 men are employed in the mines. There are several hotels and rooming houses, restaurants, saloons, and stores, also a post office, and two newspapers, *The Fairview Miner* and *The News*.

The town has stage-line connection with Wonder and Fallon, also telephone connections to points on the railroad. Three surveyors make headquarters in

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Note—The sketch map which accompanies this article is published by permission of the Clason Map Company, Denver, Colo.



Fairview and several lawyers and doctors hang out signs. Beside these the town has a justice of the peace and a constable, who so far have had nothing to do. The climate is healthy though very hot in summer.

Freight coming in costs $1\frac{1}{4}$ to $1\frac{1}{2}$ c. per lb. from the railroad at Hazen, and from Fallon to Fairview 1c. per lb. Since Dec. 30 all freight from Hazen to Fallon has come by train.

The average freight rate on mining machinery is $1\frac{1}{2}$ c. per lb.; lumber, $1\frac{1}{2}$ to $1\frac{3}{4}$ c., and liquors $2\frac{1}{4}$ c. per lb. Bulky material, furniture, etc., costs more. Freight from Fallon to Wonder varies from 2 to $2\frac{1}{2}$ c. per lb.

Ore is hauled from the Nevada Hills to the railroad for about \$12.50 per ton by returning teams. It is hauled from the mine to the loading platform below, at \$1.50 a ton.

GEOLOGY OF THE REGION

The country rock is mostly andesite and this is cut by later rhyolite and andesite dikes. Strong fissuring has occurred with silification of the andesite. Along these fissure zones, the rock outcrops prominently. North-south fissuring and faulting has taken place after the ore deposition; in several cases noted the displacement has not been great. The strongest mineral-bearing fissures strike northwest and dip to the south, though there are undoubtedly others. As far as observed little mineralization accompanies the faulting fissures. In the main ore-bearing zones the vein material is quartz, and silicified andesite with values often extending several feet into the hanging. Free gold, cerargyrite, and argentite carry most of the values. Ruby silver and some silver bromides occur in smaller amount. The gold is alloyed with silver

claim of the Nevada Hills Mining Company's property. The road from Fairview leads southeasterly up a wash to the foot of the Eagles Nest, passing the Ida Mines Company's claims on the right, and swings east through a sharp cañon to the Fairview Eagle, Eagles Nest, and Hailstone properties. The loading station for the Nevada Hills ore is at the turn of the road into the cañon; the sacked ore being piled on a large platform. A branch road from here leads up a steep grade to the mine.

The company owns the Boulder and Boulder No. 1 claims, and the Florence No. 4 and Pappais fractions, in all about 50 acres. The company also owns a controlling interest in three other properties.

The Boulder claims were located by P. Langdell, in Jan., 1906. J. T. Hodson and W. H. Webber came into the district about two months later, and thoroughly



OUTCROPPING DIKES OF ANDESITE AND RHYOLITE



TOPOGRAPHY OF THE FAIRVIEW RANGE

WATER AND SUPPLIES

Water costs \$2.50 a bbl. Hotel Fairview hauls its own water from East Gate. It costs 25c. a bbl. at the well, and unloaded at the hotel costs them \$1.65 a bbl. East Gate, 11 to 12 miles east of town, is an old silver camp. It furnishes water from three wells, 15 to 35 ft. deep. The water is good and contains no alkali. A well is being bored below Fairview on the flat, about 3 miles from town. The well is now down over 300 ft. with a 12-in. hole. They expect to strike water from 600 to 1000 ft. below the surface. If water is found a second hole will be bored about a mile nearer town, possibly also a third. A company has been organized to pipe water from Bench creek near Wonder.

Mining machinery if bought in Fairview costs from 20 to 30 per cent. more than if bought on the railroad. Wood costs \$25 a cord; coal, more than \$50 a ton; lumber, about \$60 per M. Wages are \$4 to \$4.50 a day, and board can be obtained for \$1.50.

and is sometimes of a white color. Roughly speaking, about one-fifth of the values are in gold.

It is probable that stephanite, tetrahedrite, polybasite and other silver minerals occur. Argentite, however, occurs in greatest quantity, and is found on the outcrops entirely inclosed in quartz. The rich float found before the mines were discovered, owed its high value mostly to argentite. Small amounts of copper staining are occasionally found; also limonite and hematite staining in considerable quantity, together with manganese staining accompanying the ore. Rich shoots containing large quantities of horn silver occur near the surface, but values are in some cases uniformly distributed. Pyrite is not plentiful.

NEVADA HILLS MINING COMPANY

The mines are situated about two miles southeast of town in the foot hills north of Fairview peak. A prominent knob called the Eagles Nest, can be seen for some distance. This is on the Boulder

prospected the strong outcrops which ran parallel to the large Eagles Nest ledge on the summit of the ridge. They bought the property for \$5000.

Ore was first found on a fairly prominent andesite outcrop, to the west of a small north-south gulch caused by a fault. A quartz vein about 18 in. wide was exposed on this ledge, and on close examination was seen to contain fine black grains of silver sulphide disseminated through the quartz. After seeing the discovery it is not easy to understand why this property had not been located before, although crossed many times by prospectors and others.

The discovery is shown in one of the illustrations to the right, and above the pile of sacked ore. The dump is from tunnels Nos. 3 and 4, which are driven here. North-south fissures parallel to the fault can be seen cutting the outcrop near the point of discovery. Rich mineral has been opened up along this vein for a distance of more than 1300 ft., and five tunnels have been driven.

THE WORKINGS

Beginning at the northwest end of the vein, and south of the large Eagles Nest rock, a rich ore shoot has been opened up on the surface. The vein strikes about north 60 deg. west at this point, and dips to the south 70 to 80 deg. Tunnel No. 2 has been run in on the vein here giving about 40 ft. depth, and some high-grade ore has been shipped from the development work. The vein outcrops 1 to 2 ft. wide above this tunnel. In places it does not show. The country rock, both walls, is andesite.

A few feet south of the tunnel entrance is a light-colored dike about 12 to 15 ft. wide, probably rhyolite, striking nearly north; it appears to cut off the ore shoot on the northwest end. So far as now known on the Nevada Hills property no ore occurs on the northwest side of this dike. The continuation of the dike can be seen across the cañon on the opposite hill.

In tunnel No. 2 the high-grade shoot exposed along the foot-wall is 1 to 1½ ft. wide. It is a soft, dark vein material, which contains large quantities of horn-silver, in scales and ribbons, often holding two lumps of gangue together, as by a string. Greenish silver bromide and possibly silver iodide occur. No tests have been made with a mineral supposed to be iodyrite, and it is probable that this dark blue mineral is a rare color of horn-silver. Some free gold can be seen in this rich ore, which runs more than \$2000 to the ton.

A winze sunk on the vein from No. 2 tunnel level is down 85 ft. At 30 ft. it encountered the shoot exposed above. The shoot pitches to the east, and has changed over to the hanging-wall. Lumps of nearly pure horn-silver approximately 8 in. long by 5 in. wide, and 2 to 3 in. thick, which came from the ore shoot here were shown. These lumps are porous, give a metallic ring when struck with a knife, and are easily whittled. The walls of the vein at this point are clearly defined, and show evidence of movement. Above, between the high-grade shoot and the vein, which is about 3 ft. wide, is a horse which contains ruby silver in places. The vein widens out at this point and values occur in the hanging.

NATURE OF THE DEPOSITS

There appears to be three nearly parallel ledges, showing silicified andesite and quartz along the outcrop. Calling the one on which No. 2 tunnel is driven the main ledge, another lies above this, and still another near the top of the ridge. These follow nearly parallel for some distance and then swing sharply to the south and join the lower ledge. The outcrop east from No. 2 tunnel exposes a quartz vein averaging 2 ft. in width, but running anywhere from 1 to 4 ft. Frequent iron and manganese stains occur, and dark specks

and stringers of silver sulphide show plainly in the white vein quartz.

The ore resembles that of Tonopah, and is a typical southern Nevada ore. The gangue is not always entirely quartz but sometimes a silicified andesite with quartz veinlets and disseminated gold and silver. Unless closely observed this rock does not appear of special value, though running \$100 to \$200 or more to the ton, and was undoubtedly passed over by prospectors many times. In places it contains vugs and cavities. Nearly always black disseminated silver sulphides are found with sometimes a little pyrite and some free gold.

The outcrop can be followed east 1300 ft. from No. 2 tunnel, and is rich nearly all the way. Silver sulphides are exposed in most places where a piece is knocked from the vein.

About 1000 ft. east of tunnel No. 2 a

ation, and is drilling a hole dipping about 50 deg. north. At the depth of 263 ft. no ledge had been encountered. Tunnels Nos. 3 and 4 are about 70 ft. below tunnel No. 2, and are driven from a small gulch near the discovery. Tunnel No. 3 follows the north-south fault, and finds the continuation of the vein in a short distance. As shown on the surface the east side has moved north. Good ore with about 80 ft. of backs to the surface is cut here by a drift east on the vein; \$200 rock is in the face.

Tunnel No. 4 is driven 140 ft. west parallel to the vein in the foot wall. Little pyrite was seen anywhere, except in this tunnel, where the foot wall appears to be mineralized.

Tunnel No. 5, on the east, has cut the ledge at the depth of about 60 ft. below tunnel No. 4, and runs \$300 across the vein as against \$200 above in No. 4 tun-



NEVADA HILLS MINING COMPANY—PLACE OF DISCOVERY

north-south fault cuts the ledge, and the west side of the fissure has moved about 40 ft. to the south. The fault seems to dip east, but is nearly vertical. Still farther east is a second fault, but with a smaller horizontal displacement. In this case the west side has moved north, or the block of ground between these two faults, with a portion of the vein, has moved to the north. A third fault of small displacement moves the west side to the south as in the first one mentioned.

THE KNOX LEASE

In the saddle west of the Knox Lease is apparently another north-south fault. An open cut exposes a heavy gouge; a short distance west of here is a second open cut on the vein, from which a carload of ore running \$212 has been shipped. The leasers have not yet found ore. On the Knox lease a diamond drill is in oper-

nel. Places here show 5 ft. of very rich ore with about 140 ft. of backs. Some \$400 assays have been obtained.

Tunnel No. 1, driven from the lowest point to cut the vein at about 220 ft. depth, is in about 400 ft., and has cut the ledge. The shoot of high-grade ore exposed above in tunnel No. 2, pitches 30 to 40 deg. east, and could not be expected to be found at this point, which is too far to the northwest. A drift is being run south-east on the vein, and should strike the shoot inside of another 100 ft.

The average of the ore sacked is from \$200 to \$300 a ton. One shipment of 31 tons netted \$209 a ton. Shipments of ore assaying \$300 and \$400 have been made, and one carload is said to have averaged more than \$1000 a ton. From the rich shoot assays as high as \$4627 have been obtained, 91.68 oz. of gold and 4298.5 oz. of silver, and assays of special samples

have run as high as 15,000 oz. of silver. The quartz vein 2 to 4 ft. wide, has given assays from \$133 to \$750 a ton. From the winze in tunnel No. 2 the ore is valuable as that it is mixed with a lower-grade ore as a matter of precaution. At present it could not be shipped by express.

The Nevada Hills Mining Company is capitalized for one million shares of par value of \$5. Approximately 50,000 shares are out for the public, and the rest is being held closely by the owners. A dividend of 10c. a share on 750,000 shares, was paid in December. The mine has only been worked 8 months, and is 60 miles from the nearest railroad. The output was more than \$70,000 for the month of September, and more than 10 carloads of ore are now piled up waiting an improved condition of the roads.

THE IDA MINES COMPANY

The Ida Mines Company's claims are passed on the right, by the road to the Nevada Hills, before reaching the foot of the Eagles Nest rock. This company has done considerable surface work. Long trenches 4 to 5 ft. deep, have been cut looking for the continuation of the Nevada Hills vein. A force of 8 or 10 men is employed and the open-cut work is being systematically and thoroughly done before any underground development is attempted. Several veins have been uncovered assaying from \$30 to \$70 a ton.

The large hog-back ridge on the property is generally believed to be the northwest extension of the Nevada Hills ledge and was one of the first properties to change hands.

A tunnel is now being driven on the Ida No. 3, to cut the intersection of the main ledge with another almost at right angles. It is expected to strike the ledge in a little more than 300 ft., and will give about 250 ft. vertical depth.

Passing on up the cañon in a northerly direction the road turns to the east, and again to the north. At the second turn a short branch road leads to the shaft house of the Fairview Eagle.

FAIRVIEW EAGLE MINING COMPANY

The Fairview Eagles Mining Company's ground is situated on the north and east of the Nevada hills, on the north side of the ridge of which Eagles Nest rock forms the summit. It owns the Boulder No. 2 and Boulder No. 3, Eagles Nest Nos. 2 and 4, and Fairview claims, comprising about 53 acres.

The main shaft is inclined, and is down about 185 ft. A 25-h.p. Fairbanks-Morse gasolene hoist has been installed. At the 70-ft. level a station has been cut. This is in an altered grayish andesite which carries values. There is a well defined streak of ore along the foot-wall, which gradually shades off into this altered hanging. The true hanging wall has not been cut.

Ore has been sacked from a shaft on the

vein a few hundred feet east of the main shaft. The strike of the vein is northeast and dip 70 deg. to the south. The vein material is quartz, with considerable manganese staining. No shipments have been made. Considerable pyrite shows in the altered hanging wall. Some of the sacked ore showed horn-silver. The Eagle vein is headed directly toward the Eagles Nest Fairview Mining Company's ground, and across a small gulch a shaft is being sunk.

EAGLES NEST FAIRVIEW MINING COMPANY

The Eagles Nest Fairview Mining Company's claims are directly northeast of the Fairview Eagle. A shaft has been sunk on the vein which enters the ground from the Eagle, and is down about 100 ft., so that work is no longer satisfactory with a windlass. A gasolene hoist will soon be installed. Ground is now being broken for the hoist house.

On the Eagles Nest drifting on the vein has begun from the bottom of the main shaft. On the Hailstone considerable trenching and surface development work has been done. The country rock on both properties is andesite.

The Animikie Iron Range

The report of the Ontario Bureau of Mines for 1906, which has just appeared, contains an interesting paper on the "Animikie Iron Range," by L. P. Silver, which embodies the results of a close examination of the country extending from Lóon lake westward to Port Arthur, a distance of 30 miles. The Animikie iron-bearing series, which is the eastward extension of the Mesabi or upper Huronian series of Minnesota, is best developed east of Port Arthur. Within the last few years some systematic work has been done in test-pitting and drilling by Rinaldo McConnell, Wiley Bros. & Marks, T. Hogan and Flaherty & Knobel, of Port Arthur. As the Canadian Pacific Railway passes over the iron lands, the facilities for shipping ore to the furnace at Port Arthur are good. The writer's observations on the geology of the region are largely supplementary to the conclusions of Prof. C. K. Leith, N. H. Winchell and other predecessors in the field. The Animikie, or upper Huronian, is the formation in which the iron ore occurs, and is composed of several members in descending order as follows: (1) black slate; (2) upper iron formation; (3) slate; (4) semi-bedded impure limestones; (5) iron formation proper; (6) quartz conglomerate.

The iron formation proper is a ferriferous, cherty carbonate called taconite by Winchell; and this is the term by which it is generally known by miners. The taconite has a spotted appearance and is

of various shades of gray, red or green. It may be said to consist of a ground mass of crypto-crystalline, chalcedonic or finely pheno-crystalline silica, evidently of secondary origin, and a precipitate from solution. Throughout this are distributed numerous rounded or subangular bodies of mineral, very slightly pleochroic and without distinct cleavage, which on analysis proved to be ferrous silicate. The banded taconite of the Animikie, which simulates the jasperlites of the other ranges, though not so distinctly banded, is really a fine-grained chert, containing the usual granules of the same composition as those of the ground mass, but the striping is due to iron oxide in evenly distributed particles.

The upper iron formation is somewhat more slaty than the lower, has less taconite in its composition, is higher in phosphorus and lower in iron. The iron ores of the Animikie range consist mainly of hematite and limonite, throughout which may be seen almost unaltered to very much altered lenses of siderite. This siderite is abundant throughout the ore of every pit and tunnel in the lower iron formation. Magnetite occurs in small quantities generally near intrusions, and is clearly a metamorphic product of the hematite. The ore has been concentrated along and near the fault zone, much of it being changed to carbonate. That the deposits in question are still in process of formation may be seen by the presence in the ore of lenses of the comparatively unaltered taconite and carbonate, which reduce the percentage of the otherwise high iron content of the ore.

Unlike the Mesabi and other iron regions south of Lake Superior, the deposits do not occur in pitching troughs, nor do they rest on an impervious basement. This may in part also account for the absence of the pure concentrations of iron ore so common to the south of the lake. The deposits here are, however, concentrations produced by meteoric waters, circulating along faults, and the best ore occurs along the best defined faults, becoming leaner at a distance from them, and gradually shading into little altered taconite.

Some analyses of the ore are given, showing metallic iron content varying from 27.64 to 40.45 per cent. It is explained that the iron content is somewhat higher than indicated by the figures, as the high percentage of carbon dioxide in the ore is soon driven off in the furnace, leaving the remaining ore of a higher iron value. The result of some experiments in concentration, made by Mr. Knobel, of Port Arthur, is also presented, showing in round figures that 70 per cent. of the top 10 ft. of the orebody will produce a grade of concentrate averaging 55 per cent. iron, 0.022 per cent. phosphorus, and 17 per cent. silica, and that 30 per cent. must be discarded as waste.

Central Electric Drive for Collieries

The Central Power System Offers Advantages for Coal Mines and Coke-oven Plants Whether Steam or Gas Engines Are Used

BY FRANZ ERICH JUNGE*

I propose first to comment on the advantages which are to be derived by central electric drive irrespective of whether gas or steam prime movers are used in the power house, and compare them with what obtains with either direct gas or direct steam drive.

It is an undeniable fact, established in numerous cases of actual practice, that electric centralization enables a colliery, when working under normal conditions, to cover all outside power demands from the available coke-oven gases even when steam drive is adopted in the central station. Therefore, when laying out the power scheme for a new mine, regardless what be the character of the mineral or metallic ores to be produced, it is wise to give to the central electric drive the first consideration, also to reserve in the general lay-out provisions for future expansion and for the distribution of surplus power to neighboring districts and for the operation of electric railways throughout the commercial-distribution sphere of the works, which application might be projected later on.

SYSTEMS OF POWER TRANSMISSION COMPARED

Obviously the most economical method of power generation in the central plant will be of no value unless the planning of the transmission and distribution system and of the mode of application is done with proper care and with observing, in the layout, definite and predetermined principles, since otherwise the losses occurring in the application will annul the savings realized in the production. There are today five different systems of power transmission in vogue in combined iron-smelting plants and coal mines: Steam, compressed air, hydraulic, gas and electric transmission. They all have one feature in common, namely, that the area of cross section of the transmission line bears a definite economic relation to the pressure of transmission of the dynamic medium.

With steam it is the loss through condensation in the pipe lines that demands a smaller pipe cross section, which in turn necessitates the adoption of higher steam pressures. With compressed-air transmission, also, heat losses must be compensated for by a reduction of the radiating surface, viz., smaller diameter of pipes, which can only be had at the expense of higher air pressures. The larger the pipe cross section of hydraulic mains, the greater the danger of freezing, and the

greater the difficulty to guard against leakage. With gas, conditions are much more favorable, because condensation losses are entirely absent, and the higher the calorific value or heat density of the available gas, the better will be the all-round economy of the system. Yet it would not pay at all to transmit the weak-power gases, such as blast-furnace gas, beyond the immediate proximity of the blast-furnace plant.

The above mentioned losses through leakage and condensation are entirely absent in the electric-transmission system, so that the efficiency of long-distance transmission is relatively high, from 95 to 98 per cent., provided that the voltage has been correctly proportioned to the respective distance. The losses which do occur in the electric-transmission system are pure tension losses, being dependent on total length, cross section and capacity of the conductor; but there are none due to changes in the form of energy. Of course insulation must be perfect, and here is where the main difficulty lies, as we shall see later on.

DIRECT VERSUS ALTERNATING CURRENT

The economy of electric transmission depends on the proper selection of the mode of current and of its voltage. But since the determination of these factors does not to any great extent affect the economy of power generation proper, with which we are here chiefly concerned, it will suffice to say just a few explanatory words on this subject.

Speaking first of combined iron-smelting plants and coal mines, which combinations grow rapidly in number and extent owing to the general modern tendency to combine in order to be able to work with maximum industrial economy, direct current between 440 and 550 volts will be applicable for all purposes in or near the blast furnace, coke oven and power plant, also in rolling mills if closely located. For transmission over large distances, direct current is also preferred, so long as the places of usage fall within the commercial-distribution center (some 600 volts tension). Beyond that alternating (three-phase) current of 5000 volts and more must be chosen. F. Janssen-Berlin, in discussing this question, gives the following comparison of the respective advantages and disadvantages of direct current versus alternating current.

DIRECT CURRENT

Central Station—Possibility of equalizing load fluctuations to a large extent;

"Puffers," storage batteries or other means for the accumulation of energy, therefore favorable conditions for efficient fuel conversion and utilization in the prime movers.

Transmission—Tension limited to 600 or 700 volts as a maximum, therefore distribution of electric energy over wide distances uneconomical or impossible.

Substation—Motors susceptible of control, with economical means for starting, braking and speed regulation; simplest conduction of current.

ALTERNATING CURRENT

Central Station—Bad load equalization, inefficient utilization of the dynamo. Therefore "puffer" or accumulator stations between generators and motors are necessary.

Transmission—High tension is possible; therefore also the distribution of electric energy over any distance practical and economical.

Substation—Motors are simple and can be connected directly to the high-tension net. They are best suited for working in one direction of rotation and at constant speed. (Ideal transmission motors.) They are less fit for reversible and such drives that must be capable of control (steel works, rolling mills), and for transportation purposes. Transformers and converters are necessary.

From the above it is seen that the realm of application of direct current is limited to blast-furnace plants, steel works, rolling mills, coke ovens and auxiliary drives. Moreover, it is necessary that the central station is located near the principal place of usage. Alternating current is best suited for such central stations which are to transmit the energy of waste gases over wide distances, for instance to neighboring blast-furnace plants and coal mines. Also for parallel operation of distant central stations. Further, for the distribution from some central plant of electric current to several industrial establishments (overland centrals), and for the transmission of energy over wide distances (electric railways).

A combination of both systems by the interposition of alternating-current direct-current converters as intermediary members, will obviously be suited to all conditions, the higher initial cost being counterbalanced by a number of other advantages.

CENTRAL VERSUS SCATTERED DRIVE

Now, as to the superiority of electric centralization over scattered gas or steam

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drive the following gives a brief résumé of the principal points: The main conductors from the central station to the various departments can be laid as underground ring cables, thus giving hardly any cause to interruptions in the supply service. Pipe lines for gas and principally for steam must be carried overground and be easily accessible on account of the repairs which occur frequently. Their initial cost is also higher. Direct steam drive causes enormous condensation losses in the pipe lines, which continue even when the engines are not running and which preclude the employment of high steam pressures, which otherwise would be adopted for securing higher economy.

With scattered gas engines there are, it was said, no condensation losses in the supply pipes. But there is this drawback, that each set requires separate provisions for back-cooling the jacket water, which are both costly and complex. The securing of skilled attendance at reasonable cost, which is yet a factor of some weight for the successful operation of gas engines, especially in this country, is a problem that is multiplied the greater the number of independent installations, while in the central station it is a single factor that can very well be taken care of.

The same line of thought applies to the matters of floor space, foundation, complication, necessity of reserves, etc., which are less favorable for gas engines than for steam turbines. Therefore the future and the success of gas engines for large-scale production lie with large units operating in the central station, where all its weaknesses can be equalized and minimized. Provisions for ample reserves and spare units, for high-class attendance, perfect control, and a favorable distribution of the plant's loads can best be made in one central power house.

DIFFICULTIES OF ELECTRIC DRIVE

The generation of high-tension electric current is just as simple and reliable a matter as is that of current of lower potential. The only real difficulty which still exists lies in the transmission system. The interdependence of the different sections of one net and their liability to break down owing to insulation troubles, short circuiting, sparking, overloading, etc., are its weakest points.

While there are automatic provisions to protect every individual generator against overloading, there are none as far as the effects of surges on the line are concerned. Altogether, our understanding of the phenomena occurring in a high-tension transmission net are still very limited and the possibilities to amplify our knowledge by proper experimentation are almost nil. But, as was said, this is perhaps the only point which is capable of improving. Generators, transformers and electric motors, it is conceded, are simple, compact, self-contained and reliable ma-

chines. Their operation and up-keep does not require extraordinary expenditures. Their floor space is small and therefore the housing for each separate drive is cheaper than it would be with either gas or steam engine. Their initial cost and the cost of foundation required is also less.

ADAPTABILITY TO FLUCTUATING LOAD

Another principal point: Electric motors adapt themselves much more easily to fluctuating-load conditions and the whole system loses its rigidity of operation, becomes widely elastic, better regulated and more easily controllable from the central plant. It is much easier to throw in a new motor when so desired and the provision for reserves or spare units at the different places of usage is decidedly cheaper.

Further, there is this great advantage about electric drive: that the great variety of types and models, which is a feature or necessity of direct drive, can be dispensed with in favor of a few standard forms and sizes. For the efficiency of electromotors decreases only very slightly with the lowering load in contradistinction to that obtained with gas and steam engines. If a small electric motor breaks down, a reserve motor can be installed immediately. Not so with gas and steam engines. Extremely heavy overloads, which occur quite frequently in colliery work, can be fully met by electric motors, which are susceptible of momentary overloads of 100 per cent. and more, without suffering harm. They may therefore be selected of a medium capacity and will yet suffice for the maximum demands.

One of the greatest and well known drawbacks of the gas engine is, beside that its range of economical load is limited to between 50 per cent. and the maximum, that it cannot be overloaded. When underrated by the manufacturer, a nominal overload capacity of 15 per cent. is all that may be reasonably expected. As already mentioned, the possibility offered by electric centralization to so distribute the various phases of a daily load that a more even curve results enables one to protect the gas engines in the central station against undue maxima and minima.

With scattered drive the capacity of (gas) engines must be made to correspond to the maximum load which may eventually occur. Therefore they will work normally with lower efficiency and higher fuel consumption than what could be attained under more favorable load conditions. Besides all this it is a very desirable feature with central electric drive that the consumption of power and its fluctuating demand can be readily observed and registered at the switchboard in the central station, while with direct gas drive this is more difficult and with direct steam drive it is practically impossible. This continuous control means a

saving of thousands of dollars per year in plant fuel cost.

MACHINES LOCATED NEAR THE BOILER PLANT

It was held until a short while ago, and by some is held even now, that electric drive of those machines which are located in the near vicinity of the boiler plant, and especially those that work continuously, like compressors, fans, etc., would bring no advantages through a reduction of plant fuel consumption. That this idea is erroneous so far as steam drive is concerned will be appreciated when making the following consideration: Large and continuously operating steam engines of from 100 to 500 h.p. capacity are normally built as compound engines having a steam consumption of about 8.5 kg. (18.7 lb.) per effective h.p. per hour. By combining, through centralization, all their power in the central station, we get units of 1500 h.p. and more, which are normally built for a steam consumption of 5.6 kg. (12.3 lb.) per effective h.p. per hour.

Assuming for the conversion of the mechanical power into electrical energy, and for transmission of the current to the place of usage, and for its transformation there into motion a liberal loss of 20 per cent., then the item of steam consumption in the power house increases in a ratio of 5.6:0.8, that is to 7 kg. (15.4 lb.), so that even then 1.5 kg. or 3.3 lb. of steam are saved per h.p. per hour through the employment of large prime movers.

A similar line of thought shows that the small electric motors are equally benefited since the current for them is produced cheaper than in smaller generators, such as are used nowadays for delivering current to the smaller motors. It should be considered that the great condensation losses in the pipe lines and engines during idle periods or with low load factor are not included in the consumption figure of 18 lb. given above, and that all these losses are absent in central electric drive.

PUMPING SERVICE

Constituting as it does the most important item of power consumption in colliery work, we shall have to devote a few remarks to the development which led to electric centralization in this particular department. Formerly the subterranean steam pumping plants used to occupy the predominant and undisputed place. Their efficiency depends greatly on whether the service rendered is intermittent or continuous, since there is obviously a great loss due to condensation in the pipes descending down the shaft, such loss lasting all the time, regardless whether or not the pumps are operating. Under very favorable conditions of operation such as obtain, for example, in the 1500-h.p. plant in the Victor mine, Germany, on which a test is available, as high efficiencies as 89 per cent. may be attained, the total loss

in steam consumption not exceeding 10 per cent. The largest steam plant of this type ever built in Europe is working with triple expansion, and is supposed to lift 25 cu.m. (883 cu.ft.) of water against a head of 500 m. (1640 ft.), corresponding to a power capacity of 3000 h.p.

Later on, the hydraulic system of raising water, of which we have in Germany 46 installations with a combined capacity of 165 cu.m. per min. (5825 cu.ft.), took the place of the steam drive, to be finally superseded by the electrically driven pump. The advantages embodied in this latest application are so obvious that there were, according to Dr. Hoffmann's report at the beginning of 1906, in the Ruhrkohlen district alone, 110 installations aggregating a prime-mover capacity of 50,000 h.p.

It was a natural consequence of the introduction of electric drive that the design and construction of pumps would thereby be modified to a certain extent, especially that the profitableness of higher speeds would be considered. And so we find now, with piston pumps, an average working speed of 100 and even 120 r.p.m. against the 60 revolutions of earlier years. This, which we may call a transient type, is known also in this country under the name "Riedler Express Pump," and has served as a model to many builders. The largest electrically driven pumping plant of this kind, and I think the largest altogether, is the one operating on the Colonia mine, near Langendeer, which lifts 20 cu.m. per min. against a head of 435 m. (703 cu.ft. 1427 ft. high).

CENTRIFUGAL PUMPS

The desirability of even higher speeds led to the adoption of centrifugal pumps, which are cheaper in first cost, attendance and floor space, and though considerably inferior in efficiency have conquered within very little time a remarkable percentage of the total service. As a matter of fact, by far the greatest quantity of water in continental mines is lifted by centrifugal pumps.

It was said that it had been conceded for a number of years that electric drive is handy and economical for medium size and small engines which are located at a good distance from the boiler plant, and that the saving in fuel cost, attendance, lubrication, and waste, also the low initial cost and other advantages referred to, warranted the installation of electric motors at those specific places. It has now also been evidenced that the draining and pumping of water in mine work can be done with greater all-round satisfaction by the adoption of high-speed centrifugal pumps, which are driven by air- or water-cooled inclosed electric motors of the three-phase current type, and which receive their energy and are controlled usually from transformers located at the mouth of the pit, with greater all round efficiency, reliability and economy of operation.

The pumps are usually of the twin-series and triple-series types, running at from 800 to 1000 r.p.m., and are mounted with the motor on a common base plate carried on trolley wheels, so that they may be used in any part of the mine. In the lead and silver mines of Ems, Germany, a pump of this type is lifting 9000 cu.ft. of water per minute against a head of 800 ft. Also for washing work in collieries these electrically driven pumps are now largely employed.

Another remarkable installation of this kind which was recently tested as to its all-round efficiency is operating in the Victor mine, near Rauxel, Germany. It lifts a quantity of 7 cu.m. per min. against a head of 500 m. (247 cu.ft. 1640 ft.) at 1000 r.p.m. The capacity of the prime mover which serves to generate the necessary electric current is 1400 h.p. indicated. The total plant efficiency is 59 per cent.

In commenting on relative efficiencies of steam, hydraulic, and electric pumps it must be considered that the issue of a comparison is largely dependent on the respective favorable or unfavorable conditions under which the different systems, especially electrically driven centrifugal pumps, are operating. Conditions are poor for the latter type when the quantity of water is small and the head high.

Also, the results are greatly influenced by the manner in which the centrifugal pumps are driven, whether they receive their current from the network of a central station, or whether they possess their own separate generators driven by either gas or steam engines or turbines. The advantage of the last named combination with centrifugal pumps consists, first, in that the number of revolutions of the pumps is kept constant without additional water-throttling regulation, since the prime mover will keep its speed automatically with fixed governor. While, when the pump is taking its energy from a network of unchangeable frequency a special throttling device for the water must be provided in order to prevent interruptions in the flow, such throttling being apt to decrease the efficiency of the pumping process more or less.

Another advantage of employing a separate engine- or turbine-driven alternating-current generator lies in the possibility thus rendered to distribute the pumping work, which represents the largest single factor in the plant's load, over such periods during which other (hoisting) engines are not running, for example, over night, thereby keeping the consumption of power proportionate to the production of gas, that is nearly constant.

Fig. 2 gives an approximate idea of the relative efficiencies of a steam, a hydraulic and an electric pumping plant for mining work, and also shows the distribution of losses which occur in electric centralization. The test was made in the Franzeska mine in Witten, by the Verein deutscher

Ingenieure, and represents results such as are obtained under actual working conditions. The term "efficiency" applied to electric pumping means the ratio of water lifted to work indicated in the (steam) engine. In the particular case under discussion the latter serves to drive an electric alternating-current generator, which in turn delivers three-phase current to the subterranean motor-driven pumping equipment (piston pumps at 80 r.p.m.).

It is seen that, notwithstanding the many losses occurring between prime mover and pumps as indicated in the diagram, the total efficiency of the electrical pumping equipment runs almost as high as 70 per cent. Since the long-distance distribution of high-tension electric current has been through the economic generation of electricity in gas-engine driven central stations operating on coke-oven gas, etc., so widely adopted all through

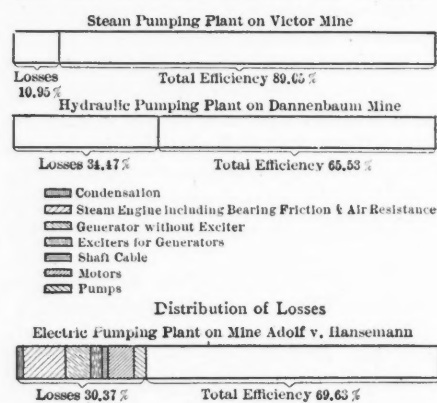


FIG. 1. RELATIVE EFFICIENCY OF THREE MODES OF PUMPING

the industrial districts in Germany, it is to be expected that complete centralization, that is, centrifugal pumps driven by electric motors which derive their current directly from the line, will be the predominant mode of operation before long.

Recovery of Arsenic at the Washoe Smelting Works

The plant for the recovery of arsenic from the flue dust from the smelting furnaces at the Washoe smelting plant is described in a pamphlet prepared by the members of the Anaconda Copper Mining Company staff. The flue dust is conveyed into two Brunton roasting furnaces. The arsenic fumes from these are conducted through 240 ft. of zigzag flue, cooling the gases and giving a product of about 90 per cent. As_2O_3 . When a sufficient quantity has been produced, the roasting furnaces are shut down and the product removed in wheel-barrows to a small reverberatory refining furnace, fired by coke, and re-sublimed in a similar zigzag flue, yielding a product of 99.80 per cent. As_2O_3 , which is ground and barreled for shipment.

The Valuation of Roasted Blende with Regard to Its Sulphur Content*

By V. HASSREIDTER—TROOZ

The results of analyses of ten different blendes roasted at six plants A-F are shown in Table I. At each of these plants muffle furnaces are employed and the roaster gases are converted into sulphuric acid.

The total sulphur *a* (column 7) was in each case determined by fusing the roasted blende with a mixture of sodium carbonate and potassium chlorate, extracting the melt with water, filtering, acidifying with hydrochloric acid, boiling off every trace of chlorine, and precipitating with barium chloride.

analysis no less than 2 per cent. sulphide S, and is rather incompletely roasted.

It should be noted also that the figures under 10 and 11 not only enable us to deduce directly the amount of objectionable and unexpelled sulphur, but further expose the character of the roast. Thus, for instance, the roasting plant *A* has partially sulphatized the blendes I and VI, while plant *E* leaves the objectionable sulphur in the roasted ore as sulphide.

When the roasted blende IX is treated for some time with warm water, only 0.18 per cent. MgO out of the total 5.70 per cent. passed into solution, showing that only a small portion of the Mg is present in the form of sulphate after roasting. The condition was similar in the case of blende X, 0.53 per cent. MgO out of 2.70 per cent. being extracted by water.¹

As regards the behavior of the lead, the

tained by the extraction and by the direct method, the roasted ore examined being poor in lead:

	Per ct.	Per ct.
(1). Total sulphur, <i>a</i>	1.95	
Extracted with ammonium acetate, <i>f</i>	0.90	
Sulphur present as ZnSO ₄	0.01	
Objectionable sulphur = <i>a</i> - (<i>f</i> - <i>d</i>) =	1.06	
(2). Extracted with HCl, <i>f</i>	0.97	
Sulphur present as ZnSO ₄	0.01	
Objectionable sulphur = <i>a</i> - (<i>f</i> - <i>d</i>) =	0.99	
DIRECT DETERMINATION.		
Sulphur present as ZnSO ₄ , <i>d</i>	0.01	
Sulphur present as ZnS, <i>e</i>	0.92	
Objectionable sulphur = (<i>d</i> + <i>e</i>)	0.93	

We have, therefore, the means for estimating that portion of the residual sulphur which, from the point of view of the zinc producer, is objectionable, and also of that which, from the point of view of the acidmaker, is described as "unexpelled," whether we resort to the direct-estimation of the ZnSO₄ and ZnS, or to the less satisfactory extraction method.

It is probably very much more difficult to estimate in a given blende of given composition the quantity of sulphur available for acid making, and this problem at present still awaits solution.

TABLE I. ANALYSES OF BLENDES ROASTED AT DIFFERENT PLANTS.

Blende.	Plant.	Pb Per Cent.	CaO Per Cent.	MgO Per Cent.	BaO Per Cent.	Total S a Per Cent.	S Calculated from PbSO ₄ , etc. Per Cent.	a-b Per Cent.	Zinc Sulphate a Per Cent.	Sulphide b Per Cent.	d + e
1	2	3	4	5	6	7	8	9	10	11	12
I	A	2.78	2.38	0.54	.....	3.18	2.22	-0.96	0.65	0.80	1.45
II	B	4.06	0.75	0.54	.....	1.80	1.52	-0.28	0.40	0.08	0.48
III	C	8.89	1.00	1.00	7.62	4.39	4.34	+0.05	0.05	0.05	0.10
IV	B	7.23	1.50	1.08	13.47	5.67	5.64	-0.03	0.57	0.05	0.62
V	C	3.78	1.65	0.40	.....	2.40	1.84	-0.56	0.19	0.42	0.61
VI	A	7.86	1.35	1.04	12.47	6.55	5.43	-1.12	1.15	0.15	1.30
VII	B	10.92	4.42	0.65	.....	3.98	4.73	-0.75	0.27	0.04	0.31
VIII	D	11.33	1.75	0.17	.....	2.13	2.89	-0.76	0.03	0.28	0.31
IX	F	11.98	2.88	5.70	.....	3.14	8.06	-4.92	0.05	0.00	0.05
X	E	1.50	8.45	2.70	.....	7.10	7.22	-0.11	0.10	2.00	2.00

In column 8 is given the sum *b* of the sulphur corresponding to the lead, calcium, magnesium and barium, assuming that each of these elements is completely converted into sulphate.

Column 9 shows the "objectionable" sulphur, calculated on the basis of the same assumption (*a* - *b*).

Lastly, column 12 shows this "objectionable" sulphur determined directly as the sum of the sulphur present in the form of zinc sulphate *d* and zinc sulphide *e*.

SIGNIFICANCE OF RESULTS

Now, if the assumption that all the lead, etc., is completely converted into sulphate in the roast were correct, the figures in column 9 should never have a negative value, and they should be identical with the corresponding figures under 12, or (*a* - *b*) should be equal to (*d* + *e*).

It will be seen that this is the less nearly the case, the higher the percentage of lead and magnesia. The divergence is particularly marked in the blendes VII - X, where the difference (*a* - *b*)—the "objectionable" sulphur—actually assumes a negative value.

The blende X, which, judging from the figure in column 9, would be considered thoroughly well roasted, shows by direct

analysis of the blendes VII to X show that 55 to 75 per cent. of the lead in the roasted ore is present as sulphate. In consideration of the variation in the composition of different blendes, in the construction of the furnaces, etc., it is hardly possible to draw any more definite conclusions with regard to the sulphatization of the elements in question.

CONCLUSIONS

It appears then that for the determination of the objectionable sulphur we have the choice only between the extraction method (ammonium acetate or hydrochloric acid) on the one hand, in which the PbSO₄, MgSO₄, ZnSO₄ and CaSO₄ are brought into solution, and the direct estimation of the zinc sulphate and zinc sulphide on the other.

According to the first method the sulphate S, dissolved, must be determined and deducted from the total sulphur (estimated in the wet way). The zinc sulphate must be determined separately, with due regard to any Cd or Mn which may have gone into solution. This method then involves three separate determinations, and has the inherent weakness of all "difference" methods.

The following example may nevertheless be quoted, as showing the results ob-

The Lawson Mine at Cobalt

The long-protracted litigation over the Lawson mine at Cobalt, which had reached the Supreme Court, has been settled by an agreement between the parties. The four original prospectors who secured the claim were T. Crawford, Donald Crawford, John McLeod, and Murdoch McLeod. The claim stood in the name of T. Crawford, who, without consulting his associates, leased it to H. E. Lawson. The property was afterward discovered to be very valuable. The rights of the three other prospectors interested were bought by John McMartin, of Cornwall, for \$25,000 each, conditioned upon their establishing their title. The High Court of Justice at Toronto decided that each of the four prospectors was entitled to a one-quarter interest. In the meantime C. Millar, S. R. Clarke and others, of Toronto, had taken interests in Lawson's claim and the case was appealed. The settlement arrived at is virtually a consent to the original decision, and under it John McMartin becomes owner of three-fourths of the mine and Millar, Clarke and their associates of the remaining one-fourth. The location, the value of which is estimated at \$5,000,000, has a rich surface showing of silver, and development work will be begun at once. The property is in the south half of the northwest quarter of lot 3, concession 4, Coleman township. Some confusion has been caused by the use of the name "Lawson" in connection with other mines in the neighborhood.

*Abstracted by Alfred J. Lotka, General Chemical Company, Laurel Hill, L. I., from an article in the *Zeit. f. angew. Chemie*, 1906, p. 522.

¹The green blende contained the Mg as carbonate.

Cornish Methods of Crushing and Ore Dressing

The Old Machines Combine Low First Cost with Simplicity. Labor Scarcity is a Factor in the Introduction of Modern Methods

BY EDWARD WALKER

Cornish practice in ore dressing is at present in a transition stage between the old fashion and the new. In using the words "old fashion," I do not intend to imply any contempt. Far from it. Those who have read my previous articles will remember my defense of the Cornish engineer who had to adapt himself to the requirements of the cost-book system and the circumstances of the uncertain tenure of mining leases. The orders of those who put up money or granted leases were: "Do the thing as cheaply as possible, and be quick about it."

new. For the old fashion in the old days it is to be said that the first cost was far less than the new fashion, and the cost of operation very little more.

It is often said that it is outsiders who have introduced the new fashion in crushing and dressing, and have taught Cornishmen a lesson in up-to-date machinery. I do not think that this is quite fair. It is certainly true that Cornishmen have been paralyzed by the financial conditions under which they worked, but when the scarcity of labor and the falling off in the grade of tin ores occurred, ten or more

metallurgical or mechanical problems was utterly out of the professional man's reach.

EFFICIENCY OF OLD METHODS

The actual mechanical efficiency, apart from the question of cost of labor, of the old fashion, is a point on which there is some divergence of opinion. I suppose that a quarter of the tin was and is still lost at most of the Cornish mines, and the fact that the people who re-work the tailings sent down the Red river and other streams, make a big return and consider-

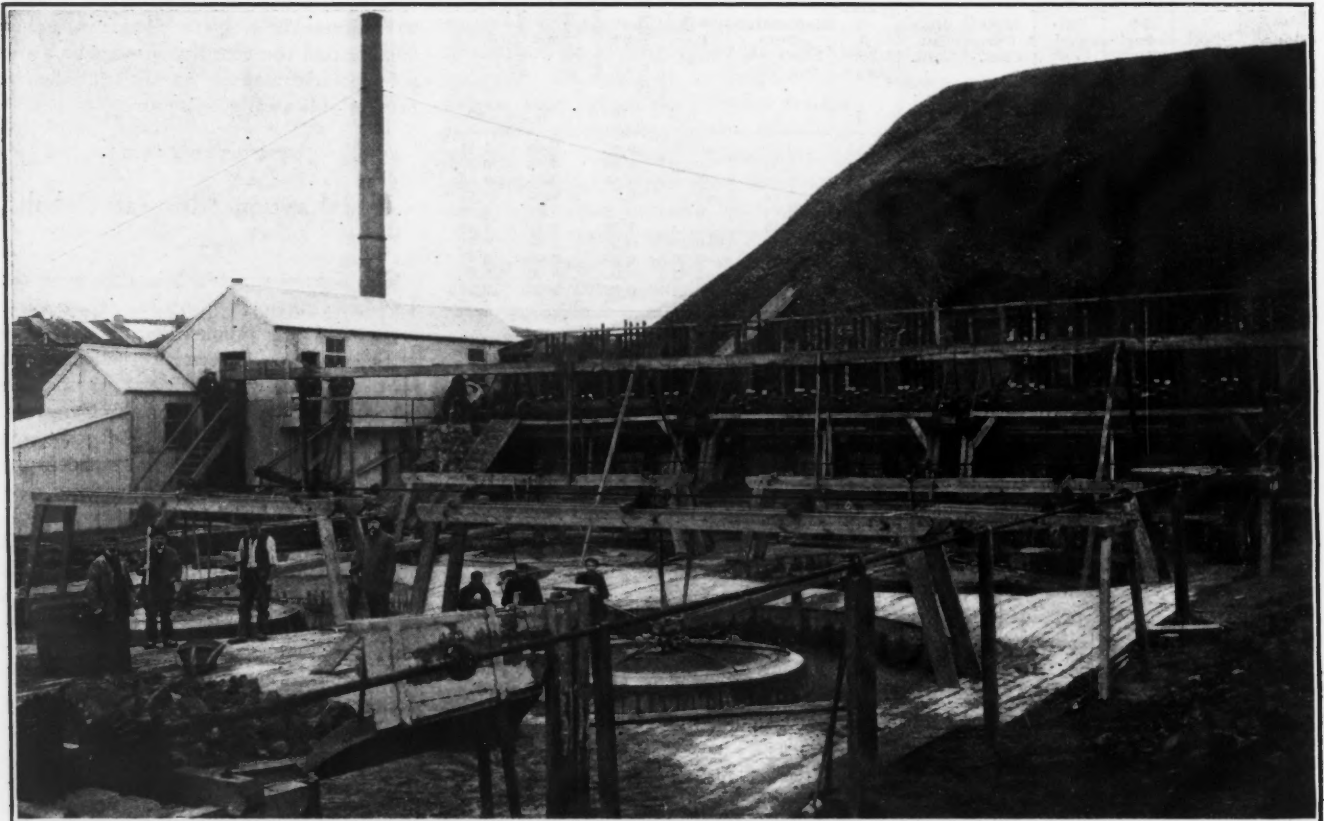


FIG. 1. CORNISH STAMPS AND BUDDLES AT WHEEL SETON

It is to the everlasting credit of the Cornishman that he evolved on these lines a system of crushing and dressing that was perfection in its way. The first cost of the stamps and the buddles and frames was wonderfully low, and the labor required to operate the plant was mostly of the unskilled type. In the old days even skilled labor was cheap, and plentiful, so that the cost of operation was fairly low. Nowadays labor is not so plentiful, either skilled or unskilled, owing to the general exodus, so that the old fashion has perforce to be abandoned in favor of the

years ago, it was chiefly Cornishmen who carried out the work of remodeling their plant and inventing labor-saving appliances. At the present time the chief firm of mining machinery makers in Cornwall is as up-to-date as any that exists, and has actively introduced many excellent modern apparatus.

The old cost-book system has much to answer for. It was impossible to put up machinery that would pay in the long run, by increasing extraction and lowering the cost of operation. Such a thing as devoting any capital to experimenting on

able profits shows that the dressing plant is far from perfect.

The old question of available capital here crops up again. In the old days the operators of the mines may not have cared about embarking on further expense for extracting plant. Besides I do not think that modern engineers, especially American engineers, should poke fun at the Cornishman for losing so much in his tailings, for the case comes under the general principle that the maximum profit is to be achieved under the conditions existing at the time.

It is not at all clear that the modern plant put up in Cornwall obtains any better saving than the old plant. Its chief advantage is the decrease in the cost of operation.

The above remarks refer entirely to the extraction of tin oxide itself. This, however, is not the only problem or even the most important problem that modern methods have to deal with in Cornwall. The tin oxide often occurs with wolfram and pyrites, and these mixtures require modern methods for their profitable handling. In the old days, unless a complex ore could be hand picked, it was utterly neglected. Not only was capital unavailable for the exploitation of complex ores, but there were no known processes by

broken ore by hand to the stamps. No rock breakers were ever used, and at some of the biggest mines are not used even now. The Cornish stamp was like all other stamps originally, a wooden mallet on a wooden stem, but what I may call the real Cornish stamp is a chilled cast-iron shoe attached to a wrought-iron stem.

The frames and mortar box are fixed directly into the ground, and instead of a metal die the bed on which the crushing is done consists of hard rock pounded into the ground. Later modifications have introduced metal dies instead of rock beds, but I consider the rock bed more typical of real Cornish practice. The stamps are lifted by cams fixed to a revolving cylinder. The accompanying illustration, Fig.

stamps are still at work, for there were other purposes for which the available capital was more pressingly needed instead of providing new installations of crushing machinery. At other mines, such as South Crofts, the whole of the plant is being replaced. At other mines, where operations had been suspended for many years, it was naturally necessary to provide entirely new plant, and this has always been of the modern fashion.

As regards the new methods of crushing, it is of course unnecessary to say anything about California stamps. I think, however, they are receiving undue preference over the pneumatic stamp, which has done good work in Cornwall and has been in operation at Dolcoath and elsewhere for some few years. Its advantages are being overlooked by those engineers who are now for the first time taking hold of Cornish propositions.

At the risk of coming into conflict with writers of various textbooks and other authorities, I would like to draw attention to this stamp. It was originally invented by William Husband, of Hayle, and was made by Harveys. It was never actively pushed by Harveys, and it was only when this firm was dissolved and the stamp taken over by Holman Brothers, of Camborne, that it received much of a chance. I give illustrations herewith.

THE HUSBAND STAMP

In most textbooks the description of this stamp is perfunctory and its real object is not made clear. The descriptions lead one to believe that it is operated by compressed air, just as the steam stamps are worked. This is quite a mistake. The stamp is driven from shafting *A*, Fig. 3, by a crank or eccentric and connecting-rods *B*, and an air cushion is interposed in the stem so as to obtain a better crushing blow and also to enable the stamp to be driven more rapidly without knocking itself to pieces. The stem *C* passes through a cylinder *D*, which in its turn is suspended by two connecting-rods *B* to the crank shaft *A* at the top.

On the stamp-stem inside the cylinder is a piston *E*. In the walls of the cylinder above and below the middle position of the piston are two series of holes *F* and *F'*. The stem and cylinder are kept in alignment by the guides *G* and *G'*. As the piston travels up or down, it traps the air above or below the holes, and the air thus compressed acts as a cushion and on the return stroke assists in the propulsion of the stem.

At Dolcoath there are three head of these stamps, each of which crushes about twelve times as much as a Californian stamp. I do not consider this a perfect comparison, for the stamps do not work under exactly the same conditions, but the comparison is near enough for a *prima facie* case.

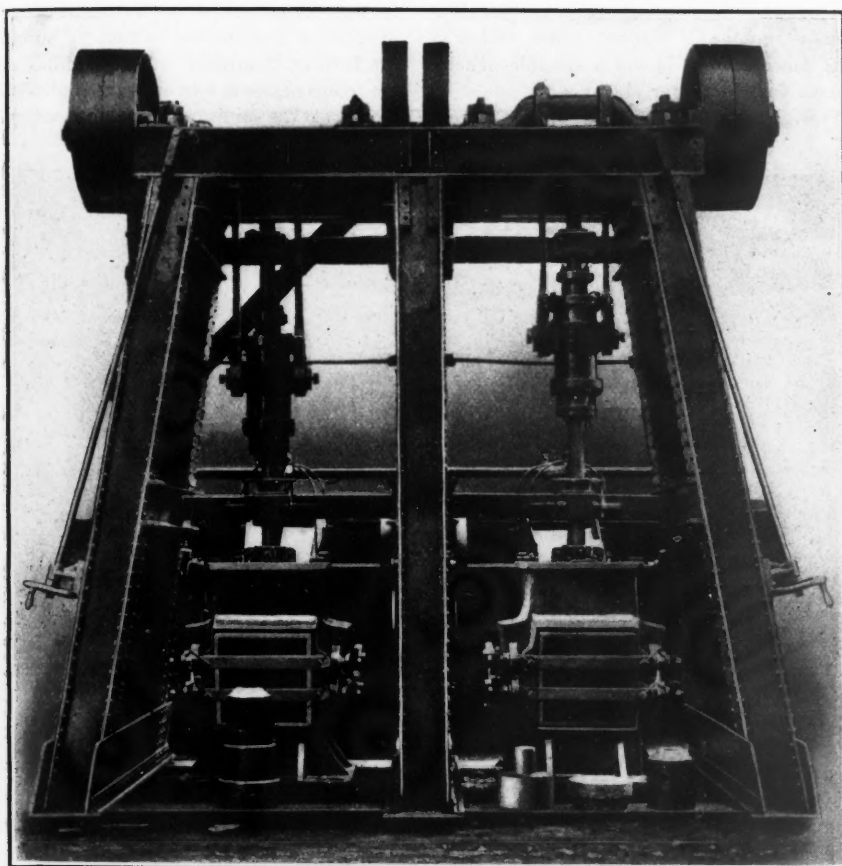


FIG. 2. THE HUSBAND PNEUMATIC STAMP

means of which they could be handled to benefit.

From this point of view, also, the criticisms of the inability of the Cornishmen to tackle complex tin ores are quite unjust. It is only during recent years that magnetic concentration has been invented and applied to the separation of wolfram from tin oxide, and even now the question of mechanically separating pyrites from tin oxide and wolfram is in abeyance, until such time as a flotation process shall be applied.

CORNISH METHODS OF CRUSHING

The old Cornish practice in crushing is to spall the ore by hand and to feed the

1, gives an admirable view of an installation of these stamps at Wheal Seton.

The stamps are not rotated, and there is a good deal of friction on the cams and torsion on the cam cylinder. The screens are mostly of Russian iron or gun metal and the holes are punched 20 to 30 to the linear inch. So it will be seen that the ores are crushed finely to start with.

There are certain advantages in Cornish stamps, but owing to their preponderating disadvantages it is not necessary to enter into a discussion of them at this time of day. It is not probable that any more will be built. At some of the mines where modern improvements have been introduced, such as Dolcoath, the old

CORNISH ORE DRESSING

The old Cornish practice in dressing tin ores did not take cognizance of any mechanical method of separating complex ores. Unless such ores could be hand picked they were neglected. Fifty years ago Cornwall was a by-copper producer, and the copper and tin occurred on the same lodes. The lines of demarcation of the tin and copper were often distinct enough to enable the miners to effect a clean separation by hand, but very large amounts of ore were mixed, and it was a

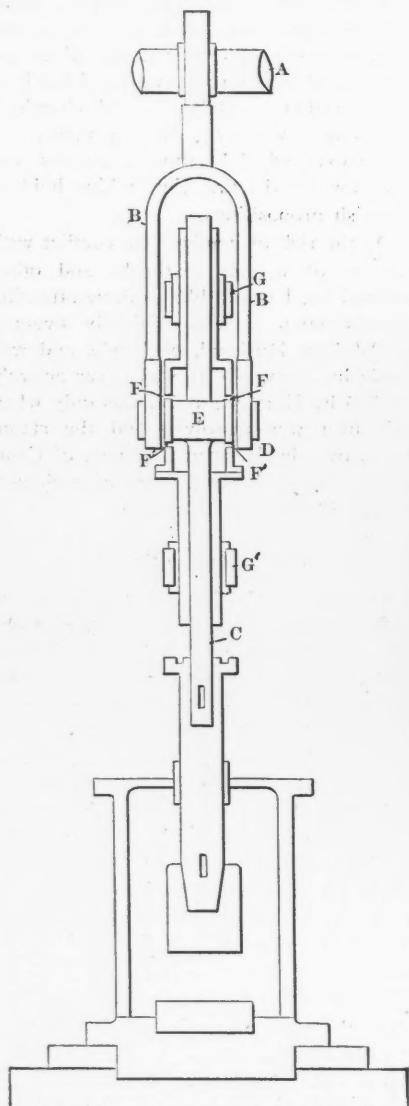


FIG. 3. SECTION, HUSBAND STAMP

puzzle whether to sell this ore as copper or as tin ore.

The amount of copper that can be separated by hand picking is now very small and perhaps only the Levant mine makes an income from this source. It is still a problem for the future how to separate mechanically the copper and other pyrites from the tin oxide. The flotation inventors are now having a good try at the problem.

Leaving the question of complex ores for the present, I will give an outline of the old method of concentrating the tin

ores. The pulp as it comes from the Cornish stamps passes into strips. These consist of troughs 1 or 2 ft. wide and perhaps 20 ft. long, arranged at a slope of 1 in 30. These "strips" are crude classifiers and separate the heavier sands from the slimes.

The sands are concentrated on stationary buddles. I would here interpolate the remark that the word "buddle" is as often misused as the words "mesh" or "ore-in-sight." A buddle is a concentrator on which the heavier particles are caught and kept in position until a thick bed is formed that can then be dug off and removed. It is a mistake to use the word buddle in connection with concentrators of conical form fixed or rotating on which the heavier and lighter particles are separated and from which they are continuously removed. Cannot some authority on concentration invent a suitable generic name for this latter class?

Originally the Cornish buddles were

board about 6 ft. each way. Launder carrying slimes and water respectively run along at the top of the frames. The slimes run down the frames, and at intervals of a few minutes, a flush of water is sent down to remove the heavy particles that have adhered. At the same time the lip of the board at the bottom is moved so that the flush carries the heavier particles into a separate discharge launder. The flush and the opening of the lip are effected automatically by the water supply itself, and after the discharge of the water, the apparatus is righted by counterbalancing weights or otherwise.

The concentrates obtained from these frames are still of very low grade, and are by no means a marketable product. In fact the action of the frames is only to produce a concentrate which is suitable for further treatment on the buddles and the concentrate is sent either to the buddles that treat the sands or to a further series of

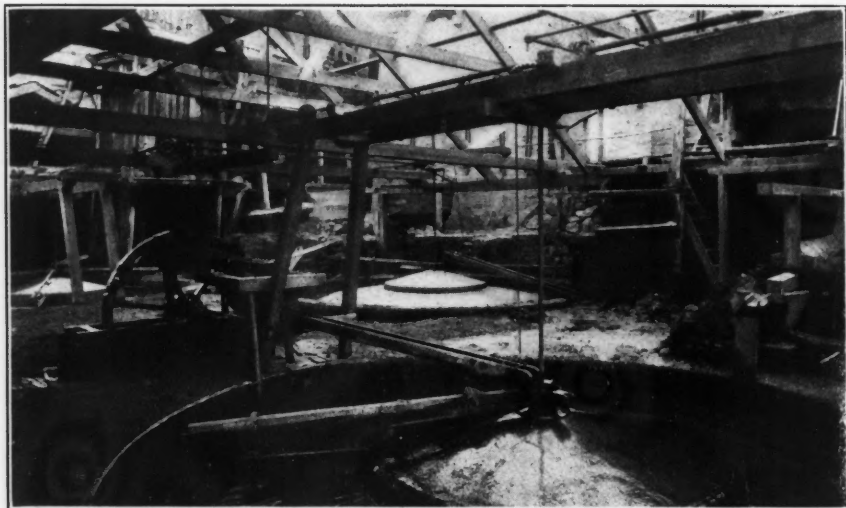


FIG. 4. CORNISH BUDDLE WITH AUTOMATIC FEED

fed by hand and many still are. All that have been put down recently are fed automatically, as is shown in Fig. 4. They are also shown in Fig. 1. The concentrates from these buddles are calcined usually in a Brunton furnace, with the object of oxidizing any pyrites, and they are then buddled again so as to remove the oxides produced by roasting the pyrites.

RACK FRAMES

The slimes from the "strips" and also the tailings from the buddles are sent to settling tanks and are afterward dealt with on a series of frames called "rack" frames, or "rag" frames, according to the degree of provincialism in the dialect of the speaker. It is not necessary to illustrate these frames in detail, but I give in Fig. 5 a view of an installation of them at Dolcoath. The detailed drawings are found in most textbooks. Suffice it to say that the frame consists of an inclined

buddles down below. After buddling, the concentrates from the frames are sent to the calciner along with the concentrates from the buddled sands. The ultimate product from all the buddles is further concentrated in the kieves, which consist of tubs. The concentrates are poured in while the water in the kieves is stirred rapidly. Thus the best quality of concentrate goes to the bottom and the poorer quality is found on the top. The latter may be returned to the buddles or added to the next charge in the kieves.

OTHER CONCENTRATING APPARATUS

I desire to point out that the buddles, frames and kieves, described here, are the outcome of the genius of the Cornishman for devising apparatus which costs very little, just as in the case of the stamps. The buddles and kieves cost very little to build. The frames cost about \$8 each. They are perfectly automatic and require no attention, and they will last for 6 or 8

years. They are therefore very economical machines for treating slimes running only a few pounds to the ton and so preparing them for treatment in the buddles.

During recent years a new slime concentrator has been in use in various Cornish mines, called the "Acme," and made by Holman Brothers. This machine is comparatively little known; it is of the revolving-table type and is a combination of a convex and a concave table.

Owing to the multiplicity of operations and the repeated handling of the products, it is impossible to figure out any accurate figures for the efficiency of the processes. In fact, the average Cornishman does not keep any records of actual results in ore dressing. The only real uncontradicted fact in connection with losses in dressing is the Red river. The tailings from the mine are all discharged into the river, and independent tin streamers work the stream

NEW METHODS

Before proceeding with descriptions of modern plants at Cornish mines, it will be of interest to give some particulars of the first introduction of new methods. The first and most important innovation was at Dolcoath. Twelve years ago, the drop in tin and the reduction in the grade of the ore brought about a crisis, and the managers were obliged to forsake the old cost-book system and to appeal to London for financial help. A large amount of new capital was subscribed on the limited liability system, and the mine was once more put on its legs.

The question of ore dressing was referred to Fraser & Chalmers, and after considerable inquiry it was decided to make a compromise between the old and the new fashions. As the grade of the ore was lower, it was decided to increase the output, but instead of abolishing Cornish stamps, the old ones were kept in opera-

Acme table already mentioned, is the most interesting. As an example of a transition period, Dolcoath is without rival. The variety of plant is exceptional, and if I may be permitted to say so without offense, it is a veritable museum of ancient and modern metallurgical plant.

Your readers may expect me to say something about sizing or want of sizing in Cornish practice, and may ask why the whole of the pulp is passed over vanners direct from the stamps without any preliminary sizing. The fact is there is a sharp conflict of opinion on this sizing question. The German engineers at Clitters are keen on sizing, while other engineers are not. It is really a subject which is as yet only in an experimental stage, and I prefer to defer any comments on it for a time.

Increased Cost of Cement Manufacture in England

An influence operating against the British manufacturer, says F. G. White, chairman of the Associated Portland Cement Manufacturers, Ltd., of England, is the advance in the price of fuel and other material required by the manufacturer. On this point the London *Financier* says that for the next 12 months the cement trade will have to pay dearer for the greater portion, at least, of its fuel, for coke is a far more important item to them than coal. Already the manufacturing processes of cement and the administration of the works owned by the associated firms are carried on with an economy which would have been considered impracticable a few years ago. All that science and technical experience can suggest has been carried into practice, where possible, with a view to reducing expenses to a minimum in every department; so that it seems scarcely probable that what will be lost by the higher price of fuel will be saved by the reduction of any other expenditure whatever. . . . It is the price of fuel which has to be considered as perhaps the most variable factor, in the economic production of portland cement. During the next 12 months there will be a slight increase in the expense of manufacture due to this cause. It will affect all cement works in very much the same way, although the large undertakings will probably have a certain small advantage.

In brief, the English manufacturer and the English trade and financial journals are undecided as to whether the enhanced cost of production can be successfully met.

A tin mine in the extreme north of the province of Kwangsi, China, is operated on a small scale, its product being exported through the port of Wuchow. An other tin mine is to be opened in the prefecture of Wuchow.

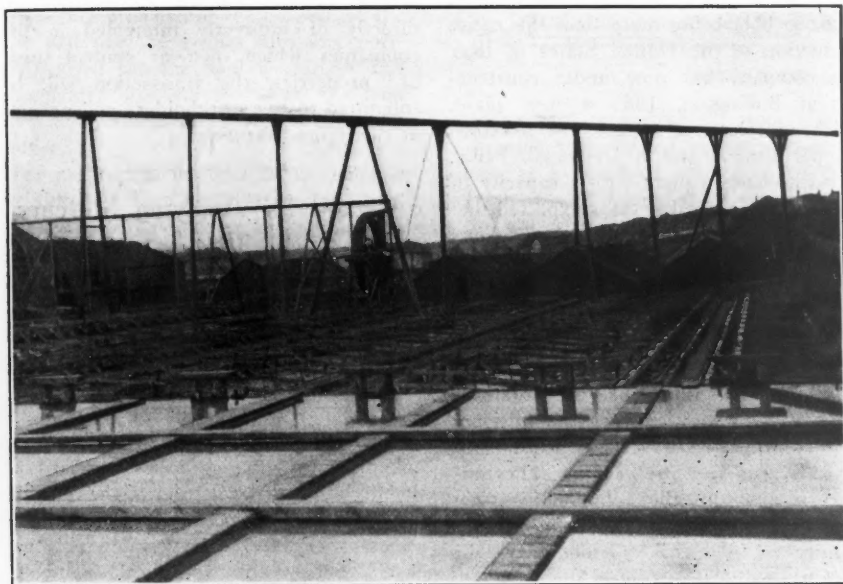


FIG. 5. RACK FRAMES AT DOLCOATH

over again. Whether it would pay the owners of the mines in the old days to have erected additional plant, such as the streamers use, is not a point that can be profitably discussed now; but certainly under the modern methods of treatment these losses should be seriously tackled.

Another criticism to be offered is that no chemical analysis is made of the ore to find out how much tin it contains. The vanning shovel used in assay work is only a concentrator and is no guide to what is in the ore or what can be got out of it. The Cornishman argues that the vanning shovel is the best guide, as it shows what can be got out of the ore and not what is actually in the ore. This may be good enough for roughly estimating the value of the ore, but it is altogether too crude for the purposes of studying ores systematically.

tion, and were supplemented by California stamps and pneumatic stamps. The present equipment of crushing machinery consists of 162 Cornish stamps, 60 California stamps, and three pneumatic stamps.

The chief innovation introduced was the substitution of Frue vanners for buddles. At the present time, the whole of the product of the stamps passes over vanners. The concentrates run about 40 per cent. of tin. The tailings from the vanners are treated in the same way as the tailings from the buddles previously used in concentrating the sands, and as the slimes from the strips. The concentrates from the vanners are calcined, and afterward separated in classifiers into sands and slimes.

The sands are concentrated on Wilfleys and the slimes buddled. Instead of the old Cornish buddles several new forms of slimers have been introduced, of which the

United States Steel Corporation

We give below some extracts from the annual report of the United States Steel Corporation for 1906, on points of special interest:

INVENTORIES

At Dec. 31, 1906, the book valuation of the inventories of all properties equaled \$119,897,467, an increase in comparison with Dec. 31, 1905, of \$6,509,470. This increase is represented entirely in the valuations of ores, raw materials and manufacturing and operating supplies on hand. The large volume of business conducted by the subsidiary companies required increased quantities of operating supplies, and prices of the same are somewhat higher than at close of preceding year. Semi-finished products for further conversion and finished products on hand show decreases.

As in previous years, inventories were taken on the basis of actual purchase or production cost of materials to the respective companies holding the same, unless such cost was above the market value on Dec. 31, 1906, in which case the market price was used. Inventory valuations are believed to be conservative. The aggregate inventory valuation of all raw, partly finished and finished materials produced within the organization is very much below the market price on Dec. 31, 1906. Inventories, however, include the profits on materials embraced in inventories which have been purchased by one subsidiary company from another; but such profits are segregated and carried in a specific surplus account, and will not be included in the reported earnings of the entire organization until such profits shall have been converted into cash or a cash asset to the organization. The specific surplus account referred to is, therefore, practically a guaranty fund for these profits so locked up in inventories, pending realization in cash.

NEW CONSTRUCTION

In the annual report for 1905 reference was made to the decision to erect a large and modern steel plant in the Chicago district. The plant will be located at Gary, Lake county, Indiana. There have been organized the Indiana Steel Company, which will construct the steel plant, and also the Gary Land Company, which will own and improve the site for the city, and will construct a large number of dwellings and business buildings. It is proposed to sell improved and unimproved property in the city to residents at about cost plus a fair interest charge, but under such restrictions as to the uses to be made of the property as may be found to be fair and reasonable. During the year substantial progress was made in the construction work, both on the steel plant and the city; the expenditures, in-

cluding payments made for real estate, amounted to \$4,720,159. There has been acquired for use for plant purposes, for the City of Gary, and for railroad yards and terminals, about 7500 acres of property, with a large frontage on the shore of Lake Michigan. The appropriations approved to this date for construction work at the steel plant comprehend eight blast furnaces, together with ore unloading and handling machinery, 56 open-hearth furnaces, blooming and rail mill, various finishing mills, central power plant, foundries, machine shop and equipment, central pumping station and other accessory works; also the construction of harbor and docks.

On Oct. 1, 1906, the Universal Portland Cement Company, a subsidiary company, took over the business theretofore conducted by the Illinois Steel Company of the manufacture and sale of portland cement. The new company has in operation in the Chicago district three cement plants, the output of which in 1906 equaled 2,076,000 bbl., being more than the entire production of the United States in 1896. The company has now under construction at Buffington, Ind., a new plant, which will have a capacity of 2,000,000 bbl. per annum, and at Universal, Penn., near Pittsburg, a plant with a capacity of 1,500,000 bbl. annually. It is expected that in the summer of 1907 both these plants will be completed and in operation. They will increase the company's capacity to 6,000,000 bbl. per annum.

THE HILL ORE LANDS

From time to time since the organization of the corporation various additional iron-ore properties have been acquired in the Lake Superior ore region. The tonnage of new ore thus obtained is very large. It is, however, doubtful if the quantity of new ore so obtained will prove to be sufficient to meet the constantly increasing demands upon the ore reserves made by the country's growing requirements for steel products. In each succeeding year it has become more difficult to acquire new ore properties geographically located so as to permit of the economical use of their ores at the furnaces of the subsidiary companies. Moreover, for such properties as occasionally could be obtained it has been found necessary to pay constantly increasing rates of royalty. In view of the foregoing and in order to safeguard its future requirements for ore, the corporation, after extended negotiations and careful consideration, made an arrangement (subject to authorization by the stockholders) for the lease on a royalty basis of the so called Great Northern Railway ore properties, comprising the properties owned in fee by, or under lease to, the Great Northern, the Northern Pacific and others. When concluded this lease is to be taken by the Great Western Mining Company, a subsidiary company of the United States

Steel Corporation, and the performance of the obligations assumed by that lessee is to be guaranteed by the United States Steel Corporation. Under the proposed lease the royalty to be paid for the ore is \$1.65 per gross ton, for ore containing 59 per cent. of metallic iron, delivered in docks at head of Lake Superior. If ore grades higher or lower than 59 per cent. in metallic iron, the royalty will be increased or decreased according to a fixed scale. The above royalty of \$1.65 per ton is for ore to be shipped in 1907, and the base price increases at the rate of 3.4c. per ton each succeeding year. The minimum to be mined and shipped is 750,000 tons in 1907 and increases by 750,000 tons per year until it reaches 8,250,000 tons, and thereafter the annual minimum continues on that basis. The lease will continue until the ore is exhausted unless on Jan. 1, 1915 the lease is terminated, under the option reserved to the said lessee. The ore is to be mined by the lessee. As several directors of the corporation are directly or indirectly interested in the companies which own or control these ore properties, the transaction will be submitted to the stockholders and proxies at the annual meeting.

Method for Assaying Mercury Ores

The following method of assaying mercury ores is given by Holloway in the *Analyst*. Mix the ore in a crucible with 10 grams of iron filings, through 60 mesh, and cover with 5 grams of iron filings through 30 mesh. Set the crucible in a hole in a tin plate or asbestos board in such a way that the bottom of the crucible may be heated by the flame, while the top remains cool. Cover the crucible with two pieces of clean silver foil which have been weighed, and which are of unequal size, the upper piece being the larger. Set on top of the silver covers a copper or metal vessel through which cold water may be passed in order to keep the plates cool. Heat for 20 min., allowing only the bottom of the crucible to become red hot. Cool the crucible, dry and weigh the covers. If tarry substances appear on the foil, they may be rinsed off with alcohol before drying. The amount of ore to be taken for assay depends upon its richness. For less than 1 per cent. of mercury use 2 grams, between 1 and 2 per cent. mercury, use 1 gram, and so on.

A mineral recently discovered in British Columbia, known as souesite, is a native nickel-iron alloy similar to the josephinite of Oregon. It is a gray metallic sand having a specific gravity of 8.215. Dr. C. G. Hoffmann of the Canadian Geological Survey states that platinum, iridosmine and gold were found associated with it.

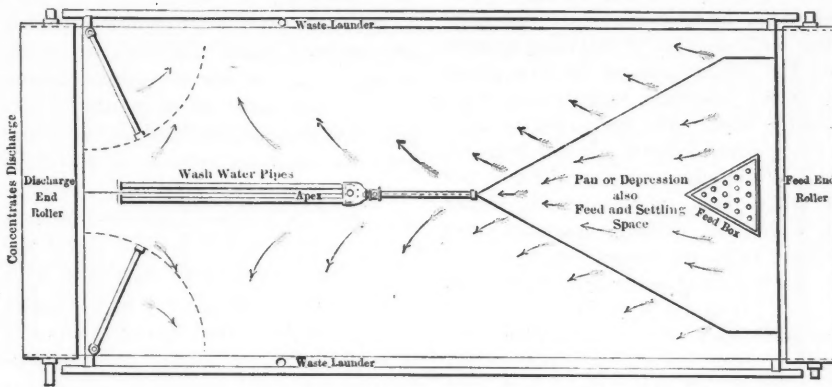
The A. & E. Slime Concentrator

The A. & E. slime concentrator, which derives its name from Randall P. Akins and James P. Evans, to whom its novel features are due, is one of the more recent ore-dressing machines of the Colorado Iron Works Company, Denver, Colo. It is of the traveling-belt, shaking-table type, its distinctive feature being a peculiar form or contour of the deck, produced by a fixed form beneath the deck to which the flexible belt of canvas or duck conforms in performing its work.

On the working surface there is a triangular pan or depression, the feed and settling space, the forward lines of which are substantially level. The central line from the apex of the triangle to the discharge end is the high line or ridge of the surface which slopes gently to the discharge launders at the sides of the table. The wash water pipes are above the ridge at the discharge end. Those at the finishing end are attached at the corners of the table and may be swung into any position desired for the final washing. The concentrates are carried over the end roller and washed into a box in the usual manner.

The mechanical features of the machine are simple. The deck or top is supported by six flat oak or hickory legs, 4 in. wide and one-quarter inch thick at the thinnest part. These legs, while supporting the top and preventing any side sway, are sufficiently flexible to allow of a reciprocal motion. The main drive shaft is

on the supporting frame. A pair of bevel gears engages and transmits the power from the countershaft through the long side shaft to the discharge end of the table, where, by means of cut gears which allow for the motion of the table, it is communicated to the roller at the discharge end by a worm and worm wheel, which in its turn imparts the travel to the concentrator belt, the speed being adjusted by shifting the belt on the cone pulleys. The travel of the belt is approxi-



DECK PLAN, A. & E. CONCENTRATOR

mately 26, 33, 43 and 56 in. respectively per minute, as governed by the step-cone pulleys, at a speed of 225 r.p.m. of the drive shaft. The drive shaft can be run up to 250 r.p.m., however, without disadvantage, and on some ores to advantage.

The floor space occupied is 7x16 ft., or about the same as any standard concentrator and less than one h.p. is required for operation. The weight of the machine

Scotch Coal Shipments

Consul R. W. Austin, of Glasgow, reports on the shipment of coal from Scotland, during 1906, as follows:

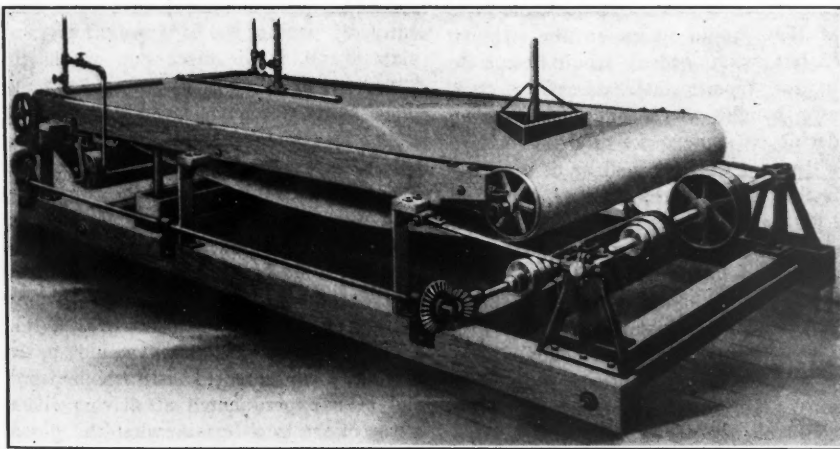
The total amount of coal shipped was 13,921,584 tons, being an increase over 1905 of 1,390,094 tons. The exports to the various countries amounted to 9,072,115 tons, against 7,863,511 for 1905, an increase of 1,208,604 tons. This would leave

an increase of only 181,490 tons in the coastwise consumption of coal in 1906 over 1905. The 1906 coastwise shipment, including bunker coal, was 4,849,469 tons, while that for 1905 was 4,667,979 tons.

The average freight rate paid on foreign shipments of coal during 1906 was slightly higher than the 1905 rate. The following are some of the rates from Glasgow in 1906: The average rate to the Italian ports of Genoa, Savona, Leghorn and Terre was \$1.54 per ton; to Venice, \$2.12; to River Plata, South America, from \$2.55 to \$3.77 per ton; to Rio de Janeiro, Brazil, \$3.40 to \$3.77; to Barcelona, Spain, \$1.88 to \$1.64; to Oran, Algeria, \$1.33, and to Marseilles, \$1.58.

The export prices of coal per ton in January, 1906, were: Splint, \$2.42 to \$2.54; steam, \$2 to \$2.17, and ell or house, \$2.29 to \$2.54. The prices continued to advance during the year, and after Nov. 1, when the export duty of 24c. was taken off, they had reached the following figures: Splint coal, \$2.67 to \$2.69; steam, \$2.25 to \$2.42, and ell or house, \$2.44 to \$2.69. On Jan. 29, 1907, export coal was quoted as follows: Splint, per ton, \$2.92 to \$3.04; steam, \$2.50 to \$2.67, and house, \$2.79 to \$3.04. House or domestic coal retails in Glasgow in small quantities at \$4.86 per ton of 2240 lb. A reduction varying from 12 to 60c. per ton is made on the sale of larger quantities.

Mining concessions in Norway are granted by the Government to foreign people only under the condition that one-third of the stockholders must be Norwegians, that all the agents and workmen be of this nationality, and that the company shall pay a considerable royalty into the treasury of the State.



THE A. & E. SLIME CONCENTRATOR

located at the head or feed end, and is fitted with cranks on each side, from which lead two side rods, which in turn are attached to the deck near supports under the head end and which impart the reciprocal motion or end shake. On the drive shaft are tight and loose pulleys, each 3x14 in., to receive the drive from the mill shaft. The tight pulley is cast heavy and also serves as a balance wheel. A four-step cone pulley on this shaft is belted to a similar one on a countershaft

boxed and ready for shipment, is about 2000 pounds.

Much difficulty is usually found in making paint adhere firmly to galvanized iron. The United States Government has adopted specifications which appear to give satisfactory results and which call for the use of vinegar in washing the surfaces before painting, which washing roughens or corrodes the surface and gives the paint better adhesion.

The Development of the Air-hammer Drill

Modifications of the Pneumatic Riveting Hammer Have Made This Light and Handy Tool Useful for General Mining Purposes

BY H. L. SINCLAIR*

No doubt those who are interested in mining or the improvements in mining machinery are aware that during the past three years many changes are noticeable in the methods used in breaking ground. Since the introduction of the first piston drills, many years ago, improvements have of course been made from time to time, but the general construction has been the same. While admitting that the cost per foot broken was, in many cases, higher than with hand drilling, operators have continued using the larger 3-in. to 3¼-in. machines in their crosscuts and shafts, and 2½-in. to 2¾-in. machines in their drifts, raises and stopes. At the same time there have been many complaints made against the operating and maintenance expenses.

Fuel costs in most mining camps were high and there was very little ground in a crosscut or a shaft which could be broken and mucked for less than \$10 per foot. It was necessary to have a drill runner and helper for each machine, or, where two drills were worked in the same heading, two drill runners and a helper. The runners were supposed to be experienced men, both in the art of breaking ground and in keeping their drills in good running order, and were entitled to at least \$4 for an 8-hour shift. In drift and crosscut work it was necessary to either work but one drill shift or handle part of the muck twice in order to give the runners a "set up." For these reasons it was no wonder that the costs of breaking ground ran into money, and the operators were "at their wits' end to find means of cutting down the expense.

EARLY DIFFICULTIES

In the stopes, raises and drifts the lighter 2¼-in. drills would give fairly satisfactory results, as they could, in a pinch, be handled by one man with a little assistance now and then from a mucker or timberman. Still, each drill, even when new, consumed 80 to 90 cu.ft. of free air compressed to 90 or 100 lb. receiver pressure, and the cost of fuel, coupled with the monthly repair bills, often made the mine manager wish he had never seen a machine drill. Then, too, he was caused no end of worry and trouble in getting good runners. One man would break as much ground as was expected of him, but in so doing would likewise break side rods, pistons, pawls, etc. Another would get

along with few repairs, but would not get results, evidently from fear of breaking the machine.

One runner preferred one make of drill and another would not have it, so the manager was, to use a common expression, "in hot water all of the time." He could not have several different makes of drills on hand on account of the large stock of repairs he would be forced to carry, and as a consequence had to take such men as he could get and "break in" new runners. For these reasons he kept at the drill manufacturers with suggestions to cut down the number of parts in their machines and make them less complicated and more substantial. His suggestions were taken in good spirit, perhaps, but the machine makers were loath to make any changes whereby the repair bills would be materially lessened, as their real income came from this source.

The larger manufacturers had men covering every camp, and when it became known that a certain property would soon be equipped with a compressor, the manager was besieged by drill salesmen who offered all sorts of inducements in order to get their machines introduced, knowing well that it was not a question as to what they would make on the original sale, but what orders would come to them for repairs later on. The compressor bought, the manager was forced to decide on some make of drill.

A decision once arrived at, it was seldom that he could be weaned from his first love, and henceforth would be known as a Sullivan, Ingersoll or Rand man, and would spend hours arguing with some fellow operator about the merits of his pet drill, while in his letters sent with orders for repairs to the manufacturer, he would probably accuse this innocent person of sitting up nights figuring how he could change parts of his machine so that the repair bills would mount up. I know one large operator who has been using a certain make of drill for nearly twenty years, but who is always complaining about the maintenance expense and threatens to make a change on the next plant he installs. About the time he is ready to purchase, if approached by the representative of a rival concern, he will argue for an hour or so on the subject and will probably conclude by saying: "Well, I guess I'll stay with the old machine. If I buy yours, I expect I would be jumping from the frying pan into the fire."

INTRODUCTION OF THE AIR-HAMMER DRILL

As I said before, many changes have been inaugurated in the past three years in the methods of rock breaking, and from the subject of this paper you will naturally infer that I intend to show what results have been obtained by the use of the air hammer drill. Before offering any argument, however, on the advantages or disadvantages of this type of machine, it might be well to explain how the machine was first used in mining operations and how I came to be personally interested in its development.

About seven or eight years ago I was employed on a property where a great portion of the value of the ore lay in a 6- to 10-in. streak of honeycombed quartz which was frozen to the wall; in fact the gangue, which made up the major portion of a 4-foot vein, contained little or no value. Our method of mining had been to strip the quartz and take it down on sorting sheets in a filled stope by the use of gads. This was rather slow and arduous work, but the value of the gold was sufficient to leave a small margin of profit, even after excessive hauling, freight and smelter charges were paid. At this time I had occasion to go East to a directors' meeting of the company, where the difficulty of saving the ore was fully explained and, in the discussion which followed, various methods of overcoming the obstacle were considered.

At this time the pneumatic riveting hammer was coming into general use in boiler shops, and one of the directors, who was of a rather ingenious turn of mind, suggested that a hammer of this sort might be brought into play; and by the use of a gad in place of the riveting tool, be used to take down the ore. While I did not think the plan would prove feasible, I consented to visit a boiler shop and even experimented at driving rivets in an effort to ascertain what the possibility might be of using them for the purpose mentioned.

At that time the hammers were not as well designed as they are to-day, and the vibration was so great that I was forced to express the opinion that excessive wages would have to be paid the miners to get them to use the tool. In considering the question, however, one very important point, which has since been brought to light, was overlooked, i.e., that there was much less "kick back" in operating the hammer against rock than against a rivet in the shell of a boiler. The reason for this difference in the action

Note—Read at the meeting of the Colorado Scientific Society, Feb. 2, 1907, Proceedings, Vol. VIII, pp. 235-246.

*Mining engineer, Denver, Colo.

of the tool is probably due to the fact that after the first few blows of the piston against the steel, the elasticity of the boiler sheet is such that it seems to spring back a trifle after each blow of the hammer. As the steel recoils it meets the next blow half way on the rebound and a shock is caused which is very trying on the nervous system of the operator. It has since been proved conclusively that with the improved type of hammer there is very little shock or vibration to inconvenience the operator, and that the remedy does not lie entirely in the improved machines. The conclusion is that, with a gad made with the proper taper, at each blow of the piston the tool is forced into the crevice and remains there until the next blow is struck. This leaves the operator with but the natural vibration of the hammer to contend with. In the later types of machines the piston is made to cushion on live air on the back stroke, and no excessive jar occurs.

FIRST EXPERIENCE NOT ENCOURAGING

The tools were, however, not put in use at the mine, and although I thought of the subject many times during the three or four years following, and before their trial as hitch cutters in various camps, it was not until nearly three years ago that I had the opportunity of trying them in Cripple Creek. At that time they were being tried for block holing and hitch cutting, and the tool used was a 12-in. hollow piece of steel with about 14 or 16 cutting edges. The manufacturers were claiming great results for both of these purposes and for drilling as high as a 4-ft. hole, finishing about 1 $\frac{1}{8}$ -in. in diameter.

It fell to my lot to attempt to drill a round of holes in a narrow stope in one of the Cripple Creek properties, and I must admit that the result of the test offered no encouragement. The makers of the machine had evidently based their somewhat astounding records on tests made in some very even-cutting soft formation; for, when the drill was operated against Cripple Creek phonolite, it was soon discovered that unless some very radical changes were made in the drill bits they would not do the work. The greatest difficulty was experienced in getting the bits spread to a gage so that they would follow. Then, too, the cutting edges were so fine that it was next to impossible to temper them to stand for more than an inch or two in that character of ground.

Another difficulty developed in the construction of the drill bits. These were made of $\frac{7}{8}$ -in. hollow staybolt iron, with 6 in. of hollow steel welded to either end for a shank and bit. It was found that crystallization would take place at the welds and either the shank or bit would jump off in a very few minutes. I decided, however, that the machine could be perfected, and with the assistance of my father, who is a mechanical as well as

a mining engineer, set about remedying the faults mentioned. We turned our attention at first to the steel, and after careful experiments found that the bits with six cutting edges cut faster and held their gage better than any other style. The cross bit was tried, but was discarded on account of its tendency to "rifle" a hole and "hang up" in crossing slips at an acute angle. We also found that with this shape of bit it was hard work to rotate the drill by hand in soft ground, and, while it cleared better, the six-tooth bits gave much better results. Sharpening tools were made for the six-tooth bits and little difficulty was experienced in drill sharpening after the blacksmith had acquired the knack of spreading the gage.

NECESSARY MODIFICATIONS

Hollow steel was necessary in drilling down holes or flat holes in sticky ground, as it was essential to force part of the exhaust air through the steel to clear the hole of cuttings. The welded bits would not stand in hard rock, and we were in a quandary as to how we would overcome this difficulty, until it was discovered that a $\frac{3}{8}$ -in. hole could be drilled through a 4-ft. piece of steel in a gun-barrel lathe. We used this class of steel for some little time, until we found that we could purchase a brand of hollow rolled steel in Sheffield, England.

With these changes we were able to drill 4-ft. holes in any ground at a speed varying with the formation of from 1 to 10 in. per minute. In testing the machine thoroughly, however, we found that a cast-steel cylinder would crystallize easily and we were forced to change the material used in its construction to the best grade of steel shafting, forming the complete cylinder out of the solid metal.

We then found that it was next to impossible to get men who would hold the machine over their heads and drill uppers. One could not blame the drill runners, as it was certainly an awful task to set a man at, and only the very strongest could stand it for any length of time. The screw-feed machine mounted on a light drift column was tried, but finally discarded, when one of the manufacturers constructed an air-feed attachment. With this machine it was possible to "set up" and "tear down" in less than a minute and the drilling capacity of the machine was increased 100 per cent. Machines of this type were placed in all of the larger mines of the country, and it was soon found in competitive tests that they would out-drill any of the 2 $\frac{1}{4}$ -in. machines.

The manufacturers of the old-line machines soon found that they were rapidly losing ground and began to experiment on the same line themselves. Several new companies were formed, principally by mining men who realized the advantages of the air-hammer drills, as compared with the piston machines, and during the

past year many improvements have been made.

As this brings us down to the present time, it only remains for me to attempt to show why this new type of drill has come to stay, and wherein it possesses advantages over the old-line drills. This I will attempt to do by taking up each class of work separately.

ADVANTAGES OF THE HAMMER DRILL

In the large crosscut or railway tunnel, the large piston drill still holds the advantage, as it is possible to drill deep rounds and break the ground far more economically and rapidly than would be possible with the small hammer type. Even in this class of work, however, there is a place for the small drill as they can be used most successfully in block holing and in taking up bottom or trimming up the walls where projections are left, either on account of missed holes, or because the drill runner has miscalculated the load he had on a certain hole. They can also be used for drilling uppers in the roof for pipe hangers, or for putting in short relief holes in the heading where they will give the cut holes a better chance to break.

In shaft or winze work, however, they can be used for drilling the full round of holes and even in the larger sized shafts, records show a saving which is simply astounding. To those who are familiar with this class of work, the reason is obvious. With piston drills, even in the hands of the best of runners, more time is lost in setting up, tearing down, lining up, cranking in and out of holes and in changing steel, than is consumed in drilling. Where the ground is even and breaks well, it is not so bad, but where slips are encountered frequently, and time is consumed in preventing a "hang up," or where the formation is such that a great many holes must be drilled to break the ground, the air-hammer drill has all the best of the argument.

The machine, steel and hose, can all be put into one bucket and the drill runner can be at work in five minutes from the time he goes on shift. The steel being loose in the chuck, he loses no time in changes, and he can start a new hole while a piston drill runner would be cranking out. Holes can be drilled in any direction and pointed to take advantage of any slip. No holes need be lost as it is practically impossible to get a "fitchured" hole even in the worst kind of ground. All of the holes can be drilled to any depth desired, up to 4 ft., except in very heavy sulphide ore, and the sump holes can be put in in any part of the shaft.

With a piston drill, the runner may get a hole down 3 ft., and then get hung up, and rather than lose time he will take a chance on breaking the ground and start another hole. On this hole he may have no trouble and he will perhaps drill it 6

ft. deep. What is the consequence? When the shaft is cleaned up he will find he has no sump, or one corner of his shaft sticks out so that he is unable to get a set up which will enable him to drill his round to advantage. He may even have to drill a hole by hand and shoot it before he can get in to do any good with his next round. As a consequence, the shifts are thrown out and valuable time is lost. When timbering commences, the small hammer drill is indispensable for cutting hitches and taking out projections where they interfere with the sets, and for these purposes alone, will pay for itself in 30 days.

In a drift, a drill runner can either mount the air-feed drill on a column or, where it is possible to pull the cut out of the top, he can work with the air feed alone, and in any ordinary ground, one man can drill a round of holes in half a shift. Where the cut is pulled from the center or bottom, he can either drill the back and top cut holes off a bar or simply use a stick of timber and butt the air feed against it. I have known of one man breaking 42 ft. in 19 shifts in a drift in granite, and not only did he do all the drilling alone, but the tramming as well.

There is a diversity of opinion as to whether it is advisable to use a 2¼-in. piston drill or an air-hammer drill in this class of work, and a decision, from an economical standpoint, can only be obtained by actual tests. As a usual thing, however, the hammer drill can be used advantageously in all drifts where a 4-ft. round, bottoming 1½-in. will break without leaving any "guns." With a piston drill of the size mentioned or larger, it is possible to make more rapid progress but the cost per foot will probably be greater as much more powder and air will be required and it is a hard matter for a drill runner to set up and tear down without some help from a timberman or trapper. In ground which breaks short, however, the piston drill usually has the advantage as a larger hole is drilled and the powder can be gotten to the bottom of the holes where it belongs.

COST OF STOPING

In stope work the 2¼-in. machine does not have a chance against the air-hammer tool and the records on some of the Cripple Creek properties show that their stoping costs have been reduced one-half since the introduction of the small machines. Where the values lie in small streaks of very high-grade ore, the saving is enormous as the stopes can be carried even narrower than by hand as the drill can be run in any place a runner can get his body.

I installed a small machine for a leaser in Cripple Creek some 18 months ago, and he informed me after his lease had expired, that the little drill was worth \$1000 a month to him. He was stoping on a 14- to 18-in. streak of 4-

5-oz. ore and found that the ground was too hard to break by hand. He then put in a 2¼-in. machine and was forced to carry his stope 3½ to 4 ft. wide. In doing this he lowered his values to \$30 to \$35 per ton. After the installation of the little air-feed drill, he was able to break one-third more ore in an 18-in. stope than he had with the 2¼-in. machine in one 3½ to 4 ft. wide. He ran his values back again \$80 to \$90, cut his hoisting and powder bills down to one-half, and his timber to one-third, and yet kept his production up to more than the tonnage he was able to get back of the 2¼-in. drill. With the piston machine his air cost him \$3 per shift, while with the hammer drill the charge was but \$1 for the same length of time. He figured the difference in net returns and found that the small machine saved him a little more than \$1000 per month. The usual method of operating the machine in an open stope is to put in a couple of light sprags well up to the back and about 10 or 12 ft. apart. By putting a 2x12-in. plank on the timbers and drilling from it, a drill runner can fill a stope full of holes in half the time he would consume with a larger drill. Not only can he drill more holes, but he can drill them in any place he desires and take advantage of every slip.

The same method is used in upraising, and data furnished by some of the largest mines in the west shows that a saving of 50 per cent. can be readily given as the average.

REPAIRS

Not only can more work be done with the hammer drills than with piston machines, but the saving in repairs is well worth considering. In nearly all of the small hammer drills, there is but the one moving part and when properly made this should last for months. The rotation being accomplished by hand there are no pawls or springs to break and no rifle nuts to wear out. As the machines are fed by air, no feed screws or nuts are required. Taken as a whole, with a properly made air-hammer drill, the repairs are less than 25 per cent. of those of a 2¼-in. machine.

Working at a drill pressure of 100 lb., a 2¼-in. machine requires 100 cu.ft. of free air per min., while an air-hammer drill of the valveless type uses but 25 cu.ft. at the same pressure.

Another advantage possessed by the hammer drill lies in the fact that it is not necessary to employ a first-class drill runner, as a good miner who knows how to point his holes will do just as much work after two or three days' experience, as the best man one could hire.

While I could, perhaps, describe the various machines of this type manufactured, and give my ideas regarding the merits and defects of the different drills now on the market, I believe that it would be wise to confine my remarks to the air-

hammer drills in general and concluded by saying, as the "old toper" did of brands of whisky, "that they are all good but some are better than others."

The De Beers Consolidated Mines

The latest report of the De Beers Consolidated Mines deals with the company's operations at Kimberley, South Africa, during the year ending June 30, 1906. In that period £5,607,718 worth of diamonds was produced, while the expenditure amounted to £3,504,182; the net profit being £2,103,536. Dividends amounting to £1,800,000 were disbursed, and a sum of £916,057 was carried forward. The company's reserve fund, which is invested in British consols, amounts to £1,178,000.

On Jan. 30, 1906, the company's contract with the diamond trust expired, but was immediately renewed for a period of five years.

The company's dynamite factory at West Somerset, S. A., was disposed of during the year to the Cape Explosives Works, a corporation composed of De Beers shareholders. The contracts with the Transvaal gold-mining companies, binding themselves to purchase at least half of their explosives from the trust for a period of seven years from Sept. 1, 1903, were transferred to the new corporation.

The mining prospects continue good, and the market for diamonds is so strong that the selling trust is able to advance prices at frequent intervals.

The average yield of diamonds per load for the De Beers and Kimberley mines is 0.41 carat, value per carat being £3 1s., and the value per load £1 4s. 9d. The yield of the Wesselton mine is 0.282 carat per load, the value per carat £1 3s. 9d., and value per load 12s. 4d. The yield of the Bultfontein mine is 0.363 carat per load, the gems being worth £1 2s. 11d. per carat, and the wash dirt is worth 15s. 7d. per load. The yield per load of the Dutoitspan mine is 0.245 carat per load, valued at £4 per carat and £1 per load.

The company's engineer estimated the stock of diamond-bearing ground in stock, and on the washing-room floors on June 30, 1906, as follows: At De Beers and Kimberley mines, 2,644,690 loads, Wesselton mine, 1,889,956 loads; Bultfontein mine, 1,212,669 loads, and Dutoitspan mine, 1,349,385 loads; the total being 7,096,700 loads.

The report concludes with a reference to the death of Alfred Beit, a life governor of the company, who in conjunction with the late Cecil Rhodes, promoted the company and its subsidiary organizations.

According to the *Chemical Trade Journal*, the total sales of bromine in Germany in 1906 amounted to 906,991 kg., against 717,432 kg. in 1905, or an increase of 20 per cent.; 13.5 per cent. of this consisted of exports to the United States.

The Edwards Duplex Roasting Furnace

The latest form of the Edwards Duplex roasting furnace, is shown in the accompanying illustration. The details of the mechanical parts of this furnace have been described in the JOURNAL of Feb. 11, 1904, pp. 242-243 and Dec. 22, 1904, p. 1000. The chief difference between the new and the earlier form is that the hearth of the present furnace is built on the ground with a sub-flue underneath, if so desired, while in the earlier type the hearth was mounted upon a tilting device.

Edwards Duplex furnaces have been installed and used at a number of plants in Australia and America. Four roasters of the type here shown have recently been supplied to the Golden Cycle mill at Colorado Springs, Colo., by the agents, Chis-

The income account shows results as follows, the net earnings being the amount remaining after paying all working expenses, general expenses and taxes:

Net earnings for 1906.....	£2,268,707
Fixed charges on ore mined.....	£ 17,824
Overburden account.....	12,724
Depreciation of plant and securities.....	61,891
Provident fund.....	5,000
Total charges.....	£ 97,439
Surplus for the year.....	£2,271,268
Dividends, preferred stock, 5 per cent....	£ 77,188
Dividends, ordinary stock, 110 per cent..	2,062,500
Total dividends.....	£2,139,688
Surplus.....	£ 31,580

The general expenses, not included above, were made up as follows: Taxes, £168,974; general expenses in Spain, £81,205; directors' allowance, £17,209; total, £267,388. The dividends paid were two of 2s. 5d., or 5 per cent. in all, on

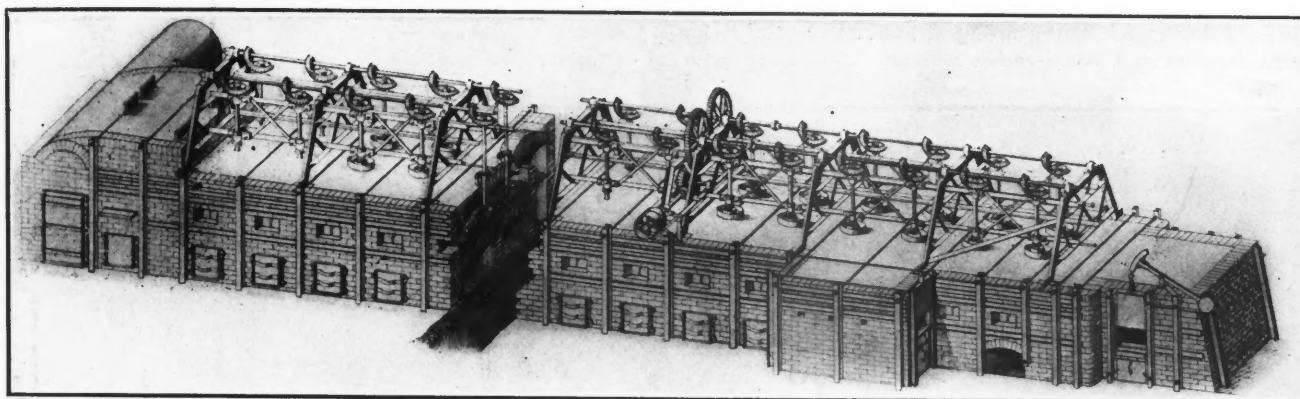
The quantity of copper brought to market in 1906 was: Refined copper, 20,698 tons; copper in sulphate, 677; copper in pyrites, 11,704; total, 3,079 long tons.

From all of the open workings there were 1,871,256 cubic meters of overburden removed in 1906; an increase of 61,287 cubic meters over the previous year.

The report says that the average market price of standard copper over the whole of 1906 was £87 9s. 3d. The price advanced considerably in the closing months of the year and remains at a high figure. The world's consumption is very large and the output of all the mines continues to be absorbed.

A further reduction in the contents and value of the reserve heaps at the mines, as they stand in the books, has been made. Other copper stocks are, as usual, carried forward at cost price.

The railway and pier again had to deal



EDWARDS DUPLEX ORE ROASTING FURNACE

holm, Matthews & Co., of Colorado Springs.

Price of Old Range Ores

The average price of Old Range bessemer ores, from the Lake Superior district, for the season of 1906, was \$4.25 at Lake Erie ports. The average charges are estimated as follows: Mining, 85c.; rail freight to lake, \$1; lake freight, 75c.; taxes, 5.5c.; interest, 2c.; royalty, 40c.; total, \$3.075. This leaves a net value of \$1.175 per ton at the mines.

The Rio Tinto Company

This company owns the great deposit of copper-bearing pyrites in Spain, which is well known for its extent, and from the fact that is the oldest mine in the world, having been first worked over 2500 years ago. Its latest report covers the year 1906. The capital stock is £3,500,000, of which £1,625,000 is in 325,000 shares of £5 par value, 5 per cent. preferred stock; and £1,875,000 in 375,000 shares, also £5 par value, of ordinary stock. There is no bonded debt.

preferred stock; one of 50s. and one of 60s.—110 per cent. in all—on the ordinary shares. The capital was increased in December, 1905, by the issue of 50,000 new ordinary shares, £250,000 par value, which realized £3,150,000. With this the company paid off the debenture issues, the total cost, with incidental charges, being £3,103,158, a surplus of £46,842 being left.

The production of copper ores is reported as follows, in long tons:

	1905.	1906.	Changes.
For shipment.....	627,336	655,328	I. 27,992
For local treatment..	1,202,768	1,268,388	I. 65,620
Total.....	1,830,104	1,923,716	I. 93,612
Av. per cent. copper..	2.363	2.411	I. 0.048

The quantity of cupreous ore invoiced to consumers was 660,723 tons in 1905, and 632,307 tons in 1906; a decrease of 28,416 tons. Of the 1906 deliveries Germany took 292,467 tons, Great Britain 168,597, and the United States 171,243 tons. The deliveries of sulphur ore were 308,184 tons in 1905, and 477,843 tons in 1906; an increase of 169,659 tons.

The production of copper for the year is given as below, in long tons:

	1905.	1906.	Changes.
Treatment at mines.....	19,530	21,287	I. 1,757
Shipped in pyrites.....	13,266	13,811	D. 455
Total.....	32,796	34,098	I. 1,302

with a considerable increase in mineral carried. They are kept in full efficiency and working order out of revenue. The public traffic again increased, and further rolling stock for all purposes has been supplied.

The shortage in the rainfall during the past four years has culminated in another exceedingly dry season. The usual period of rains is again near at hand, but unfortunately the stock of water in the reservoirs has been greatly reduced. The utmost economy in consumption is being practiced, and all possible steps have been taken to add to existing sources of supply; but if no rain falls before the end of May, it is feared that a reduced output of copper for 1907 must be expected.

The corrosive action of certain alkali salts upon gold and platinum is accounted for by the fact that when potassium is fused in the presence of air or oxygen, it is at once converted into a higher oxide which exerts a corrosive action on refractory metals such as gold and platinum. Pure silver is only slightly affected, probably because silver, unlike the other noble metals, is incapable of forming salts which correspond to potassium aurate and potassium platinate.

Electric Winding Plant at a German Colliery

The Vereinigte Marie Luise Mine at Neindorf Employs the Ilgner System with Starting Motor and Fly-wheel Equalizer

BY ALFRED GRADENWITZ*

In the electrically operated winding plant employing the Ilgner system, recently installed by the Allgemeine Elektrizitäts-Gesellschaft at the Vereinigte Marie Luise mine, near Neindorf, Germany, a special starting dynamo is operated by a motor assisted by fly-wheel masses. Heavy fluctuations in load due to the winding service compensate one another in the converter set, a practically constant current being taken from the circuit.

The electrical energy is generated by a central engine and boiler plant installed by the Buckau Limited Machine Works. The winding engine, shown in Fig. 1, has been designed as a drum engine without

between which the two winding drums, 3000 mm. in diameter and 600 mm. wide, are mounted on a shaft of Siemens-Martin steel 250 mm. thick. The drum located near the driving motor has been designed for shifting, while the other drum is rigidly connected to the drum shaft. The latter is coupled by a flange clutch immediately to the motor axle, which latter is supported also by an external bearing carried by an especially heavy foundation plate.

The drums have hardwood linings with turned-in rope grooves for a round-rope 32 mm. in thickness. Substantial braking rings acted upon by compressed air and

ing in the same way the three-way cock and thus causing the air to escape from the lifting cylinder; and third, by the braking magnet, connected up in series with the magnet coils of the winding motor, the magnet disengaging the small weight referred to and thus actuating the falling weight of the safety brake in case of a breakdown in the magnet coil or of arbitrary disconnection of the shunt.

By shifting the three-way cock the falling-weight brake may be released by the aid of the compressed-air cylinder.

INDICATOR

The winding engine is fitted with an in-

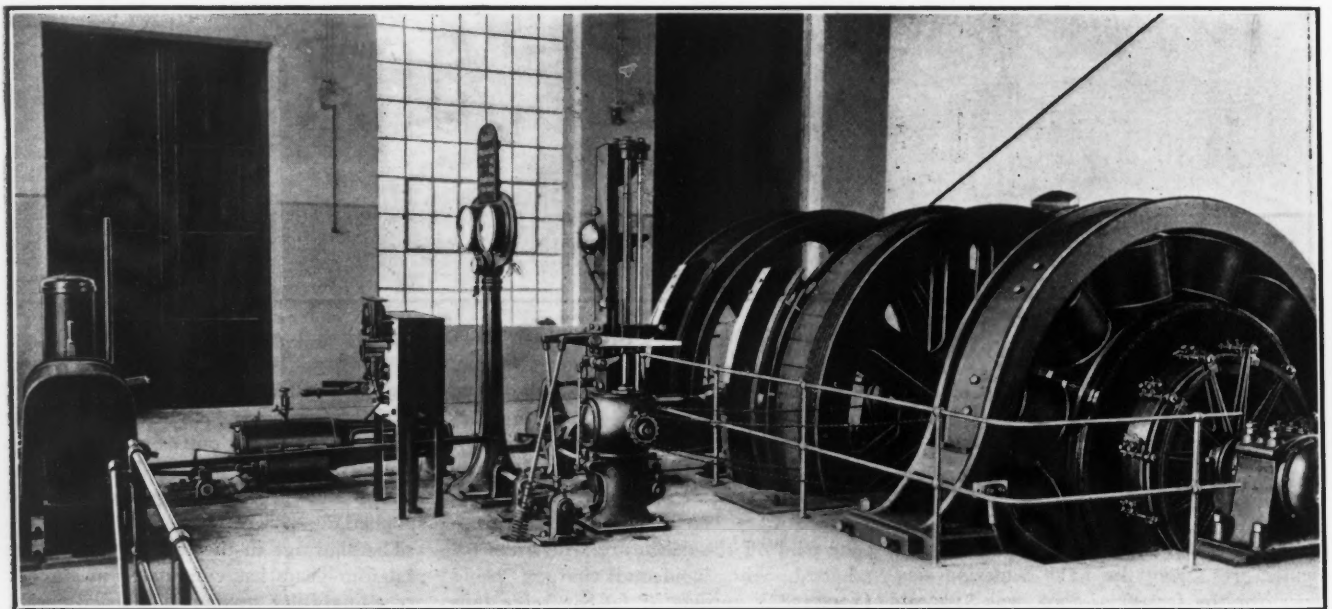


FIG. 1. GENERAL VIEW OF WINDING ROOM

lower rope, and is calculated for 110 m. maximum depth; it serves in hauling both loads and crews, the speed being 5 m. per sec. in both cases. The machine is used also in revising the pit, running at a speed of about 0.2 to 0.3 m. per sec. Four trucks with an aggregate effective load of 1500 kg. are hauled in each run, while in hoisting crews six men are conveyed each time. As the winding frame has two stories, a transfer of the load is necessary.

ARRANGEMENT OF THE HAULING ENGINE

On a substantial iron foundation-frame are mounted three ring-lubrication bearings 400 mm. wide and 220 mm. in diameter,

*25, Koerner Strasse, Berlin.

falling-weight brakes acting independently are cast on the inside.

THE BRAKES

The brakes are of the jaw type, the controlling brake being operated by means of a horizontal compressed-air cylinder at a working pressure of 5 atmospheres. The safety brake is of the falling-weight design; the weight is supported by a vertical compressed-air cylinder and can be actuated in three different ways: first, voluntarily by hand, allowing the air below the piston of the vertical cylinder to escape by actuating a three-way cock; second, automatically, by the indicator, which as the rising cage passes by the pit mouth, disengages a small weight, open-

indicator showing the position of the cages in the pit. It is of the double-spindle type, each spindle being operated separately and being adjusted automatically to the proper depth in shifting the drums. The indicator also actuates the winding-motor controller by means of a special rod. The speed of the winding motor is gradually reduced to zero as the rising cage approaches the pit mouth, by gradually shifting the controlling lever to its zero position. The engine is thus stopped automatically and practically without shock when the engineer fails to arrest the cage.

Another rod causes the falling-weight brake to be actuated as soon as the pit mouth has been passed by the rising cage. As the speed has been automatically re-

duced before the falling-weight brake is disengaged, the stopping of the winding engine by the aid of the falling-weight brake is effected at a very low speed, and without any material shock.

The indicator is further provided with an alarm bell which rings as soon as the slackening mechanism has been actuated.

All moving parts of the hauling engine, the drums and driving motor, are protected by a railing.

ELECTRICAL EQUIPMENT

The electrical equipment of the winding engine comprises a rotary-current direct-current fly-wheel converter shown in Fig. 2, using the Ilgner system, the hauling motor and controller, and necessary auxiliary apparatus, switches and measuring instruments.

The energy required in operating the winding engine is derived from a central

station supplying the energy required by the winding motor. Both the starting machine and winding motor are excited from the outside by an exciter machine of about 6.5 kw. output with 110 volts tension mounted upon the end of the fly-wheel shaft, the casing of which is fixed to the outside bearing of the starting machine. By altering the excitation of the starting machine, its tension is made to vary between zero and the maximum figure of 230 volts, thus regulating the speed of rotation of the motor.

MOTORS AND TRANSFORMERS

The starting dynamo must commutate a multiple value of the normal full-load current with a tension practically equivalent to zero and a neutral position of the brushes, when the winding engine is started. As there is only the transverse field due to the reaction of the armature

has been provided with a protective sheet-iron cap, which at the same time avoids any trouble due to the draft produced by the rapid rotation of the fly-wheel. The whole of the converter is surrounded by a protective railing, interrupted only where the hand-wheel jack is situated.

ILGNER CONVERTER

The arrangement of the Ilgner converter and fly-wheel brake is shown in Figs. 3 and 4. The converter serves a

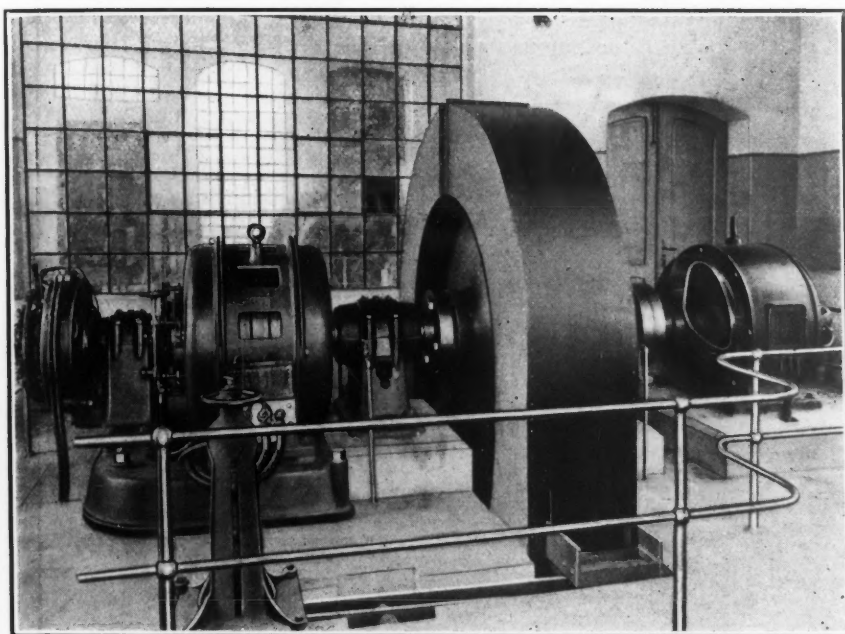


FIG. 2. CONVERTER WITH FLY-WHEEL BALANCE

station yielding rotary current at a tension of 3000 volts and at 100 cycles per second. This current is supplied to a slip-ring armature rotary-current motor, yielding an output of about 75 h.p. with 570 r.p.m. in normal working order. The motor is connected by a clutch with a steel shaft carrying in two ring-lubricated bearings 180 mm. in diameter a fly-wheel 2470 mm. in external diameter and with a rim of 280 mm. width. This fly-wheel, designed as a full cast-steel disk, has a weight of about 6300 kg., its maximum circumferential speed being about 74 m. per second. The fly-wheel bearings are provided with ring lubrication and water cooling.

Upon an extension of the fly-wheel shaft is mounted what is called the starting machine, a direct-current dynamo of about 100 kw. output with 230 volts ten-

in that case, a machine constructed according to the normal design could not comply with these requirements. A compensated direct-current dynamo has therefore been used in which a winding arranged between each two field coils and traversed by the armature current fully compensates the transverse magnetizing effect of the armature, thus insuring a reliable service with any load and field intensity without sparking.

In order to be able to stop the transformer quickly in case of danger, or during extensive intervals in operation, a jaw brake, acting from below on the fly-wheel, has been provided, which is worked by means of a hand wheel and spindle. The locking cock for the water-cooling conduit is arranged immediately beside the hand wheel of the braking spindle. In order to avoid splashing, the wheel

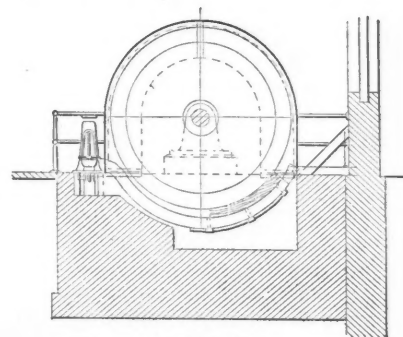


FIG. 3

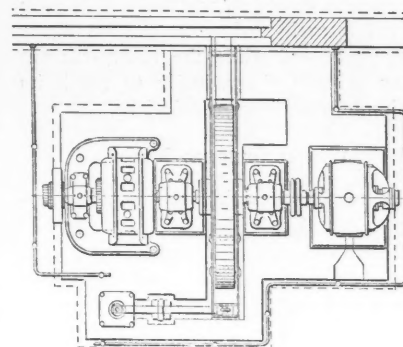
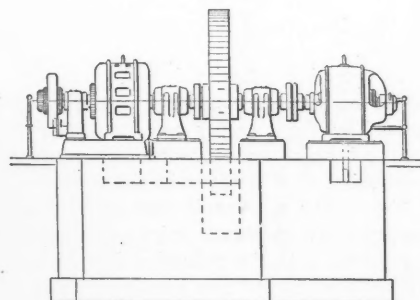


FIG. 4

double purpose. It converts the high-tension rotary current into the direct current, which is more convenient in the present case, and it insures by its reaction on the central station a practically perfect compensation of any oscillation in load due to fluctuations of the hauling service. The latter effect is insured by supplying the surplus required in starting the hauling motor and during the acceleration period from the energy stored in the fly-wheel masses. At times of low-energy requirements the energy of the primary station is used in accelerating the fly-wheel masses slackened by the work performed.

In order sufficiently to actuate the fly-wheel masses, preventing any excessive increase of the energy supplied to the rotary-current motor from the circuit, and to keep any oscillation of energy within moderate limits, the liquid starter serving to start the rotary-current converter motor is provided with an automatic lag regulator. This, as shown in Fig. 5, comprises a liquid reservoir, at the bottom of which are placed plate electrodes connected to the slip-rings of the rotary-current motor. The counter-electrodes are suspended from a partly equilibrated beam, pivoting round the axle of an auxiliary motor, which merely performs a tilting motion.

If during the starting of the winding engine the current absorption of the converter exceeds its normal figure, the auxiliary motor tilts the lever, lifting the electrode plates suspended from the beam and thus inserting additional resistance. If, on the other hand, the current absorption during an interval in operation drops below its normal figure, the motor tilts in an opposite direction, thus approaching the electrode-plates and reducing resistance.

By inserting additional resistance the lag of the converter motor is not only increased by about 14 per cent., putting the fly-wheel upon an extraordinary energy supply, but any increase in the intensity of the motor current is also prevented, the armature resistance being augmented in proportion to the reduction in number of revolutions. As the fly-wheel masses are recharged during an interval in operation, the same phenomenon will occur in an opposite direction, any sudden drop in current intensity below its normal figure being prevented while the rotary-current motor is enabled gradually to reach its maximum number of revolutions.

WINDING-ENGINE MOTOR

The motor operating the winding engine, the shaft of which is flanged directly to the drum shaft, is designed for a tension of 220 volts with about 32 r.p.m. This motor has an output of about 108 h.p. during full operation, while yielding up to about 240 h.p. at the end of the period of acceleration.

The motor is started, controlled and reversed entirely by altering the excitation of the starting dynamo. This alteration in the exciting current, which is only a few per cent. of the main current, is effected by simple resistance regulation through a small controller, and which is operated from the driver's cab by means of a hand lever. Each position of the controlling lever corresponds with a given traveling speed between zero and the maximum figure of 5 m. per sec., the tension between the terminals of the winding motor being determined by the intensity of the exciting current, which is adjusted by the controlling lever.

The winding motor is reversed by alter-

ing the direction of the exciting current. The contact device of the controller is designed on lines similar to the collector of a direct-current dynamo, and is of substantial construction. The whole apparatus is inclosed in a dust-tight casing. Fig. 7 represents the regulating resistance apparatus.

The braking magnet above referred to for the falling-weight brake has been designed for a lifting service of 150 kg. per cm., and is connected in series with the field of the hauling motor.

switch is arranged on the foundation plate of the maximum-current switchout in the armature circuit between the starting dynamo and hauling motor, which switch is removed before again inserting the maximum switch whenever this has been in action, thus avoiding any damage to the latter.

In order to stop the winding engine in case the controller for some reason cannot be used, an emergency switch operated by a crank and worm gear has been arranged in the neighborhood of the en-

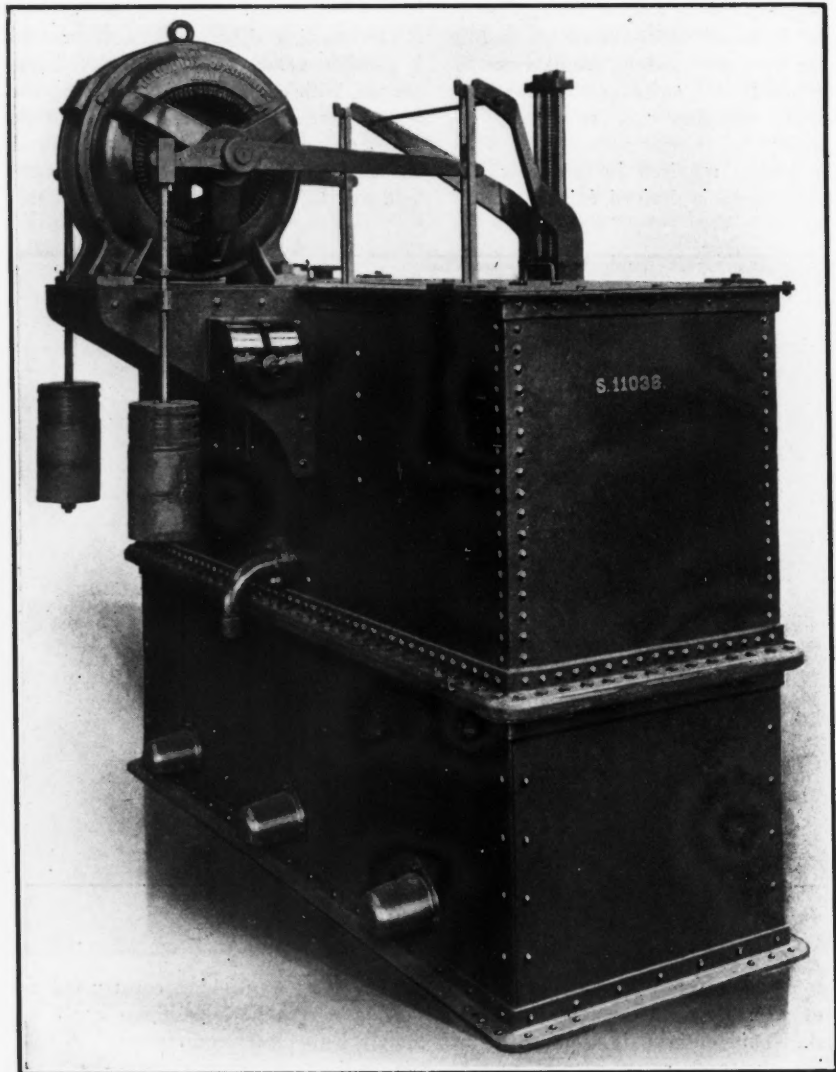


FIG. 5

CONTROLLERS AND SAFETY DEVICES

The armature circuit has between the starting dynamo and the hauling motor an automatic maximum-current switchout, which when the current intensity exceeds a given (adjustable) maximum breaks the circuit, thus preventing damage to the machine. As the safety brake should operate when the current is cut out from the motor, a single-pole switch has been connected with the maximum switchout, in order to short-circuit the field of the braking magnet, thus disengaging the falling-weight brake. Another single-pole

switch is arranged on the foundation plate of the maximum-current switchout in the armature circuit between the starting dynamo and hauling motor, which switch is removed before again inserting the maximum switch whenever this has been in action, thus avoiding any damage to the latter.

Near the engineer's stand, Fig. 7, there is on a cast-iron column a double-side deflection ampere meter, a double-side volt meter, and a manometer. The engineer can thus tell at any time the current intensity, and the tension of the machine; the manometer indicates whether the working pressure required to operate the compressed-air brake is available.

COMPRESSOR

The compressor required for generating the compressed air used in braking is of the single-stage twin type, with a suction output of 18 cu.m. at a working pressure of 5.5 atmospheres. It is operated by a special rotary-current motor of about 5 h.p. output through a simple toothed-wheel gearing.

The compressor forces the air into a drum of about 2 cu.m. capacity from which the compressed air required for the two air cylinders of the hauling engine is drawn. The capacity of the drum is sufficient for several brakings. The air supply to the lifting cylinder for the falling-weight brake has been so designed as to cause the piston to drop whenever the air supply from the drum fails. The suction pipe of the compressor is automatically closed when a maximum pressure of 6 to 6.5 atmosphere is exceeded in the drum, opening automatically as soon as the pressure drops below about 5 atmospheres.

SWITCHBOARD

The switchboard for the Ilgner transformer comprises two marble panels mounted on an iron frame. All connections and safety fuses are located at the rear of the switchboard.

The right-hand panel includes the rotary-current instruments and apparatus and the left-hand panel the direct-current appliances. The former comprises the two measuring instruments for the converter with their transformers arranged behind the switchboard, below which there is the handle of the high-tension oil switch. On the same panel are the single-pole high-tension safety fuses for the rotary-current motor driving the converter, three single-pole high-tension safety fuses for the transformer, reducing the tension

from 3000 volts to 215 volts for the driving motor of the compressor, and a converter switch for the transformer of the auxiliary motor used in regulating the lag.

The direct-current panel has the volt meter and the ampere meter, in addition

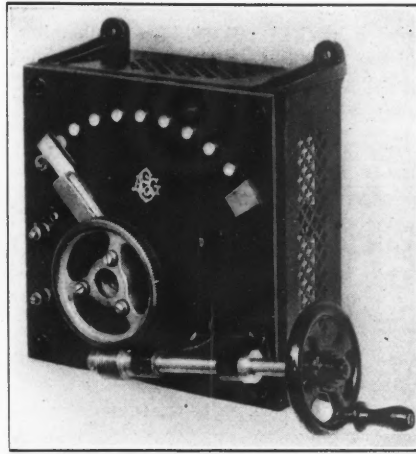


FIG. 6

to a double-pole switching lever with intermediary contact and spark extinguisher for the exciter machine of the transformer.

The compressor transformer, as well as the small transformer for the motor of the regulating device, is located behind the switchboard.

National Lead Company

This company's report for 1906 shows \$20,750,000 common stock and \$20,713,000, preferred stock issued. The net earnings for the year were \$2,499,632; dividends paid—7 per cent. on preferred and 3 per cent. on common stock—were \$2,015,406, leav-

ing a surplus of \$484,226. The balance from previous year was \$3,554,596, making a total of \$4,038,822. The report says: "In addition to the net earnings shown the company has an interest exceeding \$600,000 in undivided earnings of other companies, which is reserved by them for working capital and other uses. The financial statement shows a healthy condition with no liabilities other than those in process of payment and an adequate working capital fully employed in our business. Sales of properties not in use resulted in a reduction of \$191,036 in plant-investment account. Raw materials have continued to advance and are now at the highest point in the history of the company, but provision has been made in the inventory for any probable shrinkage in values. The efficiency of plants has been maintained by expenditures for repairs and maintenance aggregating \$188,418, which was charged to the cost of operation. The aggregate volume of business done (expressed in tons) was slightly less than the preceding year, due to the rapid advance in prices and the reluctance of consumers to believe in their continuance. With the close of the year, however, orders for future business indicate an increased distribution."

Isle Royale Copper Company

This company owns a copper property in the Lake Superior region, which has been worked with varying success for a number of years. Its report is for the year 1906.

The mining report shows 192,210 tons of rock mined and stamped, from which was saved 4,076,509 lb. mineral, yielding 2,937,098 lb. refined copper. This shows an average of 15.3 lb., or 0.765 per cent. of copper, to the ton. The cost of mining and stamping was \$1.53 per ton; of stamping alone, 27.25c. per ton.

The income account is as follows for the year:

	Total.	Per Lb. Copper.
Copper sold.....	\$552,371	18.81
Interest, etc.....	35,969	1.22
Total receipts.....	\$588,340	20.03
Mine expenses.....	\$294,557	10.03
Smelting, freight, etc.....	64,179	2.19
Exploration work.....	72,637	2.47
Total charges.....	\$431,373	14.69
Net earnings.....	\$156,967	5.34

Adding \$615,626 brought forward from previous year, made a total of \$772,593 surplus.

Opening work for the year included 865 ft. shaft sinking, 6937 ft. drifting and 450 ft. crosscutting; a total of 8252 ft. The new ground opened was more extensive than in any year since 1901. Work was pushed in order to provide sufficient stopping ground. Work has been pushed especially on the new No. 2 shaft.

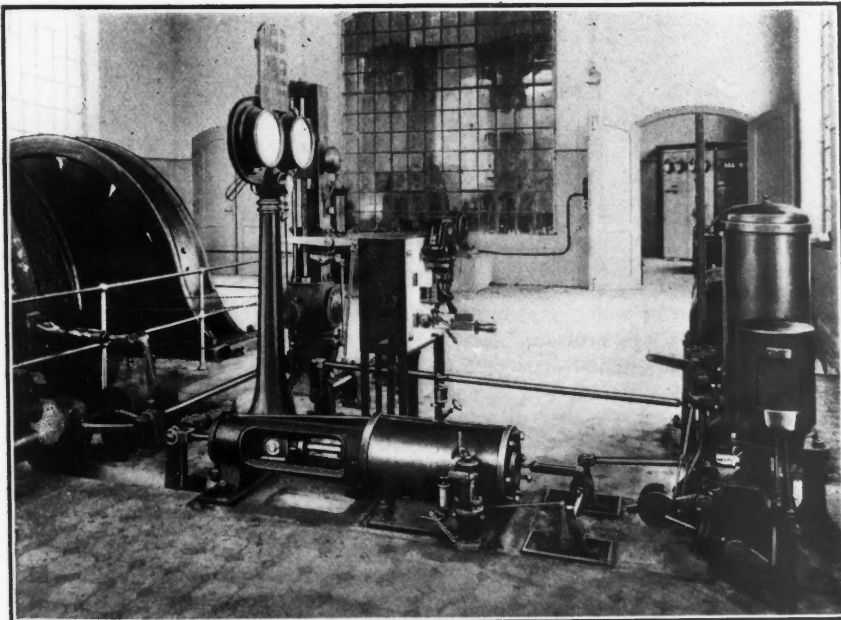


FIG. 7. ENGINEER'S STAND

Colliery Notes, Observations and Comments

Practical Hints Gathered from Experience and from the Study of Problems Peculiar to Bituminous and Anthracite Coal Mining

DEVELOPMENT AND MANAGEMENT

The coal production of the State of Washington for 1906 was 3,290,523 tons, as compared with 2,846,901 tons for the year 1905, an increase of about 15½ per cent.

In horizontal drives it is advisable to have the slack side of the rope or belt on the top, so that it will embrace a greater angle of the pulley and thus give a firmer drive. When the belts or ropes are unduly tight, there results undue friction and wear on the brasses of the pedestals.

A masonry dam built underground to resist heavy pressure, should be recessed into the sides of the entry a distance not less than 3 ft. If bricks are used to construct the dam, they should be laid in concentric rings with a ½- or ¾-in. space between, which is filled in with pure cement. It is advisable to use only the hardest bricks and not mix sand with the cement, which latter should be quick-setting.

In building an anthracite coal bin, the following is the space required for the different sizes of coal:

to tons (2240 lb.) lump...	393.0	cu.ft.
" broken	422.6	"
" egg	430.8	"
" large stove.....	434.9	"
" small stove.....	437.7	"
" chestnut	439.2	"
" pea	441.4	"
" No. 1 buckwheat...	441.4	"
" No. 2 buckwheat...	441.4	"
" ordinary coke.....	814.0	"

Two kinds of air bridges are used in mines, overcast and undercast. The former is preferable to the latter for several reasons: If the mine makes water, it is out of the question to build an undercast, as the water might accumulate at the bridge, resulting in a decrease of the sectional area; it is liable to be filled with carbon dioxide when the ventilation is sluggish, besides, an undercast cannot be built so air tight as an overcast and also has the further disadvantage of collecting dust and small particles of coal, in time becoming choked.

The amount of water necessary to flush culm into a mine depends on the distance the material is to be carried and the slope of the pipe. When flushing to level and down-hill places, 1 lb. of culm requires about 1¾ lb. of water; if it is desired to flush up-hill or to workings at a height from 25 to 100 ft. above the level of the shaft bottom, the weight of the water must be from three to six times as great as the weight of the culm. It should be borne in mind that when the flushed ma-

terial is packed tightly into a chamber, and the roof pressure comes on, the culm will be compressed from one-third to one-fourth.

Burning coal dust is not generally practiced in the United States, but in Europe there are several arrangements on the market for burning powdered coal. The coal is ground in a mill and conveyed to the hopper or bin by means of a conveyer and is delivered into the furnace by a forced draft. The amount of fuel and quantity of air fed into the furnace are controlled by slides. The method of firing is an automatic stoker, together with forced draft; consequently, the combustion of the fuel is complete and smokeless. But the objectionable features of this system are the cost of grinding the coal to a fine powder, driving the fan and providing labor to keep the flues open, and the accumulation of ashes in a fine condition.

From an English source it is learned that a seam of coal 24 ft. thick has been reached at a depth of 580 yd. in South Staffordshire. It is estimated that with the new machinery installed it will be possible to raise 3200 tons per working day of eight hours, an output which, it is claimed, has never been reached from a single shaft in the history of mining. The work will be done by hydraulic lifts working subsidiary cages designed in a manner to embody a combination of the best English, American and German practices. Electricity will be used not only for lighting on the surface, but to some extent in the mines and for haulage purposes. Employment will be given to 1500 to 2000 miners. The new coal area is said to cover 2000 acres.

A ready rule for calculating the pressure exerted on a pipe by a column of water is to allow a pressure of ½ lb. per square inch for each foot in depth. If more accurate results are desired, we may consider that a column of water 1 ft. high exerts a pressure of 0.434 lb. per sq.in., therefore a column of water, say, 200 ft. high would exert 86.8 lb. pressure. Now, if we let d equal the internal diameter of pipe in inches, p equal pressure in lb. per sq.in., t equal thickness in inches, then for a 6-in. cast-iron pipe we have

$$t = \frac{d \times p}{5600} = \frac{6 \times 86.8}{5600} = 0.093$$

in. This result should be increased by at least 15 per cent. to provide a margin of safety.

For many years the United Kingdom produced more than one-half of the

world's total coal output, and this exalted position as the largest coal producer was only relinquished to the United States in 1899. The total production of the United Kingdom since its earliest shipment has amounted to approximately 11,000,000,000 metric tons, while the production of coal in the United States since its earliest development in 1814, has totaled nearly 6,000,000,000 tons. In 1871, this country surpassed Germany, and in 1899, with a production of 230,000,000 tons, we exceeded the British output. Germany has steadily maintained its position as the third largest coal-producing country, and has increased its production from 26,000,000 tons in 1864 to 190,000,000 tons in 1906.

The most important things to be considered in furnace ventilation are the general arrangement and size of the furnace. This method of ventilation is prohibited in some States, especially in gaseous mines. In case the mine is gaseous and a furnace is employed the air feeding the furnace fire should be taken directly from the main air course. The return should be conducted through a dumb drift or an inclined plane connected with the air shaft at a point about 75 ft. above the furnace, so that the heat from the furnace gases will not be sufficiently hot to ignite the mine gas. The products of combustion from the furnace, if sufficiently mixed, render the mine gases inexplorable. If a dumb drift is not provided, the fresh air in a sufficient quantity should be allowed to mix with the return current so as to insure its dilution below the explosive point before it reaches the furnace.

When a wooden dam is used for stopping water in mines, it is important to see that every joint is wedged in from the back after the dam has been built. For this purpose, fir or pine wedges about 1 ft. long, 2 to 4 in. wide, and 1 in. thick, are best adapted. In filling the smaller joints, it is best to use small oak wedges 3 or 4 in. long. One consideration of much importance in building wooden dams, is to see that only dry wood is used both for building and wedging; the benefit results from the wood swelling when it gets wet, thus causing the joints to further tighten. The pipe placed at the bottom of the dam to permit the water to escape during construction, may be closed either by a wooden plug or a valve on the outer end. The latter method is preferable as it need not be closed until all the men are out and the large man-hole is plugged. A valve will also permit the water to be run off at any desired time.

George Otis Smith

George Otis Smith, who has just been appointed director of the United States Geological Survey, is a native of Maine and retains his legal residence in that State, having a summer home at Skowhegan. He was born at Hodgdon, Aroostook county, February 22, 1871.

He graduated from Colby college in 1893 and immediately joined a geological survey field party working on the Marquette iron range, Michigan. During the

Dr. Smith has worked in Michigan, Washington, Utah, North Carolina, the New England States, New Jersey, and Pennsylvania. For seven field seasons he was engaged in reconnaissance, and detailed surveys in Washington. In the course of this work he made a special study of several artesian basins, and the results were published as a water-supply paper. His experience in Washington included also economic work in the coalfields of that State, the results being published in a Survey report on the coalfields of the Pacific coast. In connection with

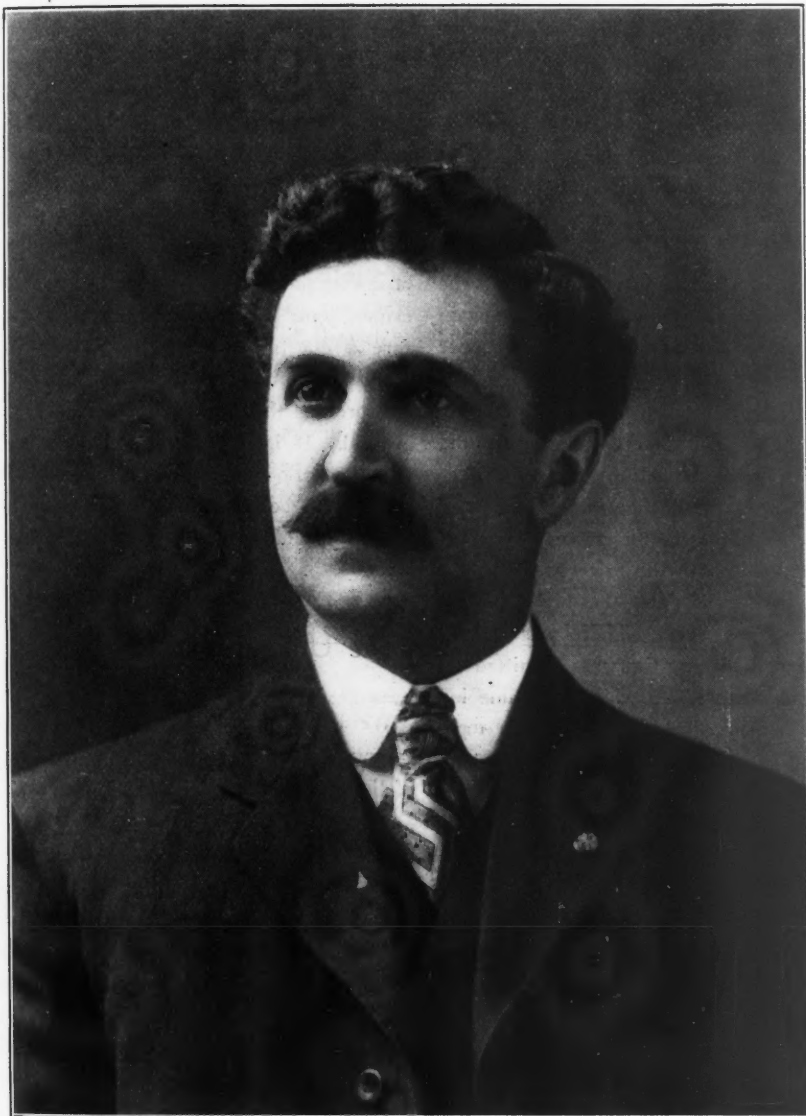
Rainier; in the Tacoma, Ellensburg, and Mount Stuart folios, in a professional paper on the geology and physiography of central Washington, and in a paper on gold mining in central Washington. In addition Dr. Smith contributed papers to the bulletins of the Geological Society of America, and to various periodicals; an article on the Mount Baker mining district, from his pen, appeared in this JOURNAL in 1902; the Clealum iron ores were described in a contribution to the "Transactions" of the American Institute of Mining Engineers, in 1901, and W. P. Jenney's paper on the mineral crest was discussed in the "Transactions," in 1903.

In 1900 the United States Geological Survey issued the Tintic special folio, in which Dr. Smith described the geologic structure of a famous Utah camp. An account of the occurrence and origin of the orebodies, the joint work of Dr. Smith and G. W. Tower, Jr., had appeared the year before, as a report on the geology and mining industry of the Tintic district.

After his western experience Dr. Smith began areal work in Maine, and later was assigned general supervision of all the Survey's geologic work in New England, and in the areas of crystalline rocks in New Jersey, Pennsylvania, and Maryland. While pursuing his investigations of the crystalline rocks, including the granites used as building stones, he made a special study of several minerals of economic value, including molybdenite. The 1905 production reports on mica, graphite and asbestos were prepared by him. Last July he was appointed geologist in charge of petrology with scientific supervision of the Survey work in that department.

In addition to doing geologic work Dr. Smith, during the past year, has served as chairman of a committee on accounting and bookkeeping, working under the direction of the committee on departmental methods, otherwise known as the Keep Commission. This has given him an opportunity to familiarize himself with the details of departmental administration, and at present he is chairman of the committee on business methods in the Geological Survey.

Dr. Smith is a fellow of the Geological Society of America, and a member of the American Association for the Advancement of Science, and the American Institute of Mining Engineers.



GEORGE OTIS SMITH

next three years he took a post graduate course in geology at Johns Hopkins University, spending one field season on the Marquette range, and another in reconnaissance work in the State of Washington. On his graduation with the degree of Ph.D. in June, 1896, he joined the United States Geological Survey as assistant geologist, having taken the first civil service examination held for that position.

As assistant geologist and geologist,

a special reconnaissance along the northwestern boundary, and across the Cascade range, in 1901, the geologist was obliged to make a topographic map upon which to record his geologic observations, exact geographic locations being necessary in the course of the examination of the boundary monuments.

The results of Dr. Smith's investigations in Washington, in addition to the report on coal, were published by the Survey as a report on the rocks of Mount

Metalliferous mining, other than for hematite iron ores, has been more active in the Cumberland district than for several years, says the *Chemical Trade Journal*. The chief products have been galena, zinc blende, barytes (sulphate and carbonate), with about five tons of tungsten ore, some antimony, and arsenical pyrites carrying nickel and cobalt. A number of abandoned mines have been reopened and others have increased their output.

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The Situation in Copper

Although the copper market is unsettled, and the future is uncertain, the facts as to the present situation are clear enough. The situation is decidedly reminiscent of January and February, 1906, although there are important differences. History never repeats itself precisely. At the end of 1905, the price for electrolytic copper had risen as high as 19c. per lb. In January, 1906, there was a slackening in the demand, and a recession in the price, which at first was conceded by the largest selling interests, but when the price reached 18 5/16c., these interests withdrew from the market, and held their copper firmly at 18 1/2c., delivered, 30 days. In the meanwhile outside interests continued to sell copper, and the price declined to about 17 5/8@17 7/8c. About the end of February, demand started up again in an active way, and the price for copper rose quickly to the asking price of the large interests which had been holding aloof. They had correctly interpreted the situation, and by their firmness had prevented any large decline in the market.

The similarity in the present situation is that last month the price had risen to 25 5/8c. for some lots, the highest daily average being 25 3/8c. There was then a recession, which at first was admitted by everyone, but after a while, the same interests which upheld the market in 1906, decided to make a stand at 25c. (25 1/4c., delivered, 30 days). In the meanwhile, other interests have offered copper much lower, and sales have been made between 24 and 25c., although their volume has not been large. The recession has been due, of course, to the absence of buyers from the market. It is true that they have largely provided for their consumption up to the end of June, but it is equally true that for many months past, they have been buying a long way ahead, and their present cessation must have a cause. Unquestionably the cause has been partly the tremendous decline in the London market for standard copper, irrespective as to what may have been the causes for that decline.

The chief copper market of the world is New York, but New York is not absolutely independent of London under all conditions. It is evident that the price at London cannot remain on the basis of 20c. for standard, and a level of 24 to 25c. be

maintained at New York, because at such disparity, American refiners can buy standard in London, import it into the United States for refining, and sell cheaper than our current quotation. If the decline at London be due merely to manipulation, buying for consumption will quickly elevate the price again. It is the fact that such has not yet occurred, which causes American consumers to be cautious. Another ground for caution is possibly a falling off in the demand for manufactured copper, as to which, however, there is great difference in opinion. It is the latter which creates the uncertainty as to the future. If there be no falling off in business, the demand for consumption, as soon as confidence is restored, will put prices back to where they were a month ago. If, on the other hand, there is being actually a contraction in business, the asking price of 25c. per lb. cannot long be maintained. It is therefore a question now, as it was in the early part of 1906, as to who is correctly interpreting the prospects of business in general. It is not too optimistic to say that the outlook is in no way gloomy. If there is to be a contraction in business, it appears unlikely to be of serious character.

The Utilization of Black Sand

We have several times referred in a complimentary way to the investigations of the U. S. Geological Survey, conducted under the direction of Dr. David T. Day, upon the utilization of the black sand of the Pacific coast, but while recognizing that those investigations have shown how the valuable metals contained in the black sand may be separated, we have pointed out that the greatest problem, namely the economical collection of the black sand, has not yet been satisfactorily solved. In fact, very little consideration has been devoted to that important matter. It was, perhaps, considered to be outside of the scope of the investigation conducted by the Geological Survey to enter into a problem which is so distinctly of an engineering character. Perhaps a further step in the development of this industry can be taken by the inauguration of a discussion in the columns of the JOURNAL. We shall be glad if our readers who are interested in the matter, which we are able to indorse as one that promises to be

important, will contribute their views and the results of their experience.

We are aware of the patenting recently of various forms of riffles for sluice boxes, undercurrents, dredges, etc., all having in view the collection of black sand and associated heavy minerals as a by-product. Several of these devices have already been installed. At one place, over 1200 tons of black sand was saved and is now being successfully treated by concentration. At one dredge many tons were collected. At this particular dredge the daily operating expense was \$70. It was discovered that the operators were deliberately washing away material to the value of nearly \$100 per day. There is no doubt if all placer miners and dredge operators will pay attention to the saving of their black sand, which in most cases is feasible and practicable, there will be a considerable increase in the platinum production of the United States to the advantage, not only of the producers, but also of the consumers, the latter being indeed the prime movers in securing the recent black sand investigation. It is now possible to amalgamate platinum with gold and easily remove the platinum from the amalgam without separating the gold from the amalgam. There are cases where the platinum content of bullion is valuable, but the producers get nothing for it, although the value of platinum per ounce is more than half as much again as that of gold.

There are many places on the Pacific coast where black sand exists in large quantity. At many localities gold and platinum are present in it in appreciable quantity, but most of the places where they occur are so exposed to storms and other unfavorable conditions, as to power, accessibility, etc., that it would be unwise to attempt to operate. On the other hand, there are some occurrences on the shores of land-locked bays where operations would be comparatively easy. A correspondent who has devoted some attention to this matter wrote us recently as follows: "I have personally dug pits near low-tide points in which the gold fairly glistened, but it would require dredges, steam shovels, elevators and general hydraulic operations. One place was so attractive that I located two miles of it. In another place I found a 6-in. streak for two miles, which averaged 13 oz. of gold per ton, together with some platinum."

The subject is a fascinating one. To sum up, it may be stated that at present there is no difficulty in making a high extraction of the gold and platinum content of black sand by comparatively simple means, but in general the black sand is so widely scattered that its economical collection for treatment at suitable points and the methods to be employed are doubtful. It is upon those points that further light is required. In the interest of the industry in general, we hope that our readers, especially those who are experienced in placer mining and dredging, will offer their suggestions.

Production of Spelter in 1906

The production of virgin spelter in the United States in 1906 was 225,494 short tons, that figure being the total of reports received from all the producers. In the JOURNAL of January 6, 1907, we reported the production in 1906 as having been 225,395 tons, which figure was based on reports from the producers, with their own estimates of probable production during the last 10 or 15 days of the year. The close agreement of the two reports shows how accurately the early statistics can be compiled. The details of the production in 1906, compared with 1905, are as follows:

PRODUCTION OF SPELTER IN UNITED STATES (In tons of 2000 lb.)		
States.	1905.	1906.
Colorado	6,599	6,260
Illinois	45,357	48,238
Kansas	114,948	129,741
Missouri	11,800	11,088
South and East.....	23,044	30,167
Total	201,748	225,494

The above statistics include only virgin spelter, i.e., spelter produced from ore. There is an additional production of several thousand tons per annum in the United States from the re-smelting of galvanizers' dross and other waste products. Some of these are converted into spelter of very good quality. Also there is a considerable exportation of dross to the European smelters. A more detailed report of the production and consumption of spelter and zinc ore in the United States in 1906 will appear in an early issue of the JOURNAL.

The Production of Copper in 1906

We have received this week the annual report of Henry R. Merton & Co., Ltd.,

of London, giving the production of copper in the world in 1906. The total is 711,675 long tons, against 682,125 long tons in 1905, the increase being scarcely 4½ per cent. For the United States, the statistics reported in the JOURNAL of Jan. 5, 1906, viz., 915,000,000 lb. are adopted. We hope to be able to publish before the end of this month our revised statistics. We may say now, however, that although they will probably be a little larger than our preliminary report, the change will be comparatively immaterial.

Among the principal copper-producing countries, Australasia, Canada, Japan, Russia, and Spain-Portugal showed important increases in 1906. Chile, Mexico, and Germany showed decreases. It is interesting to compare the statistics of Henry R. Merton & Co., with those which have been previously published. Aron Hirsch & Son, of Halberstadt, Germany, have reported the copper production of the world as 736,711 metric tons in 1906, while James Lewis & Son, of Liverpool, in the earliest estimate published, reported 730,000 long tons.

The New Director of the Geological Survey

The new director of the Geological Survey, Dr. George Otis Smith, whose appointment is announced this week, is one of the younger members of the Survey in point of age, though he has a record of 14 years of continuous active service. During that time he has worked in many parts of the country, chiefly in the East, though his contributions to the literature of the Survey include monographs on Washington and on the Tintic district in Utah.

He brings to his work as director the qualifications of a record of good executive ability in subordinate positions, and a reputation as a keen, alert observer. Moreover, he has had recently special opportunities of studying closely the methods and organization of the Survey. While he is only 35 years old, with his reputation still largely to be made, he is well equipped for the work before him. The Survey will have in him an active and ambitious director, who has every opportunity to stamp the mark of a strong personality on its future work.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice or Suggested by Articles in the Journal, and Inquiries for Information

CORRESPONDENCE AND DISCUSSION

The Location of Reduction Works

Herbert Lang has, in your issue of March 23, set forth the advantages of the level as compared with the terrace site for smelting works. In a paper in *Trans. A. I. M. E.*, Vol. XXVI, p. 389, I advocated the use of the flat site, and my contention was farther supported by Henry A. Vezin, in the discussion of the paper, who summarized the advantages as follows:

- (1) The cost of the works is smaller.
- (2) The arrangement can be made more convenient, as the lay of the ground does not compel placing the different buildings or departments in a certain predestined order so as to obtain the fall required.
- (3) Every square foot of the ground may be at will alternatively the equivalent of an inferior and superior terrace to every other, and, hence parts of a works, that on a terrace site must be far apart in vertical distance, can on a level be placed side by side.

NOT A PARALLEL CASE

So far as the iron blast-furnace is concerned, it must be remembered that the stock is raised 100 ft. vertically, prohibiting practically the use of trestles to deliver at the tunnel head, while the corresponding distance from slag to charge-floor in copper smelting need be no more than 12 to 20 ft. Again, many of the iron furnaces, depending upon lake ores are stocked up at the beginning of the winter with a six months' supply, which needs plenty of yard room and special provision for the rehandling of ore, fluxes and fuel.

Mr. Lang has in view the design of plants to handle material up to 1000 tons daily, and for such the level site may be considered the most advantageous. When, however, we arrive at conditions where it is cheaper to use the industrial locomotive, many of the objections to the side-hill site fall away, since it is then possible to return by practicable grades to any higher level, using the mechanical force of the locomotive, where by hand it would be practically impossible.

At the Washoe plant of the Anaconda Copper Mining Company, when I asked Mr. Mathewson, the manager, what he thought of the side-hill location, he replied that for their conditions the sloping or side-hill site was better. At this plant, as described in my paper (*Bimonthly Bulletin A. I. M. E.*, July, 1906, and in a re-

cent pamphlet issued by that company) 13,000 tons of materials are daily handled by compressed-air locomotives with certainty and despatch, and where any desired materials, such as slimes or flue-dust, are readily returned for retreatment. Not only this, but extensions of the present buildings have been put in without crowding the plant.

OTHER CONDITIONS TO BE CONSIDERED

On the other hand, I have in mind a recently constructed side-hill plant of capacity sufficient for 400 tons of ore daily. With a difference of level of 120 ft. the slag is yet returned by an elevator to storage bins for resmelting. Excavation and retaining walls added much to the cost of the plant, and yet the gravity idea was not fully carried out; in fact the plant lacked the advantages urged by Vezin as cited above.

In concentrating mills the centrifugal pump is freely used for returning the pulp or tailing for retreatment. Both in the copper country of Lake Superior and in South Africa tailings wheels of large diameter are employed to dispose of the tailings of large plants. In the cyanide practice of South Dakota the pulp from the stamps is elevated as fast as made, and delivered at a higher level to launders which discharge to classifying cones.

In many cases about stamp mills, where gold or silver ores are treated, it would be much better if the heavy rock-breakers were placed upon the ground, and the ore, crushed during the 10-hour day shift delivered to the storage bins which feed the stamps. Even the product of the stamps, after passing over the amalgamating plates, could well be elevated to classifiers by centrifugal pump before going to concentrating tables, as at the cyanide annexes to stamp mills now coming so much into use.

In other words, elevating and conveying machinery has been so perfected that it may be, and is, freely used about reduction works, and at a very low cost per ton for moving materials. At the Garfield plant, Utah, and at Cananea, mechanical methods have been happily installed. At these places the troughed conveying belt is used for delivering materials from the sampling mill to the storage bins or piles. Long bins or stock piles are filled by traveling trippers, so that the entire lot is throughout of uniform constitution, and thus uniform operation of the furnaces is assured. Philip Argall, in designing and erecting the Golden Cycle

cyanide mill at Colorado City, has carried out the same ideas for the regular storage of ore.

SLAG FOR MINE FILLING

Mr. Lang's idea of using slag blocks for mine filling, it seems to me, would hardly work out. Even with care in casting and tempering, by quickly covering with dirt, they are likely to split and break in handling. Those of us who have had to handle slag a good deal, have had more or less to do with making slag blocks and slag squares for paving the ground near the furnaces, but except for slag floors have generally given it up.

L. S. AUSTIN.

Houghton, Mich., April 6, 1907.

Mine Explosions and Atmospheric Pressure

With reference to your recent articles on this subject, it may interest some of your readers to know that a similar correspondence between barometrical pressure and the emission of gases has been observed in metalliferous mines. In Gilpin county, Colo., there is a considerable area in the east-central part of the principal producing district, in which many or all of the mines are troubled at times by a heavy colorless gas, which consists in part or entirely of CO₂. This gas appears to be stored in the country-rock as well as in the veins, and sometimes issues under considerable pressure. The country is gneiss, and neither it nor the veins contain any large percentage of carbonate minerals; siderite occurs occasionally, but is by no means common, nor is it at all characteristic of the mines where the gas is found.

In investigating the cause of an accident at the Brooklyn mine, in this area, some 11 years ago, my brother, the late Arthur L. Collins, made a series of observations which clearly demonstrated that the periods when the rate of flow of the gas in that mine was greatest coincided with periods of low barometer. His observations were embodied in a note contributed to the Proceedings of the Colorado Scientific Society for 1898; and were afterward confirmed by a series of experiments of my own in other mines.

I have recently observed what appears to be an illustration of the same principle in the behavior of acetylene lamps. In the Newhouse tunnel, at Idaho Springs, we are using lamps of the Wolf type.

Happening to be near the breast of the tunnel recently while blasting was going on in one of the laterals, at a distance of nearly $\frac{3}{4}$ of a mile, my lamp was as usual extinguished by the concussion. Relighting it with a candle flame, it was immediately re-extinguished; but without the candle flame being in the least affected. Keeping the latter close to the lamp, and re-lighting it each time it was extinguished, this was repeated at least a dozen times. Even after it ceased to be extinguished, the flame could be observed to "dip" at regular intervals. Evidently this was not due to any direct movement of the air, for the acetylene lamps are infinitely less affected by air-currents than a candle-flame. I attribute the effect observed, which I have since often repeated, to pressure waves following the explosion; transmitted either through the rock, or through the air in the drifts. As each little wave of compressed air (and they follow one another at intervals of not over a second) reaches the acetylene lamp, it momentarily arrests the emission of gas from the carbide in the generating chamber, so extinguishing the flame.

Similarly, I take it, the pressure of the air in times of high barometrical reading temporarily arrests the emission of gas from rock or coal, to be correspondingly released when the pressure is lessened.

I am of opinion that in districts which are troubled with these outbursts of noxious gases every mine should be furnished with a recording barometer; and that it should be the duty of the shift-boss to consult the readings daily before each shift of men goes below.

GEORGE E. COLLINS.

Denver, Colo., March 30, 1907.

Increase of Moisture Shipped in Sealed Cars

The trouble with moisture in coke met with by your correspondent may be due to some extent at least to the action of the well known natural law that the surface tension between solids and liquids diminishes with rise of temperature, as everyone has experienced who has held an apparently dry cloth before a fire and noticed how damp it seems to get. Of course the moisture is equally present in both cases, but is not apparent to the touch in the normal condition, being too firmly bound in the interstices of the material.

In the case of such an exceedingly porous body as coke the phenomenon would show itself markedly, and coke shipped "dry" in higher latitudes might be dripping wet on arrival in Mexico, and yet the moisture content as ascertained by analysis be practically the same.

Some of the facts mentioned by your correspondent appear to point to an explanation of this kind, such as the influence of the seasons and of the physical

characteristics of the coke, and although various tests have been made, including moisture analyses, they do not seem to me to have been very well directed. Coke shipped warm, with 1 per cent. moisture, would be cool before leaving the cold belt, and consequently condense all the moisture it could take up at that temperature, to liberate it again higher up the thermometer, the sealing of the car, unless absolutely hermetical, not preventing the admission of water in the state in which it normally exists in air, as a gas and subject to the gas laws, but hindering its subsequent evaporation as a liquid.

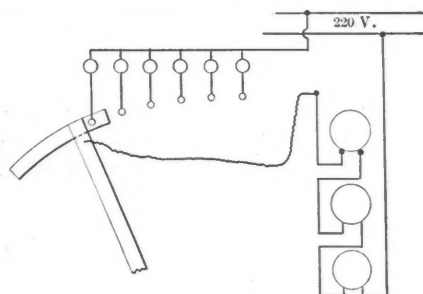
On a rough calculation for 14 per cent. moisture, your correspondent's theory would require that the coke should be about one-third metallic iron.

R. T. HANCOCK.

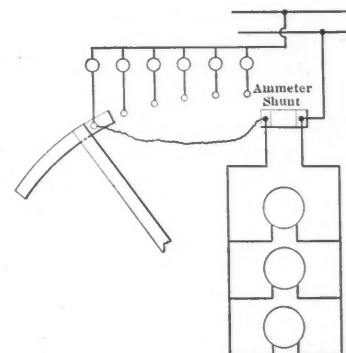
School of Mines, Camborne, Cornwall, Feb. 25, 1907.

Electric Indicator for Water Tanks

In the description of "An Electrical Indicator for Water Tanks," in a recent number of the JOURNAL, there is an evi-



IF SERIES AMMETERS ARE USED



ARRANGEMENT FOR SHUNT AMMETERS

dent error in the cut showing the electrical connections to the device. The indicating instruments (ammeters) are shown connected in multiple with the lamps and with the 220-volt supply. These indicators should be shown in series with the branch of supply circuit which furnishes current to the lamps, as shown in the accompanying sketch.

EUGENE BETTS.

Nashville, Tenn., March 7, 1907.

Storage of Tailings for Future Handling

There are in various parts of the American continent and also in South Africa, dumps of tailings, varying from a few thousand tons to well over a hundred thousand tons, which have, by the method of storage employed, been rendered valueless, or at least, much less valuable than should have been the case. To take a concrete example: a certain wet-crushing mill crushes a free-milling gold ore, the average value of the mill tailings being $1\frac{3}{4}$ dwt. These tailings, considered as a

whole, are, under existing local conditions, too lean to work at a profit. The tailings consist of about 40 per cent. slimes assaying 1 dwt. per ton, and about 60 per cent. good leachable material, assaying $2\frac{1}{4}$ dwt. per ton.

If these tailings were separated by suitable classifier into low-grade slimes and relatively high-grade sands, the slimes would be almost certainly of no value, while the sands at $2\frac{1}{4}$ dwt., if in condition to be treated, would be an asset at any time. But all the tailings are commonly run into one dam without any attempt at classification, other than that which is the natural result of a tendency on the part of the coarser and heavier material to deposit at the head of the dam. In this and similar cases, either the sand or the slimes taken separately might have been a valuable asset had the proper classification been effected as the tailings, carried by water, left the mill.

Another striking example was a case in which a clean, free-milling quartz ore yielded to ordinary plate amalgamation all except a shade over 1 dwt. per ton. A mechanical analysis of the tailings showed that practically 50 per cent. of the total gold was located in that coarser portion

constituting about 10 per cent. by weight of the total tailings. This coarser and richer portion could easily have been separated by hydraulic classification, or other means, during the passage of the tailings from the mill.

Whatever may be the character of the tailings, the necessary classification can generally be carried out with greater ultimate profit concurrently with the milling. If this is not done the product will be valueless or, at best, the tailings will be treated at a greater cost or with unsatisfactory recovery.

These remarks apply more especially to gold or gold-silver tailings, but they are no doubt also applicable to tailings from other ores.

H. T. DURANT.

Bulawayo, Rhodesia, Feb. 9, 1907.

The Brazilian Government is about to levy a heavy export tax upon monazite sand, says the "London Engineer," which will effect the incandescent gas mantle industry.

New Publications

Because of a series of unforeseen contingencies, especially in connection with the revision of the proofs and an accident with the engravings, the publication of "Mine Timbering" by Messrs. Saunders, McDonald, Parlee, and others, which was announced last fall, has been unexpectedly delayed. We make this announcement in view of the large number of inquiries as to the whereabouts of this book. The large number of subscribers who have sent in advance orders for it are requested to have a little more patience, with our assurance that everything possible is being done to make publication without any unnecessary delay.

SCHOOL OF MINES OF COLORADO, QUARTERLY, VOL. 1, No. 2. Catalog Edition. Pp. 148. 6x9 in.; paper. Golden, Colo., 1906-1908: School of Mines.

DIETURBINEN FUER WASSERKRAFTBETRIEB. By A. Pfarr. 2 vols., pp. 819; 46 plates, 496 figs. 7½x10½ in.; cloth, 36 marks. Berlin, 1907: Julius Springer.

NEW ZEALAND MINING HANDBOOK. Edited by P. Galvin, Secretary Mining Bureau. Pp. 589; illustrated. 5½x8½ in.; cloth. Wellington, New Zealand, 1905: John Mackay, Government Printer.

SYNOPSIS OF MINERAL CHARACTERS ALPHABETICALLY ARRANGED FOR LABORATORY AND FIELD USE. By Ralph W. Richards. Pp. 99; illustrated, 4½x6½ in.; leather, \$1.25. New York, 1907: John Wiley & Sons.

MINERAL RESOURCES OF THE UNITED STATES. CALENDAR YEAR 1905. David T. Day, Chief of Division of Mining and Mineral Resources. Pp. 1403. 6x9 in.; cloth. Washington, 1906: Government Printing Office.

IOWA GEOLOGICAL SURVEY, VOLUME XVI, ANNUAL REPORT, 1905, WITH ACCOMPANYING PAPERS. Frank A. Wilder, State Geologist; T. E. Savage, Assistant State Geologist. Pp. 673; illustrated, including numerous maps. 7½x10 in.; cloth. Des Moines, 1906: Iowa Geological Survey.

PEABODY ATLAS. Shipping Mines and Coal Railroads in the Central Commercial District of the United States, Accompanied by Chemical, Geological and Engineering Data. By A. Bement. Pp. 149; illustrated; 17x18 in.; cloth, \$5. Chicago, 1906: Peabody Coal Company.

THE GEOLOGY OF FALMOUTH AND TRURO OF THE MINING DISTRICT OF CAMBORNE AND REDRUTH. By J. B. Hill and D. A. MacAlister, with petrological notes by J. S. Flett. Memoirs of the Geological Survey, England and Wales. Pp. 357; illustrated. 6x10 in.; cloth, 7s. 6d. London, 1906:

Printed for His Majesty's Stationery Office by Wyman & Sons.

HANDBOOK OF MATHEMATICS. By J. Claudel. Translated from the seventh French edition by Otis Allen Kenyon. Pp. 708. 6x9 in.; cloth, \$3.50. New York, 1906: McGraw Publishing Company.

This book treats of arithmetic, algebra, geometry, trigonometry, analytic geometry (conic sections, etc.), and differential and integral calculus. The larger part of the material has been taken from Claudel's "Introduction à la Science de l'Ingenieur," which has had a remarkably large sale in France. The translator has added a little material relating especially to American weights and measures, etc. Certainly it was a good idea to combine in one book a series of treatises on all the common branches of mathematics, prepared on a uniform system and simplified by cross-references, and we predict for the American translation a wide field of usefulness and a high measure of appreciation.

RELAZIONE SUGLI STUDI E LAVORI ESEGUITI DAL 1897 AL 1905 (con un Album di N. 74 Tavole). Società Italiana per de Strade Ferrate del Mediterraneo. Two volumes. Pp. 382; illustrated. 12x16 in.; board covers. Roma, 1906: Premiata Tipografia d. Squarci.

The two large volumes contain a description of the engineering details connected with the building of the railroads named, including excavation, grading, bridge construction, etc. The text is profusely and beautifully illustrated with photographs, working drawings of bridges and machinery, and with colored maps and sections showing the geological structure of the territory pierced by tunnels. The details of driving a number of tunnels, mostly in rock, but also in soft ground, are given in full. The official specifications of the Italian Government for railroad bridges are also given.

HENLEY'S TWENTIETH CENTURY BOOK OF RECIPES, FORMULAS AND PROCESSES. Edited by Gardner D. Hiscox. Pp. 787; 6x9 in.; cloth, \$3. New York, 1907: The Norman W. Henley Publishing Company.

This book is a collection of what its title indicates. It is a highly varied assortment, beginning with acid proofing, ending with zinc ointment and including such different subjects as the compounding of beverages and the manufacture of artificial stone. The editor modestly hopes that his recipes and formulas will give satisfactory results, inasmuch as he has carefully selected them from trustworthy authorities, but he honestly paves the way for possible disappointments. We are disposed to think that users of the book will encounter many of the latter, yet we have no doubt that it will prove a

valuable reference, sometimes yielding much information that is exactly what is needed and sometimes furnishing ideas that will be worth while.

HYDROMETALLURGY OF SILVER, WITH SPECIAL REFERENCE TO CHLORIDIZING ROASTING OF SILVER ORES AND THE EXTRACTION OF SILVER BY HYPOSULPHITE AND CYANIDE SOLUTIONS. By Ottokar Hofmann. Pp. 345; illustrated. 6x9 in.; cloth, \$4. New York, 1907: Hill Publishing Company.

Contents: Theory of chloridizing roasting. Crushing of the ore. Percentage of salt required. Loss of silver by volatilization. Methods of roasting. Consumption of fuel. Reverberatory furnaces worked by hand. Mechanical roasting furnaces. Collecting flue-dust. Sulphate roasting. Chloridizing of argentiferous zinc-lead ore. Chloridizing of calcareous ores. Lixiviation with sodium hyposulphite. Precipitation of silver. Treatment of the precipitate. Construction of troughs. Trough lixiviation. The Russel and Kiss processes. The Augustin process. Extraction with sulphuric acid. The Zier-vogel process. Treatment of silver ores rich in gold. Cyanidation of auriferous silver ores.

The scope of this important work is clearly indicated by the above enumeration of its contents. Its distinguished author needs no introduction to the metallurgists of the world. He is recognized as the leading authority on the subject whereof he writes in the present work. A large part of the development of the extraction of silver by hyposulphite lixiviation as a modern process is due to him, and in the practice of the art there is probably no metallurgist who has had so extensive an experience. His present contribution to technical literature is largely a record of that experience, which makes it rank among that rare class of books by authors who tell chiefly about the things that they have actually done.

The lixiviation of silver by means of hyposulphite solution is not now so important a metallurgical process as it used to be, although it still finds considerable application. It is a good process for many kinds of ore, which appears to have fallen recently into an unmerited neglect. However, the hydrometallurgy of silver has recently attracted renewed attention through the application of the cyanide process to the treatment of silver ore, and the appearance of Mr. Hofmann's work, which treats of that subject at considerable length, is consequently timely. It is possible that a combination of hyposulphite and cyanide lixiviation will be found to be the best treatment for many kinds of ore. If the present treatise directs attention to that subject, it will serve a useful purpose. The book is one that most metallurgists and chemists will want to have in their libraries.

Personal

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

Leo von Rosenberg, of New York, is in Prescott, Arizona.

F. H. Minard left Denver for New York a few days ago.

G. D. Doveton has returned to Denver from El Oro, Mexico.

W. C. Russell has returned to Tonopah, Nev., from a business trip to New York.

R. L. Lechner, of New York, spent a few days in Butte, Mont., recently on mining business.

Dr. R. A. F. Penrose, Jr., of Philadelphia, has gone to South America on professional business.

W. H. Paul is now manager of the Dolores Mines Company, San Isidro, Chihuahua, Mexico.

Hudson H. Nicholson passed through Denver recently on his way from Goldfield, Nev., to Chicago.

H. W. Hardinge was in Denver a few days ago on his way from Mexico and Arizona to New York.

G. Lavagnino, of Salt Lake City, was in Denver last week and left there for his home at Pasadena, California.

Theodore E. Schwarz returned last week to Denver, Colo., from New Mexico, and leaves again this week for Leadville.

James W. Neill, consulting engineer for the East Butte Company, who lives in Pasadena, Cal., has been in Butte on business.

Dr. Shadwell, a British economist, has sailed from Liverpool to report on Canadian industrial conditions for the London Times.

E. C. Engelhardt, superintendent of the Hercules Gold Mining Company, of Deadwood, S. D., spent a few days in Denver last week.

James Epperson has been reappointed State inspector of mines of Indiana. His appointment was opposed by the United Mine Workers.

William Parnell, formerly superintendent of the Tamarack mine, but now of Denver, Colo., has been in the Lake copper country.

Walter Harvey Weed, of New York, who has been in Arizona on professional business, is expected to return to New York this week.

Charles M. MacNeill, president of the Utah Copper Company, has been in Utah making an inspection of the properties of that corporation.

Prof. J. E. Spurr is in Leadville, Colo., making a special geological examination of the conditions in the Leadville basin, down-town section.

Aug. Mathez, of Denver, has lately been examining property in Summit county, Colo., and is at present in Wisconsin on professional business.

J. D. Irving, of Lehigh University at Bethlehem, Penn., is at present in Leadville, Colo., securing data for a monograph on that district.

Edwin E. Chase returned to Denver recently from the Cœur d'Alene and Black Hills districts, and left there again for New Mexico and Arizona.

Silas W. Eccles, vice-president of the American Smelting and Refining Company, is making an inspection of the Utah and Nevada properties of that corporation.

R. A. Varden, of the firm of Bambridge, Seymour & Co., has returned to London after a visit to various mining fields in South America, extending over 12 months.

W. H. Linney, manager of the Nipissing Mining Company, Ltd., at Cobalt, Ont., has resigned. He has been in charge of operations since the company was formed.

William F. Gordon, general manager of the Mistletoe Mining Company and Magdalena Tunnel Company, is now at Magdalena, N. M., where he will remain for several months.

Right Hon. James Bryce, British ambassador to Washington, while in Canada last week visited the Geological Survey at Ottawa and displayed a thorough knowledge of geological matters.

Evans W. Buskett, formerly metallurgist at the zinc oxide works, at Coffeyville, Kan., is now connected with the Mineral Point Zinc Company, at Joplin, Mo., in its ore-buying department.

George Otis Smith, it is announced, has been selected for the office of director of the United States Geological Survey, to succeed Charles D. Walcott, now secretary of the Smithsonian Institution.

Eli T. Conner, recently with the Pennsylvania Coal and Coke Company, at Cresson, Penn., is now general manager of the New River Collieries Company, with office at Thurmond, West Virginia.

William Shovell, formerly of Butte, Mont., and for some time superintendent of the Big Master gold mine, Manitou lake, Ont., has been appointed superintendent of the Columbus mine at Cobalt, Ontario.

Charles C. Christensen, for 28 years mechanical engineer in the mining machinery department of Fraser & Chalmers and the Allis-Chalmers Company, will remove his office on May 1 from Chicago to West Allis.

Fred S. Eaton has been appointed chief clerk of the Calumet & Hecla mine, succeeding the late J. H. Lathrop. Mr. Eaton has been cashier of the mine for a

number of years. Harry Harper will succeed Mr. Eaton.

Dr. Reginald A. Daly, geologist for the Canada International Boundary Commission, has been offered the professorship of physical geology at the Massachusetts Institute of Technology, in Boston, and has accepted the position.

Dr. Ellis, of the Canadian Geological Survey, has returned from a three-months trip to the West Indies, where he made a study of the oilfields and asphalt deposits in Trinidad and Barbadoes, as well as the sulphur deposits on the Dutch island of Saba.

James MacNaughton, general manager of the Calumet & Hecla, and James B. Cooper, superintendent of smelters, have been attending the session of the United States court at Grand Rapids, Mich., in the Calumet & Hecla-Osceola controversy.

E. E. Hoffman, of Portland, Oregon, is considering bringing an exhibit to illustrate the progress of mining in the Northwest to the Jamestown Exposition with a view of familiarizing the East with the present state of mining development in that territory.

John Hammell, of New York, who has for some months been prospecting in the Elk lake country in Ontario, where he located a number of claims, is leaving with a party to look for gold in the region beyond Lake Abitibi and the Hight of Land, on and near the Quebec border.

H. D. Richardson has resigned his position as assistant superintendent at the Nipissing mines, Cobalt, Ont., where he has been for the past year, to look after the development of some property in which he is interested in Idaho. His address will be Boise, Idaho, after May 15 next.

Henry C. Schmidt has resigned his position as superintendent of Minas Dolores y Anexas plant of the American Smelters' Securities Company, at Matehuala, San Luis Potosi, Mexico, to take the position of superintendent of mines for the National Metallurgical Company of the same place.

Obituary

Thomas Palmer, a pioneer of the iron industry of Cleveland, Ohio, died in that city March 16. He was born in England and on coming to America in 1855, was employed by Cooper & Hewitt, becoming superintendent of the plant at Trenton, N. J. In 1865 Mr. Palmer went to Cleveland and operated the old Butterfly iron mill; later he was made superintendent and manager of the Cleveland Rolling Mill Company, at Newburg, in which capacity he remained until his retirement 10 years ago.

Jacob Reese, for many years a prominent figure in the Pittsburg iron trade,

died March 26 at his home in Sharon Hill, Philadelphia, aged 82 years. He was a prolific inventor, having taken out over 200 patents in connection with the manufacture of steel and iron. With his father he is said to have made the first iron by the boiling process in this country. The universal mill is also credited to him. One of his patents covered the basic process, but it was not commercially developed by him, this being due to the subsequent exploitation of the same field by Thomas and Gilchrist, in England. In many other matters he anticipated improvements in iron and steel processes, being in advance of his time. He was actively engaged for many years in the operation of rolling mills at Pittsburg, his firm of Reese, Graff & Woods occupying a leading position in the trade. He was also connected with other manufacturing enterprises.

Societies and Technical Schools

American Water Works Association—Notice is given that the twenty-seventh annual convention will be held at Toronto, Ontario, June 17 to 22, instead of June 11 to 14, as at first announced.

McGill University—On April 5 the McDonald engineering building of this institution at Montreal was destroyed by fire, the cause of which is unknown. The loss is complete, only the walls being left. The building, which was completed in 1893, was one of a group, which includes the Physics, the Chemistry and Mining buildings. It was erected, equipped and endowed by Sir William C. MacDonald. Beside numerous lecture rooms, students' rooms, and departmental library, and a large technical museum, which contained the Reauleux collection of kinematic models, believed to be the most complete in America, the building contained large and thoroughly equipped electrical and magnetic laboratories, dynamo rooms, lighting station, and laboratories of mathematics, dynamics, mechanics, geodesy and thermo-dynamics. The building and its equipment when it was opened represented an outlay of \$484,646. Since then considerable additions have been made to its contents. There was \$320,000 insurance on the property. Several of the professors lost private libraries, papers and other valuables.

Industrial

The office of Way's Pocket Smelter Company has been removed to the Merchants' Trust building, Los Angeles, Cal., with George H. Parker in charge. The factory will remain at South Pasadena for the present.

The National Wood Pipe Company, Los Angeles, Cal., is moving into new

office quarters in the Equitable Savings Bank building in that city. The San Francisco office has been removed to the Hansford building, Market and Davis streets.

The Cyclone Drill Company, of Orrville, Ohio, recently shipped one of its combined core and hollow rod drilling outfits to Wm. Gelder & Co., of New York, for prospecting their property at Tonopah, Nev., and a duplicate outfit to O. W. Dunlap, Carlsbad, N. M., where a large mineral property is to be developed.

The Witte Iron Works Company is completing a new factory of steel, brick and stone construction at Sixteenth to Seventeenth streets, Oakland to Eastern avenues, Kansas City. The new factory has 60,000 sq. ft. of floor space and is equipped with the best machinery. The company owns its own supply of natural gas and water, and has provided its own independent electric lighting plant, telephone service, etc. The new works are situated on the Missouri Pacific and Kansas City Southern railroads and are only 30 minutes by street-car line from the center of Kansas City. The new plant has been necessitated largely by the expansion of the business of the company in the manufacture of gasolene mining hoists.

The German-American Portland Cement Company, of La Salle, Ill., whose plant is equipped throughout with Allis-Chalmers cement making and electrical machinery, recently ordered two additional 5x22 ft. Gates tube-mills, and a special Allis-Chalmers induction motor which will operate geared to the tube mill, at a speed of 660 r.p.m. The Sydney Cement Company, engaged in the manufacture of slag cement in Sydney, N. S., has recently purchased a set of Allis-Chalmers crushing rolls, 26x15 in., as an addition to its present equipment. The new rolls are designed to reduce the granulated slag from 8 to 30 mesh, and will have an approximate capacity of 3 to 4 tons an hour when operating at a speed of 125 r.p.m.

About six months ago the Electro Metallurgical Company was incorporated and began the manufacture at Niagara Falls, N. Y., of ferro-alloys, principally ferro-vanadium, ferrotungsten and low carbon ferrochrome. Additional equipment is now being installed. In February the company acquired the works at Kanawha Falls, W. Va., and the business, good will and patents, so far as they relate to the manufacture and sale of ferro-alloys, of the Willson Aluminum Company. Additions are now being made to these works with the object of increasing the output and more particularly of ferro-chromium and ferrosilicon. The Electro Metallurgical Company's general offices are at 157 Michigan avenue, Chicago, and it has also an office at 79 Wall street, New York.

Trade Catalogs

Receipt is acknowledged of the following trade catalogs and circulars:

United Engineering and Foundry Company, Pittsburg, Penn. Lever Shears and Vertical Shears. Pp. 52, illustrated, paper, 3½x6 in. 1907.

Hayward Company, 97 to 103 Cedar street, New York City. Net Price List of Orange-Peel and Clam-Shell Buckets. Pp. 14, illustrated, paper, 3½x6 in. 1907.

The North Coast Engineering Company, Seattle, Wash. Manufacturers and Dealers in Fuel Oil Burning Appliances, Pump Governors and Reducing Valves. Pp. 24, illustrated, indexed, paper, 6x8½ inches.

Construction News

Eureka, Utah—The Beck Tunnel Mining Company intends to install a new hoisting plant. Jesse Knight, Provo, Utah, is president.

Copper Ridge, Colorado—The Copper Ridge Mining Company proposes to put in machinery for sinking a deep shaft. Bert Goldsworthy, Steamboat Springs, Colo., is manager.

Rollinsville, Colorado—The Mountain Monarch Mining Company intends to put in an air-compressor plant at its tunnel. Frank Augustus, Rollinsville, Colo., is manager.

Idaho Springs, Colorado—It is reported that extensive additions are to be made to the power plant of the Stanley Consolidated Mines Company. A. G. Brownlee, Idaho Springs, Colo., is manager.

Tolland, Colo.—Herrod & Co., operating in Jenny Lind gulch, are figuring on the erection of a five- or ten-stamp amalgamating mill before summer. Reuben Herrod, Tolland, Colo., is manager.

Black Hawk, Colo.—The New National Tunnel Mining Company, G. Whitney Adams, Central City, Colo., manager, is contemplating the purchase of an air-compressor plant for tunnel operations.

Gilpin County, Colorado—The Ingram Mining and Milling Company intends to erect a 20-stamp mill and concentrating plant on Elk creek. Ira Pollard, 522 Mining Exchange building, Denver, Colo., is manager.

Quartz Valley, Colorado—F. W. Hearne & Co., operating the Tucker property in Quartz Valley district, are going to increase the capacity of their concentrating mill. H. W. Kane, Central City, Colo., is manager.

Hawkeye District, Colorado—At the Dirigo group arrangements are to be made for a new air compressor, additional machinery for the mill, and a wire-rope tramway. G. H. Elling, E. & C. building, Denver, Colorado, is manager.

Special Correspondence from Mining Centers

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

REVIEWS OF IMPORTANT EVENTS

San Francisco

April 4—The rain storms have been still heavier throughout the State, and much damage has been done by floods. Bridges in all directions have been washed away and train service generally interrupted. At Dredgeville, below Oroville, several lives were lost, and the people made homeless. The mines in nearly all the camps have been hampered for lack of power, the floods having put the electric power plants out of commission. Land slides have carried away mine buildings, and immense quantities of surface water have come into the mines. Flumes and ditches have been materially damaged and numbers of mines, both quartz and gravel, have had to close down for the time being. The loss of bridges has stopped ore shipments from some properties, notably in Shasta county. The big hydraulic restraining dam in Bear river, between Dutch Flat and Liberty Hill, which has stood previous high waters for 16 years, has been destroyed. The Bowman dam near North Bloomfield, reported carried away, still stands, however. Snow has fallen lower down toward the valleys than usual, there being, for instance, 6 feet at the Balaklala mine in Shasta county. At the present writing the rain has ceased and the rivers have passed the highest water mark. It will, however, be some time before repairs can be made to the various electric power plants.

Asbestos of the chrysotile variety is reported as found by F. T. Smith and J. T. Dillon near Washington, Nevada county. Very little work has so far been done in the claim. Asbestos is found in many places in this State, but it is not generally of a superior quality, the fiber being somewhat short and more or less brittle.

Assemblyman Geo. W. Foot is arranging for a general meeting of hydraulic miners at Grass Valley early this spring to take steps toward the resumption of hydraulic mining on a more general scale. Mr. Foot succeeded in passing a resolution through the late legislature, which permits the Government to take charge of caring for the débris washed down into the streams by the miners, on certain conditions. At the proposed meeting ways and means of sending a representative or delegation to the next Congress will be agreed upon and a plan of action outlined. The Foot resolution proposed that the Government permit hydraulic mining to be resumed after it has erected a

series of dams in all the streams affected, in addition to installing a fleet of big dredgers below. The latter are expected to keep the streams clear of silt and maintain the rivers in a serviceable condition, while huge pumps will assist in depositing the silt on swamp land, thus eventually reclaiming these. Of course, the Government will not be asked to do this simply as a matter of accommodation to the miners, as a provision will be made in the proposed bill in Congress whereby a certain per cent. of values obtained from each cubic yard of mined ground will revert to the United States to defray the expense. The bill providing for three members of the consulting board in the State engineers' department, was so amended that it is not required that these men shall be directly engaged in hydraulic or placer mining. They may be mining men of any kind. This consulting board has not yet been appointed.

The Northern California Water and Power Company has been engaged for some time past in securing patents to much of its ground between French Corral and North Bloomfield, in Nevada county. The company purchased the Eureka, Lake and Bloomfield water and mining systems and, it is believed, will utilize these holdings in a great power enterprise. W. B. Bourn is one of the chief promoters, and he is principal owner in the North Bloomfield, Kate Hayes and other gravel properties. It is hardly probable that he expects to resume hydraulic mining under present conditions, but the water rights, reservoirs, ditches, etc., of the mines are now more valuable than the mines themselves.

Salt Lake City

April 6—The ore and bullion settlements for the month of March, as reported by Salt Lake banks, reached a total of \$3,202,000; while dividends were reported to the amount of \$798,500, the contributing mines and respective amounts being: Utah Consolidated, \$450,000; Daly West, \$108,000; Utah, \$3000; Beck Tunnel Consolidated, \$40,000; Grand Central, \$15,000; Victoria, \$10,000; Columbus Consolidated, \$60,000; Daly Judge, \$112,500. Payments will be made by Utah Consolidated and Columbus Consolidated during the present month.

Shareholders of the Bingham Standard Copper Company have ratified the action of the board of directors in effecting a coalition with the Bingham Central Min-

ing Company. A new corporation is to be formed to be known as the Bingham Central-Standard Copper Company. With the merger completed the holding company will be in possession of over 500 acres of ground.

The Jennie Extension Mining Company has been formed to develop a property at Gold Springs, Iron county. The officers are: F. R. Davis, president; C. A. Short, vice-president; H. R. Elliott, secretary and treasurer.

The Reuben Gold Mines Company has been formed in Salt Lake to develop the Reuben group of lode mining claims situated in the Stateline district in Iron county. The officers are: Will J. Dooly, president; C. E. Peak, vice-president; Lewis H. Beason, secretary and treasurer. The headquarters of the company will be 314 Herald building, Salt Lake City.

Governor John C. Cutler has disapproved the bill passed by the late legislature giving smelting companies the right to condemn land within a radius of four miles of smelter sites in counties of a population of less than 75,000. The executive took the ground that the measure bore the distinct marks of class legislation, and was therefore unconstitutional.

The operators of the Alta, Utah, district, believe that they have effectively solved the transportation problem for that camp, and will use aerial tramways between the mines and Wasatch, about two miles from the entrance to Little Cottonwood cañon. Wasatch is to be the terminus of a standard-gage railroad to be built during the present year. Aerial tramways will be utilized for a distance of from 7 to 10 miles.

Considerable mining activity is reported from the Gold Butte region, in southeastern Nevada. Prospectors have been flocking in there for some time, and late reports from Gold Butte are to the effect that numerous sales of mining property have been made lately. The Gold Butte Mines Company is carrying on the principal operations at the present time. Charles M. Schwab is said to have acquired an option on the Lincoln group of copper-bearing claims, and the Savanic copper mine, just over the Arizona line, has been taken up by a New York syndicate.

Two judgments, one for \$23,444, and the other for \$9,473, have been entered in the district court at Salt Lake against the Sheba Mining Company, with property in Juab county. A sale of the property has been ordered.

The Copper Belt and Revenue Deep Tunnel mining companies have consolidated their properties, which are situated in the Gold Mountain Mining district. A. B. Sawyer, Jr., of Salt Lake, is secretary.

A suit has been filed in the district court by Richard F. Smythe and others against the Bingham Group Mining Company, and others, to quiet title to the Ceresus lode mining claim, in Bingham. It is alleged that the defendants have attempted to place a mortgage of \$30,500 on the property in question, by which plaintiff's title has been clouded.

Denver

April 6—On March 27 Deputy United States Marshal Frank, of Denver, seized 34 sacks of ore, at the Pueblo office of the Wells-Fargo Express Company. The ore is supposed to have been stolen from the Mohawk mines in Nevada. A writ of replevin was issued by the United States court against the express company, and the ore placed in charge of the Federal authorities.

For the first time in its history, the Denver mint will shortly be coining a large amount of 50-centavo pieces for Mexico. During the month of February more than \$7,000,000 worth of \$10 American gold pieces was turned out, and at present the whole force is at work on \$5 pieces and subsidiary silver coin.

Judge Wood having denied the motion of the attorneys of Charles H. Moyer, William D. Haywood and George A. Pettibone, for a change of venue, the trial of these parties will be held in Boise, Idaho, probably early in May.

It is estimated that 50,000 h.p. can be developed on the seven drops of the Gunnison tunnel, which the United States Government is building to carry the water from the Gunnison river through the mountains to the Uncompahgre valley, where 150,000 acres of land will be irrigated. Estimates on an electric-power scheme in connection with that enterprise, are being made, which would reduce the cost of the work considerably to the settlers who will pay for the same in 10 years, for water rights at a certain amount per acre. It is expected that the tunnel will be completed next year, its entire length being 30,582 ft., of which about 19,000 ft. have been completed.

Scranton

April 7—A small breaker recently transformed into a washery at the Hurry Up colliery, near Fishbach, has been destroyed by fire. The plant was recently purchased by the Herskers, of Mahanoy City, from the Williams Coal Company, of Wilkes-Barre. The loss was \$50,000.

Recently the State constabulary were called out to interfere in a quarrel between two coal companies. There was a

conflict between the officials of the Reliance Coal Company, of Pittston, and the Pennsylvania Coal Company. The trouble arose over the placing of a steam pump by the Reliance company, pipes from which would lead through the mine workings of the other company, which, not long ago, closed up a waterway that afforded natural drainage into the deeper workings of its mine. The Reliance alleged that this was done to force it to sell the mining rights to the Pennsylvania company. Twenty-five troopers replied to the call and a number of the officials of the Reliance company were arrested for assaulting officials of the other company.

Duluth

April 4—Iron-ore shipments by the leading producers of the Lake Superior region for the past two years show some decided changes in proportionate positions and some interesting facts. Some of these are given herewith:

	1905.	1906.	Changes.
Oliver Iron Mfg. Co.	18,163,112	20,414,818	I. 2,254,706
Pickands, Mather & Co.	2,010,450	2,766,031	I. 755,581
Corrigan, McKinney & Co.	2,542,443	2,622,688	I. 80,245
Cleveland-Cliff Iron Co.	1,859,806	2,221,753	I. 361,947
Jones & Laughlin Steel Co.	795,996	584,222	D. 211,774

There are many others operating groups of mines, but their totals are small. The decline of the merchant firm of Corrigan, McKinney & Co. from second to third place is due to a falling off in production from their Stevenson mine, for which the addition of St. Paul, in 1906, and others in 1907 will scarcely compensate. The advance of Pickands, Mather & Co. shows the desire of the Buffalo Steel Company to secure sufficient ore from that firm for the operations of its works. Besides the two firms named, the Cleveland-Cliffs Iron Company is a large producer of merchant ore.

The Great Northern Railway is pre-eminently the road of the Mesabi district over which independent ore is shipped, but the production of mines along that line shows a remarkable decline in the volume of ore sent forward by non-consumers. Out of a business for 1906 of 6,083,057 tons all but 429,500 tons was by consuming companies, as shown in the following table:

	1905.	1906.
Mahoning Ore & Steel Co.	1,009,171	1,275,661
Corrigan, McKinney & Co.	1,688,552	1,409,232
Pickands, Mather & Co.	649,775	797,163
International Harvester Co.	246,442	450,117
Pittsburg Iron Ore Co.	319,775	412,032
Consumers' Ore Co.	228,169	317,743
Jones & Laughlin Steel Co.	419,224	309,338
Shenango Furnace Co.	165,604	71,235
Inland Steel Co.	137,129	19,595
Oliver Iron Mining Co.	120,217	24,014
Cleveland Cliffs Iron Co.	113,880	.....
Buffalo & Susquehanna Iron Co.	20,984	.....
LaBelle Iron Works	5,957	.....

All the above are consumers of at least a large part of their own ore production. The following are the few non-consumers left on the Great Northern lines, and of these the largest, Leonard,

will next season be among the mines operated for the benefit of its owners, now the United States Steel Corporation:

	1905.	1906.
Leonard Iron Mining Co.	284,725	243,915
E. H. Jennings & Bros.	.....	82,889
Meriden Iron Co.	.....	53,624
Bradford Mining Co.	53,473	49,372

There are, to be sure, several independent operators on the Gogebic, Menominee and Marquette ranges, in addition to the firms mentioned in the first list above, but their totals are well tied up, and are not great at the best. The elimination of the independent ore producer has proceeded with rapidity during the past year, owing to the continued absorption of mines by consuming interests, and this tendency is still marked.

London

March 30—For the first time for 10 years the ordinary shares of the United Alkali Company have received a dividend. The distribution for the year 1906 is at the rate of 2 per cent. At the start of the company these shares received 6 per cent. in 1892 and 5 in 1893. Since then the only distribution has been 1 per cent. in 1895 and 2 per cent. in 1896. The general trade of the country has been extremely prosperous during the past two years, and the chemical trade has once more proved an excellent index of the state of affairs. The gross profits of the company during 1906 amounted to £588,804 as compared with £487,264 during 1905, and £411,584 in 1904. The debentures take £134,900 as interest, and management and taxes about £60,000, so that the net divisible profit for the year was £393,293. Out of this £140,000 is applied to depreciation, reserve and extinction of debentures. The distribution on the 7 per cent. preference shares absorbed £187,800, and £56,875 was distributed among ordinary share holders. Year after year goes by without any mention of a reorganization of the capital. As I have often written in this column, the United Alkali Company was floated at the height of chemical prosperity in this country, and the capital does not nowadays correctly show its present position.

The Salt Union, Ltd., was formed at about the same time, and under the same commercial conditions as the United Alkali Company, but its history has been a much more depressing one. Not only have the ordinary shares received nothing for 10 years, but the preference dividend has often been passed. The results of the operations during 1906 are as discouraging as ever, for the gross profit was only £161,000, as compared with £166,000 in 1905. The net profit was £70,300, out of which £54,000 had to be paid for debenture interest. During the year 910,000 tons of salt were sold, a slight increase over the production during 1905. There does not appear to be any very rosy prospect before the company.

Mining News from All Parts of the World

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

THE CURRENT HISTORY OF MINING

Alabama

Considerable development is going on in the iron-ore fields of Alabama. The Tennessee Coal, Iron and Railroad Company is placing machinery for mining ore in the southern part of Jefferson county, along the Red Mountain tract. The ore bed is said to be 14 ft. thick and runs higher in metal value than any red ore found in the district. It is intended to get mines opened at this point just as fast as possible. It is stated that the ore in this district carries an average of 55 per cent. metallic iron. In addition to this considerable development is under way in the brown-ore properties of the State.

Arizona

YAVAPAI COUNTY

H. J. Beemer Company—This company has been developing the Storm Cloud group of mines in the Hassayampa district, 10 miles south of Prescott; the property was taken over about one year ago.

Mount Tritle Copper Company—A correspondent writes: This company has acquired what was formerly known as the Dunkirk mine, which is held under bond and lease; the last payment will be made in April when the title passes to the new company. The property consists of two claims held under the above bond, eight claims held under an option, and one claim located by the new company. It is situated in the Hassayampa district, 15 miles from Prescott, and in the immediate vicinity of the Senator, the Stormcloud and the Davis mines. Active development has been carried on by the new company, new buildings having been erected; and underground work is being pushed. Four tunnels are being run into the side of Mount Tritle through which the main vein cuts. When driven a distance of 2000 ft. the lowest adit will give 1000 ft. of stoping round. The tunnels are now in respectively, 160 ft., 170 ft., 270 ft. and 150 ft.; the four tunnels lie one over the other and about 100 ft. apart vertically; there is developed 1000 tons of ore averaging \$42.40 per ton; there is partially developed 2000 tons of ore averaging \$40 per ton. The average width of the pay streak is 2½ ft., varying from 1 to 4 ft. The ore is all shipping ore and the company is now making regular shipments to the smelter at Humboldt. All this ore is developed in one ore-shoot, and at least five other shoots are known to exist on the vein, though they are not yet opened by the tunnels. The latest news

from the mine announces the striking of a new shoot of ore, sampling \$43 per ton, and 4 ft. wide. The management is contemplating the immediate erection of a concentrating plant to handle about 2000 tons of ore now on the dumps and averaging about \$11 per ton; also a large amount of low-grade ore that is being developed underground between the richer shoots. The Mount Tritle Copper Company is an Arizona corporation, with an authorized capital of 500,000 shares of \$1 par value. Of this stock 100,000 shares will remain in the treasury; 400,000 shares will be issued, and have been underwritten by responsible parties.

Neiman—This mine, situated in the Santa Maria river district, has been taken over by Montana parties, who propose to develop it on a large scale. The ledge is developed to the depth of only 100 ft. The ledge has an average width of 3 ft., and the ore is said to run well in gold.

California

AMADOR COUNTY

Argonaut—At this mine, Jackson, the new owners are opening up the 2500 level, and it promises as well as the level above, though no ore has been milled yet.

Wildman—All work has ceased on this property at Sutter Creek, the men refusing to work any longer without cash payments.

EL DORADO COUNTY

Long Cañon—The mining excitement in the Long Cañon country has called 500 miners from the Nevada fields recently. Some of these rich mines are in Placer and some in El Dorado counties.

Woodside-Eureka—This company has been organized by A. K. Grimm, A. C. Capwell, C. Esterly, F. P. Mitchell and R. B. Myers, of Oakland, to open the Eureka and Woodside mines near Georgetown, which were at one time large gold producers.

Horseshoe Bar—This company, owning several mines on the river between Forest Hill and Josephine, is putting in a hydraulic elevator at Horseshoe Bar and is building an eight-mile ditch to tap a water right.

INYO COUNTY

Montezuma Mining and Smelting Company—This company, owning five claims near Big Pine, has been shipping silver-lead-gold ore to the Salt Lake smelters,

but developments are now such that the directors intend erecting a 50-ton smelter.

Molus—Brown Brothers & Key have resumed work in this once well known mine, at a point some hundreds of feet from the old workings.

Greenwater & Death Valley—In the Queen shaft of one of the properties of this company at Greenwater, a small stringer of sulphide of copper has been struck at the depth of 270 ft. This is one of the Schwab properties.

Furnace Creek—On this mine a depth of 500 feet has been attained, and several bodies of good copper ore have been cut.

Bermuda and Oban—Development work has commenced on these properties, adjoining the Saratoga and Red Boy, owned by Harry Chickering. Machinery is shortly to be installed.

Gladstone-Greenwater—An extension of time on the bond has been given and instructions have been received to proceed with the work, which was suspended pending negotiations for an extension.

KERN COUNTY

Amalie—This mine in Amalie district, now owned by the Bawden-Marx Company, has been unwatered and the work of taking out ore will begin at once.

Sunshine—Negotiations are pending for the purchase of this mine at Randsburg from Thomas and William Atkinson, the original discoverers.

MARIPOSA COUNTY

Mount Washington Consolidated—This company, composed of Los Angeles men, has purchased from James F. Peck, of San Francisco, a group of mine claims near Hornitos, for a large sum. The principal mine is the Washington, famous years ago as the Quartz Mountain, and at that time a large producer. A mill is to be erected at once.

NEVADA COUNTY

Dolly Madison Mining Company—Operations have commenced on this property, at Randolph Flat, under Superintendent Hay. The old shaft will be pumped out.

Resartus Mining Company—This company, H. H. Hicks, superintendent, is opening the Lincoln mine, near Nevada City, and ore carrying free gold and high-grade sulphurets, has been found east of the shaft at 65 ft. depth.

Canada Hill Consolidated Mining Com-

pany—In this mine, Nevada City, formerly known as the Charronat, sinking has been resumed, and a 2-ft. vein has been found.

PLACER COUNTY

Northern California Gold Mines Company—This company, operating the Herman mine, on the Deadwood Divide, is putting in an extensive electric plant.

Three Queens—This is the name of a rich mine recently bought by Wingfield, of Nevada, from Mr. Savage. C. D. Wilkinson has been selected as superintendent. Seven other locations have been made near by, and aside from the rich pocket, the vein carries ore ranging as high as \$84 per ton.

PLUMAS COUNTY

Genessee—This mine, commonly known as the Gruss, has been sold to a mining syndicate and a new shaft will be sunk.

RIVERSIDE COUNTY

Turtle Mountain District—Rich gold finds have been made in this new district, about 40 miles from Needles. The ledges so far found are large, and a number of prospectors are at work.

SACRAMENTO COUNTY

Prosperity—This drift mine at Blue Ravine above Folsom has been sold to T. F. Hornung, of San Francisco, who with others will reopen it.

Perazzo Ranch—A new company has started to drift on this ranch near Folsom, where Hupp & Roberts spent considerable money without finding pay gravel. Further prospecting is to be done.

SISKIYOU COUNTY

Advance—Henry Wood & Co., of Denver, Colo., have made the final payment of \$70,000 on the purchase of this mine near Etna, in the Salmon river district.

Colorado

BOULDER COUNTY

Ingram—A shipment of high-grade ore to the Denver smelters brought returns of \$7.50 per pound. Mine is located at Salina, Colo., and Henry Meyring is manager.

Nederland Tungsten Mining and Milling Company—Incorporation papers have been filed showing capital stock of \$500,000, T. L. Owings, Bascom Scruggs and C. Marquardt being incorporators. Company will operate at Nederland.

FREMONT COUNTY

Federal Mica Mining Company—This company, of Duluth, Minn., is developing a large deposit of mica in Fremont county and the company is preparing plans for a mill. Some good sized sheet mica is found and the balance of the product will be pulverized.

LAKE COUNTY—LEADVILLE

On account of the condition of the roads during the month of March, and the scarcity of cars, the tonnage for the district amounted to 76,000 tons only. With the disappearance of snow, the drying of the roads and the necessary cars the tonnage for the present month will reach 80,000 tons of all classes of ore.

Elva Alma—A good plant of machinery has been installed at this shaft, Ball mountain, and sinking is now in progress. The bottom of the shaft is in good porphyry and the conditions are favorable for the striking of a good body of mineral. The shaft adjoins the Sunday.

Evans Gulch—Big and South Evans gulches are at present commanding a great deal of attention from investors; this is due to the rich ore that has been opened in the Winnie and the Mammoth. The Cleveland, which is the northern extension of the Winnie, will complete its sinking during the month, having reached a depth of 625 ft. A drift will be run to the south to connect with the Winnie drift, and the ground to the north will be thoroughly prospected. The unwatering of the Boulder shaft started at the beginning of the week and by the middle of the month the bottom should be reached. The Hoosier Girl, Little Ellen hill, has resumed work. A new plant of machinery has been installed at the Silent Friend and sinking the shaft another 100 ft. is in progress. The Mammoth shaft has been unwatered to below 525 ft. and the water is being lowered steadily.

Iowa Gulch—This section is unusually busy and a quantity of ore is being sent out. At the Helena from the 300-ft. level 30 tons daily is being shipped from a perpendicular vein; this vein has also been opened at the 500-ft. level. The tunnel being driven to the Mansfield shaft by the Midland Mining Company is making good progress and the shaft should be cut about the middle of the month. When this is accomplished work will be carried on at the 175-ft. level on a small vein that is in the shaft, and which may lead to the main ore channel.

Leo Shaft—This shaft, head of California gulch, has been unwatered and the company is now drifting on a streak of mineral from the 550-ft. level.

McCrae Shaft—This shaft of the Little Pittsburg Mining Company, Fryer hill, was recently secured under lease to Leadville parties; a new shaft was sunk, and when it reached a depth of 370 ft. drifting was started and an excellent body of ore has been opened.

President—In this mine, Breece hill, a good body of ore was recently opened in one of the drifts at the 500-ft. level, and from it two carloads of gold ore weekly are being shipped.

Red Hook Tunnel—It is learned on good authority that another tunnel project

will be started in the early summer in the Sugar Loaf district. It will start from the Colorado gulch side and be driven to open and develop the Red Hook claim.

TELLER COUNTY—CRIPPLE CREEK

The production of the Cripple Creek district, during the month of March, amounted to nearly 56,000 tons, valued at \$1,297,555.

Stratton Cripple Creek Mining and Development Company—This company has just declared a dividend of \$50,000, which is the fourth time that this amount has been distributed among the stockholders.

Stratton Estate—The legislative committee, appointed to investigate the affairs of the Stratton Estate, has made its report and this shows that it is worth more today than when Mr. Stratton died. Since then a number of suits have been instituted but this litigation has all been practically settled except in one case which was tried in the district court and decided in favor of the estate, but a writ of error was issued, so that the Supreme Court was applied to and the committee found that the plaintiffs were understood to have offered to settle at a small figure. It is the opinion of the committee that the State of Colorado is entitled to the interest on the inheritance tax—the latter amounting to \$284,000—as well as to the principal. This interest amounts to about \$77,000 at the present time.

Work—The annual meeting was held on April 1, and the report to the stockholders shows that during the past year, the gross production was 13,404 tons, valued at \$856,063. About \$140,000 was received from royalties. The Little Clara lease produced the principal part of this revenue. The sum of \$75,000 was paid in dividends during the year.

Indiana

VANDERBURG COUNTY

Winifred E. Mining Company—This company, with office in Evansville, has incorporated. The company proposes to open mines in this county near the Gibson county line.

VIGO COUNTY

Oil development in this county is assuming large and profitable proportions. A number of coal operators are turning their attention to the work of sinking wells. Several refineries are being constructed. The field promises well.

WARRICK COUNTY

Mining is slack in this county. Of the six large coal mines near Boonville only one, the Wooley, is running with sufficient regularity to afford the miners satisfactory employment. The other operators are only running part of the time. Decreased demand and lack of cars are the causes.

Epworth Coal Mining Company—This company has incorporated with ample capital. It will develop new mines and lands recently leased near Newburg.

Kentucky

KNOX COUNTY

Moss Rock Coal Company—This company has been organized by D. W. and C. F. Clark and G. W. Taylor for the purpose of developing coal lands in the vicinity of Barbourville. The company has secured property on the Louisville & Nashville Railroad, and arrangements have been made for the immediate beginning of work.

WHITLEY COUNTY

Mount Morgan Coal Company—This company, which has recently been reorganized, owns about 2000 acres of coal lands near Williamsport, Ky., and is developing the Jellico seam, at present producing about 10 or 12 carloads per day. Officers: T. B. Mahan, Williamsburg, Ky., president; W. T. Underwood, Lexington, Ky., vice-president; M. H. Maury, Williamsburg, Ky., general manager; S. E. Mahan, secretary and treasurer.

Michigan

HOUGHTON COUNTY—COPPER

Copper Range Consolidated—This company is ready to close for two 2000-kw. turbine generators for the new electric plant to be erected on the site of the Michigan smelters. This plant is to furnish light and power for all the Range mines. The company contemplates using electricity quite extensively.

Missouri

JASPER COUNTY

Elliott Land—In a drill hole on this tract, near Carl Junction, ore was encountered at 137 ft. The drill showed 26 ft. of what is reported to be a rich deposit of ore.

Hardy & Wyly—These parties have drilled through 34 ft. of zinc ore on their 10-acre lease of the Aylor, Hannum & Stickney land at Alba. A shaft will be sunk at once.

Mattes Brothers—Mattes Brothers several months ago purchased the land of the old Jackson estate from the John Jackson Investment Company. Parts of this land had produced ore in past years but at the time of the purchase every mine on the land was abandoned. As soon as they secured control they placed a drill at work on the high level land—an arm of the divide between Shoal creek and Short creek—and in seven consecutive drill holes they have encountered a 12-ft. vein of zinc and lead at from 85 to

97 ft. The old Thanksgiving mine on this land has been reopened, near the north line, and is making weekly sales of ore. West of this mine is the McHenry Mining Company with a development on the 100-ft. level that is promising. This land is situated west and southwest of Joplin. Mattes Brothers also have a lease on the divide east of Duenweg, on which they have made some of the best strikes in that section and where they are erecting two concentrating plants, one of 1000 and one of 500 tons capacity.

Noble Land—Col. James O'Neill, of Webb City, who purchased the fee of four acres on Sucker Flat in the south edge of Webb City, from the estate of the late John W. Noble, of St. Louis, reports that the blanket vein is being proven to exist over this tract, being encountered at the 180-ft. level. This establishes the existence of the blanket vein on the south as well as north and east of Webb City.

Old Times Lead & Zinc Mining Company—This company has let a contract for the erection of a modern concentrating plant on one of its properties, one mile south of Galena. It will be of 300 tons daily capacity and will be driven by electricity furnished by the Spring River Power and Light Company.

NEWTON COUNTY

Deep Ore—On the Jesse Trent land, 3 miles south of Granby, 75 ft. of ore is reported shown by the drill. This is the first deep drill hole, but it is Mr. Trent's intention to keep a drill operating steadily in an effort to determine the extent of the orebody. This new location of a deep ore deposit at a distance from any tested ground renews interest in deep deposits.

Montana

BUTTE DISTRICT

The output of copper in Butte during March was about 25,500,000 lb., according to estimates made by leading mining officials here. This is greater than it has been in any month since last October. Producers are making an extra effort to have the March output equal that of some of the summer months. They are wasting little or no time in working ground that does not contain mineral. Development work, suspended Feb. 26, will be resumed by the companies within a few days.

Amalgamated—Ore production is heavy, shipments to the smelters aggregating 13,000 tons a day. Not all of this ore is from mines of the company; other operators are contributing to it. The Washoe plant is receiving about 10,000 tons and Great Falls the remainder. During a tie-up of the street railway system, which lasted two days, all second-class ore mined in the Original, a Clark mine, was shipped to the Washoe and the West Stewart was closed. The barren zone in

the latter has been penetrated, and at a depth of 1900 ft. the company has a 60-ft. vein of ore, all of commercial value.

North Butte—Shipments from this property are heavy and the month promises to break all records. No dead work is in progress. The vein of the Edith May is showing well at the 1800, and when further developed will add greatly to production, although the hoisting plant is taxed almost to capacity. The company has planned extensive development work at the northern end of its property, and will begin operations there as soon as prevailing contentions with employees are adjusted.

Pittsburg & Montana—Shaft No. 2 is nearing the 1400-ft. level. A large station will be cut when sinking is finished, and equipped with adequate pumping machinery. Openings will then be made toward the west to connect with winzes sunk on the 1200. Shipments of ore average about 200 tons a day. When the showing of ore in the property warrants, the old smelter, which went out of commission last spring, will be remodeled and operated.

Boston & Montana—A despatch from Butte, April 8, says: "Because 52 electrical workers, machinists, and blacksmiths, employed in the Great Falls Smelters of the Boston & Montana Company, were denied an increase in pay and walked out today 5000 men were thrown out of work in Butte tonight when the mines belonging to the company were shut down."

Nevada

A bill passed by the Nevada legislature provides that all grub-stake agreements must be recorded the same as mining locations, otherwise they are not valid. The measure also provides that each grub-stake agreement must have some definite time of terminating, so that after that time the prospector will be able to locate claims for himself, and not be bound to the man backing him.

NYE COUNTY—TONOPAH

Denver Annex—The workings in this property continue to look well. About 45 ft. of drifting has been done on the bottom level in ore, some of which is of shipping grade.

West Extension—The drifts on the 115-ft. level are among the show workings on the field. Characteristic green ore is visible all the way and in places patches of shipping-grade ore are noticeable in which free gold shows well. The vein is over 30 ft. in width.

California—The west tunnel is in 143 ft., with quartz-stringers showing in the face. The Davis tunnel has been driven 270 ft. in the south drift, and the vein carries good milling values.

Ore Shipments—Shipments over the Tonopah Railroad for the week ending March 28 were: Tonopah Company, 2050 tons; Belmont, 300; Montana-Tonopah, 100; total, 2450 tons. In addition to ore shipped, the new mill of the Tonopah Company crushed 2250 tons, and the Midway mill, 280; a total of 2530 tons. This made a total of 4970 tons of ore.

Pennsylvania

ANTHRACITE COAL

Delaware & Hudson—This company will open its large new breaker at Olyphant in a few days. It will be the largest owned by the company, and replaces the breaker destroyed by fire three years ago. The combined capacity of the breaker and washer will be 3000 tons per day. It is also the best equipped plant in the system of this company. There are so many mechanical pickers and other labor-saving devices that there will be fewer boys employed than in any other of the company's breakers. It has been painted inside and outside with fireproof paint.

Delaware, Lackawanna & Western—After an idleness of more than five years the Hallstead colliery will be reopened. It is at Duryea, and was shut down in 1902 during the strike at the time that the steam men and pump-runners were called out by the mine workers. As a result the pumps were idle and water from the Susquehanna river flowed into the workings flooding the entire mine. The work of pumping out the water has been going on continuously for five years, and has just been completed. The breaker is an old one, but has been renovated. About 400 men and boys were thrown out of employment when the mine was flooded.

Lehigh Coal and Navigation—This company will build a private telephone line 112 miles in length. This will be the longest private line in the State. It will connect all the collieries with the head offices in Philadelphia, and it will run along the company's canal from Mauch Chunk to Philadelphia.

Lehigh Valley Coal—This company will drive tunnels on the Otto and Pardee tracts, and will make extensive improvements at the Blackwood colliery so that it will be one of the large producers. This company will reopen the Centralia mine, which has been closed down for some time.

South Dakota

CUSTER COUNTY

Interstate—Preparations have been completed for extensive development work on this property, 8½ miles southwest of Custer, near the Saginaw. The holdings include 17 claims all patented. A shaft has been sunk 200 ft. on a quartz ledge, 18 ft. wide. Crosscuts will be run at this level. A shaft will also be sunk

100 ft. on another ledge carrying values. The company also owns 60 acres of placer ground on French creek.

LAWRENCE COUNTY

Maitland—A deal has been consummated by which this company will add to its holdings a tract of land lying between False Bottom and City creek. Prospecting with a diamond drill has proved good ore in a vertical ledge to the depth of 200 feet. A station is now being cut for setting up the drill to explore another vertical.

Homestake South Extension—Development work is being carried on at the 150-ft. level, and in a few days sinking will be resumed. When the shaft reaches the 300-ft. level, crosscutting will again be done. Air drills and electric machinery are about to be installed, the power to be furnished by the Consolidated Light and Power Company of Pluma.

PENNINGTON COUNTY

Holy Terror—W. F. Collins, manager of this company, has been discharged and proceedings are now on in the courts to compel him to give up the books. The management will place Messrs. Warner, Gray and Simm, of Keystone, in charge of the property for the present.

MacKay-Shepherd—A deposit of mica has been encountered on this ground, 7 miles southeast of Keystone on Sheep mountain. Samples have been taken which could readily be cut into sections 5 inches square.

Mills—Copper prospects have been uncovered on this ground on Middle Squaw creek. The ledge is 3 ft. wide at one place and 4 ft. at another.

Tennessee

MAURY COUNTY

People's Phosphate Company—This company has been organized by R. L. Kimbrough and others at Mount Pleasant to work phosphate deposits.

Utah

BEAVER COUNTY

Frisco Contact—The new steam hoisting plant at this property is in commission. The mine has been shut down for several months, owing to the fuel shortage.

JUAB COUNTY

May Day—The control of this Tintic property has passed to John Dern and associates of Salt Lake.

Tintic Ore Shipments—Shipments during the past week amounted to 148 carloads, the contributing mines and respective amounts being: Ajax, 4; Beck Tunnel, 9; Bullion Beck, 8; Bullock, 1; Centennial Eureka, 53; Carisa, 4; Eureka Hill, 9; Eagle & Blue Bell, 7; Grand Central, 6; Godiva, 2; La Clede, 1; May Day,

5; Mammoth, 6; Ridge & Valley, 3; Scranton, 6; Swansea, 2; Star Consolidated, 4; Tintic Iron, 3; Uncle Sam, 5 cars.

Lower Mammoth—After considerable difficulty, this company has one of the new electric hoists, recently installed, in working order.

SUMMIT COUNTY

West Quincy—This company has been prospecting with diamond core drills for some time past and has succeeded in striking the contact vein, believed to be an extension of the one opened in the Quincy mine which is now owned by the Daly West Mining Company. A permanent working shaft will be sunk.

Vermont

ORANGE COUNTY

More work has been done recently in the copper mines around Corinth than for a long time past. The Pike mine is shipping some ore, which is hauled by teams to the railroad. Copper ore is reported found on the Bicknell property. The mineral rights on the Hastings property have been bonded by Boston parties, who are preparing to do some development work.

Washington

STEVENS COUNTY

First Thought—This company has applied for patents for the Gibbons, Keystone and Defender lodes, consolidated, 40.2 acres, in all, and the Rosalie, Noonday traction and Danby lodes, consolidated, 27 acres, all in the Pierre Lake district. The First Thought mine is now having its ore conveyed by aerial tramway to the railway and shipping to the Granby smelter, at Grand Forks, B. C., and the Northport smelter, when it runs.

Napoleon—The B. C. Copper Company, it is reported, contemplates installing a cyaniding plant, to mill the product from a large body of decomposed quartz and iron oxide, situated above the present main workings of the mine.

Sure Thing—Galena has been encountered associated with the usual copper-gold ore, an unusual thing on Toulon mountain.

Orient—From the end of an 800-ft. tunnel, after boring a short distance, the diamond drill struck into quartz and continued in it nearly 200 ft.

Hester—This company is opening the Regina claim, on Pierre creek, by sinking a shaft on the foot-wall side of the vein and crosscutting. Some good copper-gold ore has been found. Thos. Foran is manager; address Orient.

Tungsten Mine Company—This company is owned by the Krupp Company, of Essen, Germany, who bought a group of 5 claims last year 1½ miles south of

Deer Trail. An electric plant, for power and lighting the mine has been installed, and a concentrator equipment has been shipped from Ohio. This company is said to have bonded a group of claims 15 miles north of Davenport, Lincoln county, known as the Putney Butte mines. It is reported that those claims have a deposit of molybdenite.

West Virginia

KANAWHA COUNTY

Thirteen coal properties on Cabin creek have been consolidated. The new company is known as the Cabin Creek Consolidated Coal Company. The companies merged in the new company are the Cabin Creek, Raccoon Fork, United Colliery, Shamrock, Thistle Coal, M. T. Davis Coal, Holley Coal, Quarrier Coal, Belleclare Coal, Red Warrior, Cherokee Coal, Caledonia Coal and Coke, Stevens Coal, and a new lease from the Shonk-Garrison Coal Company, of 3700 acres, as well as the river tipple of the Stevens Coal Company at the mouth of Cabin creek. The deal embraces about 20,000 acres on Cabin creek. The officers of the Consolidated company are: President, M. T. Davis; vice-president, James Kay; treasurer, W. M. Packett; secretary, S. P. Richmond; board of directors, M. T. Davis, James Kay, W. A. Ohley, Azel Ford, W. M. Puckett, E. W. Knight and Malcolm Jackson.

Canada

BRITISH COLUMBIA

An amended statement of mineral production in 1906 has been made, which will, it is believed, closely approximate the actual result. The metal production was as follows:

	Quantities.	Values.
Gold, placer, oz.....	46,000	\$920,000
Gold, lode, oz.....	250,000	5,167,500
Total gold, oz.....	296,000	\$6,087,500
Silver, oz.....	3,470,000	2,201,765
Copper, lb.....	37,692,251	8,675,100
Lead, lb.....	53,600,000	2,742,750
Zinc, tons.....	4,000	60,000
Total values.....		\$19,767,115

The non-metallic production for the year was as follows:

	Quantities.	Value.
Coal, tons.....	1,530,000	\$4,590,000
Coke, tons.....	210,000	1,060,000
Building materials, etc.....		950,000
Total values.....		\$6,590,000

This makes a total value of \$26,357,115, which is \$3,895,790 in excess of the amount reported for the previous year.

NOVA SCOTIA

Dominion Coal Company—Owing to severe weather the output for March fell 100,000 tons below the estimate. It was 203,184 tons as against 309,809 in March, 1906. The output for the first three months of the year was 681,482 tons, as against 767,131 tons in the corresponding months of last year.

ONTARIO—COBALT DISTRICT

Shipments of Cobalt ore over the Timiskaming & Northern Ontario Railway for the week ending March 30 were as follows: Coniagas, 650,070 lb.; Nipissing, 117,720; O'Brien, 145,990; Right-of-Way, 3800; Trethewey, 101,650; Cobalt-Townsite, 43,000; total, 477,230 lb. The small Right-of-Way shipment was consigned to the Anglo-French Nickel Company, of Swansea, Wales.

Cobalt Lake—A bill has been introduced into the Ontario legislature by Attorney General J. J. Foy to validate the titles of the holders of the Cobalt Lake and Kerr Lake mining properties. It was explained that the measure did not exclude the claim based upon discoveries which would be dealt with under the existing law.

Barnard's Point Gold Mining Company—A plant comprising a Rand drill, 25-h.p. boiler, hoist, etc., has been shipped to Barnard's Point, Larder Lake. John Macdonald, late of the Silver Queen, has been engaged as manager, and a gang of men will start on development work.

Beaver Mine—This property, Cobalt, has been taken over by a new company, the Beaver Consolidated Mines. The recent strike on the Timiskaming property, immediately adjoining, has encouraged active development. Two main shafts are down 45 and 50 ft., respectively.

Prince Rupert—This property of 100 acres, located near the Edison mine, Coleman township, west of the Montreal river, is to be developed. A steam drill air compressor and hoist are now on the way.

Rochester—The new steam plant, at Cobalt, comprising 5x5 hoisting engine, 25-h.p. boiler, and steam drills, is now in operation. The main shaft is down 45 ft., and will be sunk to the 100-ft. level, when drifting will be done east and west. Some fine samples of native silver have been obtained.

Temagami Reserve—English steel-makers have ordered from H. Dreany, of Toronto, a ton of molybdenite from the deposit on the Temagami Forest Reserve. It is to be used for experimental purposes.

ONTARIO—PORTAGE BAY DISTRICT

Silver Ridge Mining Company—Operations will be begun immediately, with Wilkie Evans, managing director in charge. A small plant will be put in.

ONTARIO—MOOSE MOUNTAIN

Moose Mountain Iron—The iron-ore handbook of Oglebay, Norton & Co., Cleveland, Ohio, for 1907 includes, in addition to the old range Lake Superior ores this firm has handled heretofore, Moose mountain magnetite, from the property 18 miles north of Sudbury, Ont., in which the Gates-Lambert party has a controlling interest. The ore is crushed to 1-in. size and the guarantee in iron, natural, is 54

per cent., or 55 per cent. dried at 212 deg.; the ores containing 2.60 per cent. moisture. The analysis shows 0.10 phosphorus, 13.19 silica, 0.02 manganese, 1.21 alumina, 3.60 lime, 3.15 magnesia, 0.011 sulphur and no titanium.

Mexico

GUANAJUATO

Guanajuato Consolidated—The success of this company in operating its Sirena mine, in the Guanajuato district, has practically decided that company on doubling its present plant, which has gradually grown until it now consists of 80 stamps, and is treating some 300 tons a day, together with some 35 to 50 tons daily from the Carmen mine, of a closely associated company. The Guanajuato Consolidated was the first modern company to take up the old mines in Guanajuato. From the very start success has followed, though the earnings were continually put into extensive development work and additions to its mill. The constant improvement of the orebodies with depth placed the company last year on a dividend-paying basis, in spite of its heavy expenditures on development and plant. Now it is understood that a remarkably rich strike has been made in the Sirena that bids fair to rival the historic bonanzas of the Valenciana and others in Guanajuato. This company was also the first to change over from amalgamation to cyanide in the treatment of the silver ores.

Carmen—Encouraged by the success at the Sirena mine, the principal stockholders in the company have organized the Carmen Gold Mining Company, and bought up the Carmen claim, a small property on one of the cross veins. These cross veins had before been considered rather treacherous, but development work on the Carmen has shown not only remarkable continuity but also that the principal values in these cross veins were liable to be in gold. In the last six months work along the vein to connect with the Pinguico mine, has shown ore, and a 25-stamp mill is proposed.

Republic—The latest deal by the principal owners in the Sirena and Carmen mines has been the organization of the Republic Mines Company, Limited, with a capital of \$2,000,000, of which all that is to be put on the market has been underwritten by the Exploration Company of New York. The object of the new company was to obtain and operate the Cardones and Barragana, but it has gone farther and taken up the option held by M. E. MacDonald and W. Murdock Wiley from Dwight Furness, on La Union, adjoining the Cardones. Machinery is being put in, a hoist is being installed at the Barragana, and La Union tunnel will be continued to the Cardones. Plans are being drawn up for an 100-ton stamp and cyanide mill, to be located probably at the mouth of La Union tunnel.

Metal, Mineral, Coal and Stock Markets

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

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, April 10—The coal trade in the West is quiet at present, but preparations are being made for the Lake trade. The weather so far this month has rather checked the expectations of an early opening of navigation, which were aroused by the mild days in March, and it is still uncertain when the first boats will start. The railroad situation is much improved, and it is quite possible that coal may be shipped too freely, overloading the markets.

In the East the situation is unchanged, and the trade is generally quiet. The domestic demand for anthracite has been a little better, under the influence of stormy weather. Steam coal continues in steady demand.

The Lehigh Coal and Navigation Company report shows that in 1906 the small or steam sizes of anthracite were more than half its shipments. The figures are: Pea, 14.41; buckwheat, 16.47; No. 2 buckwheat, 20.45; No. 3 buckwheat, 2.64; total small, 53.97 per cent.

COAL-TRAFFIC NOTES

Shipments of coal and coke originating on the Pennsylvania Railroad Company's lines east of Pittsburg for the year to March 30 were as follows, in short tons:

	1906.	1907.	Changes.
Anthracite.....	1,330,747	1,319,081	D. 11,666
Bituminous.....	9,332,869	9,196,623	D. 136,246
Coke.....	3,150,406	3,433,068	I. 282,662
Total.....	13,814,022	13,948,792	I. 134,770

The gain this year has been wholly in coke, coal showing a small decrease.

Shipments of Broad Top coal over the Huntingdon & Broad Top Railroad for the year to April 6 were 277,908 tons.

Coal and coke tonnage of the Chesapeake & Ohio Railway for the eight months of its fiscal year from July 1 to Feb. 28 is reported as below, in short tons:

	Coal.	Coke.	Total.
New River.....	3,547,009	136,059	3,683,068
Kanawha.....	2,367,539	60,894	2,428,433
Kentucky.....	113,470	.....	113,470
Connecting lines...	297,403	78,843	376,246
Total.....	6,325,421	275,846	6,601,267
Total, 1905-6.....	5,860,861	323,082	6,183,943

The total increase was 417,324 tons, or 7.3 per cent. Deliveries of tonnage originating on the line this year were: Points west of mines, 2,835,008 tons coal and 147,512 tons coke; points east, 1,209,055 tons of coal and 49,411 tons coke; tide-water, 1,983,955 tons coal.

Anthracite shipments in March are reported at 5,234,814 long tons, a decrease of 562,353 tons, as compared with March, 1906. For the three months ended March 31, the shipments were, in long tons:

	1906.		1907.	
	Tons.	Per Ct.	Tons.	Per Ct.
Reading.....	3,301,673	20.7	2,890,392	19.2
Lehigh Valley....	2,828,990	17.4	2,597,830	17.3
N. J. Central.....	2,061,700	13.0	1,888,592	12.5
Lackawanna.....	2,613,741	16.4	2,515,496	16.7
Del. & Hudson....	1,601,867	10.1	1,508,313	10.0
Pennsylvania....	1,385,630	8.7	1,402,590	9.3
Erie.....	1,494,920	9.4	1,595,778	10.6
N. Y., Ont. & W....	679,830	4.3	660,483	4.4
Total.....	15,968,351	100.0	15,059,474	100.0

The Lehigh Valley tonnage now includes that of the Delaware, Susquehanna & Schuylkill, or Coxe Brothers & Co., formerly reported separately. The total decrease for the three months was 908,879 tons, or 5.7 per cent. In the first quarter of 1906 unusually heavy shipments were made, in anticipation of a strike.

New York

ANTHRACITE

March 10—The hard-coal market is fairly active, although the usual April demand is not as heavy as was expected. The small steam sizes are in good demand, but the supply shows no tendency to increase. There seems to be a smaller amount produced from the washeries and there is a tendency among producers to cut down the output of small coal as much as possible. Prices are as follows: Broken, \$4.25; egg, stove and chestnut, \$4.50; buckwheat No. 1, \$2.50; pea, \$3; rice, \$1.85; barley, \$1.50, all f.o.b. New York harbor shipping points.

BITUMINOUS

The Atlantic Seaboard soft-coal trade shows some dullness, which was rather unexpected at this time. Consumers are supplying themselves with anthracite, and most of the boats are being monopolized by hard-coal shippers. Contracts for the coming season have nearly all been closed, and some first orders on new contracts are coming into the hands of the shippers. Trade in the far East is taking on a fair amount of coal, especially for those ports which have been closed until recently. Trade along the Sound is quiet, the attention being given to anthracite rather than to bituminous coal.

New York harbor trade is showing a small amount of business at \$2.70@2.75 for good grades of steam coal. All-rail trade is fairly active at prices ranging from \$1@1.25 at mine., according to

grade. Transportation from mines to tide is about up to schedule but is irregular; car supply is up to demand in most cases.

In the Coastwise market, vessels are showing a disposition to charter promptly, which indicates an expected falling off in rates. We quote current rates of freight from Philadelphia to Boston, Salem and Portland, \$1.10; to Portsmouth and Bath, \$1.15; to Lynn, Saco and Gardner, \$1.25; to the Sound, \$1. All include discharge and the loading and discharging clause.

Birmingham

April 8—Negotiations are under way again in Alabama for the purchase of large tracts of coal lands and indications point to some big deals. These negotiations are said to be for the purpose of development, and not speculation. The coal production improves as the railroad service improves. As far as can be learned there will be no decided reduction in output during the summer this year. The operators have heavy orders on hand, and mine workers will find steady employment.

Chicago

April 8—The local coal market continues to be sluggish, as regards bituminous coals, but somewhat active in April scales of anthracite. This is probably due to the fact that in every line of business consumers are becoming more prudent. The April reduction of 50c. from circular price increases the demand for standard sizes, particularly chestnut. It is noted, however, that more consumers are coming to use the smaller sizes of anthracite, on which the discounts between March and September do not apply. Something of the increase is doubtless due to the apprehension that freight rates on all-rail coal will be advanced May 1.

In the bituminous market there is a steady demand for coal in industrial lines, but prices have continued low, and many operators are trying to ease the market by suspending production. Contracts for the coming year's supply are not being made to any large extent, the consumer being apparently satisfied to trust to open market conditions. Illinois and Indiana are quoted at \$2.15@2.50 for the greater part of the lump and egg being marketed; run-of-mine is \$1.70@2.20 and screenings sell for \$1.35@1.50.

Eastern coals are quiet, the demand being fairly steady and the supply good. Smokeless is holding up fairly to circular

prices of \$3.35 for run-of-mine and \$3.65 for lump and egg.

Cleveland

April 9—The lake season opened here late Monday night, when two boats left for Milwaukee and Chicago, respectively, with an aggregate of 15,000 tons of coal. The car shortage in the Ohio territory has greatly hampered the loading of coal for this center, and in consequence few boats have yet their full cargoes. Prices on track have undergone no change, as consumers are fairly well supplied under contract, and there is little inquiry in the open market. Anthracite dealers report a continuance of the strong demand noted last week.

The coke market shows some improvement, but prices are unchanged. Connellsville receipts have been light. Foundry is quoted at \$3.50@3.60 for this year delivery; furnace, \$2.90.

J. J. Phillips, a leading coal operator in the Ohio fields, is placing on the local market \$2,000,000 of the bonds and stock of the Letcher Coke Company, recently incorporated in Kentucky.

Indianapolis

April 7—There was less demand for coal for domestic use during the month of March than for any previous March in the memory of the oldest coal dealer. This was due to the uncommonly mild weather. Local dealers begin to stack up for the coming season after April 1. This is usually deferred until April because the operators make some concession in the price for April orders, and dealers avoid taxation on coal received after April 1.

Operators in this State are feeling more encouraged than a few weeks ago. Orders are being booked more rapidly than usual and the railroads are endeavoring to move coal promptly. This is necessary during the next three months, since harvest time makes a demand on the roads to move the crops.

After the block-coal operators conferred with representatives of the railroad companies interested, they withdrew their complaint against the roads. The freight rate on block coal is 10c. a ton higher than the rate to similar points on bituminous coal, and it was to this differential that block-coal men objected. The complaint was withdrawn at the request of the railroad officials pending an investigation.

Pittsburg

April 9—Heavy shipments were made this week to lake ports for the north-western markets as the advanced rate from this district to the lakes will go into effect April 15. The new rate is 88c. on cargo and 98c. on vessel fuel coal, an increase of 5c. over last season. Accord-

ing to reports received, contracts have been made for a larger tonnage for lake shipment than last year, but prices are practically the same. There is a good supply of railroad cars and the mines are being operated fairly well. Prices remain unchanged on the basis of \$1.15@1.25 for mine-run coal at the mine.

Connellsville Coke—Prices are a trifle lower this week, sales having been made at \$2.75@2.85 for furnace, and \$3.40@3.65 for foundry coke. The prices, however, are temporary and are due to an accumulation. For last-half delivery furnace coke is reported at \$3. The *Courier* for the week ending March 30 gives the production in both regions at 404,478 tons. The shipment aggregated 15,445 cars distributed as follows: To Pittsburg, 4754 cars; to points west of Connellsville, 9736 cars; to points east of Connellsville, 905 cars.

Foreign Coal Trade

April 3—The coal production of Spain for the full year is reported by the *Revista Minera* as follows, in metric tons:

	1905.	1906.	Changes.
Coal.....	3,075,741	3,079,736	I. 3,995
Lignite.....	168,994	204,840	I. 35,846
Total mined.....	3,244,735	3,284,576	I. 39,841
Coke made.....	675,812	659,927	D. 15,885
Briquets made.....	296,501	333,086	I. 36,585

The chief producing region in Spain is the Asturias, which furnishes about 60 per cent. of the total. Of the coke reported in 1906 there was 449,927 tons made in coke ovens, chiefly at the large iron works, and 210,000 tons at gas works. Of the coal reported there was classed as anthracite 163,275 tons in 1905, and 159,519 tons in 1906; a decrease of 3756 tons.

The approximate consumption of coal, coke and briquets in Spain for the year 1906 were as follows, in metric tons:

	Coal.	Coke.	Briquets.
Production.....	3,284,576	659,927	333,086
Imports.....	2,199,091	228,101	.....
Total.....	5,483,667	888,028	333,086
Exports.....	4,398	.....	.....
Consumption.....	5,479,269	888,028	333,086
Consumption, 1905.	5,448,962	821,100	296,501

The increase in coal was 30,307 tons; coke, 62,928; briquets, 36,585; a total advance of 129,820 tons in fuel consumption.

Imports of coal and coke into the United States for the two months ended Feb. 28 are reported as follows, in tons:

	1906.	1907.	Changes.
Great Britain.....	45,774	7,954	D. 37,820
Canada.....	309,225	232,847	D. 76,378
Japan.....	4,962	17,684	I. 12,722
Australia.....	30,441	56,542	I. 26,101
Other countries.....	3,985	483	D. 3,502
Total coal.....	394,387	315,510	D. 78,877
Coke.....	29,560	32,396	I. 2,836
Total.....	423,947	347,906	D. 76,041

Some Nova Scotia coal comes to New England ports, but the bulk of the imports of coal is on the Pacific coast. The coke is chiefly from British Columbia, though a little comes from Germany.

Iron Trade Review

New York, April 10—The pig-iron buying has been better, several large concerns having come into the market for foundry iron for third-quarter delivery. Little business has been done in spot iron, as there is not much to be had.

In steel and finished products there is no special change. New business is not plentiful, but the mills are all very busy on orders. Railroad orders for structural and bridge work are held back, but this does not seem to affect those for new rails. There are a good many orders coming in for rails and other material for electric railroads.

The waiting tendency still seems to exist, but is, if anything, less pronounced than it was recently.

It is announced that the United States Steel Corporation has authorized the construction of a steel plant at Duluth to meet the requirements of that section of the country. The plant will probably cost from \$5,000,000 to \$7,000,000, and include, it is said, one blast furnace, six open-hearth furnaces, one blooming mill, one rail and shape mill, two bar mills, by-product coke ovens, coal docks and other necessary appurtenances. The corporation recently bought property at Sandwich, Ont., on the Detroit river, probably with the purpose of erecting a plant for Canadian trade.

It is announced that the Canadian Government will give bounties for four years on iron ore smelted by electricity according to the following sliding scales: On pig iron manufactured from Canadian ore by the process of electric smelting: 1909, \$2.10 per ton; 1910, \$2.10; 1911, \$1.70; 1912, \$0.90 per ton. On steel ingots manufactured by electric process direct from Canadian ore, or from pig iron smelted by electricity in Canada from Canadian ore: 1909, \$1.65; 1910, \$1.65; 1911, \$1.05; 1912, \$0.60 per ton.

Iron and Steel Exports—Exports of iron and steel, including machinery, from the United States for February, and the two months ended Feb. 28, are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1906.	1907.	Changes.
February.....	\$12,738,927	\$13,946,042	I. \$1,207,115
Two months...	25,729,363	28,273,978	I. 2,544,615

The total increase for the two months was 9.9 per cent. The leading items of export for the two months were, in long tons:

	1906.	1907.	Changes.
Pig iron.....	11,719	12,829	I. 1,110
Billets, ingots & blooms	40,726	16,518	D. 24,208
Bars.....	12,404	16,217	I. 3,813
Rails.....	55,551	47,328	D. 8,223
Sheets and plates.	12,014	19,312	I. 7,298
Structural steel.....	12,059	18,162	I. 6,103
Wire.....	23,759	24,906	I. 1,147
Nails and spikes.....	11,276	8,387	D. 2,889

The notable increases were in sheets and structural steel; while the larger decreases were in nails and in billets, ingots and blooms.

Iron and Steel Imports—Imports of iron and steel, including machinery, from the United States for February and the two months ending Feb. 28, are valued by the Bureau of Statistics as follows:

	1906.	1907.	Changes.
February.....	\$1,875,173	\$3,020,986	I. \$1,145,813
Two months.....	4,300,190	6,317,048	I. 2,016,858

The increase for the two months was 46.7 per cent. The chief items of the iron and steel imports for the two months were, in long tons:

	1906.	1907.	Changes.
Pig iron.....	40,042	98,987	I. 58,945
Scrap.....	6,026	3,551	D. 2,475
Ingots, blooms, etc.....	3,675	3,294	D. 381
Bars.....	8,179	5,752	D. 2,427
Wire-rods.....	2,915	2,812	D. 103
Tin-plates.....	5,237	5,381	I. 144

The only large proportional change was the increase in pig iron, which came chiefly from Great Britain.

Iron Ore Movement—Exports and imports of iron ore in the United States for the two months ended Feb. 28, are reported as follows, in long tons:

	1906.	1907.	Changes.
Exports.....	7,079	1,645	D. 5,432
Imports.....	182,018	188,899	I. 6,881

Most of the exports were to Canada. The imports were chiefly from Cuba and Spain.

Imports of manganese ore for the two months were 28,333 tons in 1906, and 34,431 tons in 1907; an increase of 6098 tons. These imports were from Cuba, India and Brazil.

Baltimore

April 9—Imports of spiegeleisen for the week were 1000 tons; of ferromanganese, 350 tons; of ferrosilicon, 76 tons. Imports of iron ore for the week were 11,800 tons from Cuba and 8710 tons from Spain; 20,510 tons in all. Imports of manganese ore were 580 tons from Liverpool and 5500 tons from Bombay; 6080 tons in all. There were also received 6732 tons iron pyrites from Spain.

Exports included 1453 tons steel rails and 48 tons splice-bars to Buenos Aires.

Birmingham

April 8—The Southern iron market is in a strong condition. Deliveries now are good, the railroads furnishing almost as many cars as desired, and the accumulated stocks are reduced to less than 25,000 tons. All sales now being made are for delivery during the last quarter of the year. Spot iron is out of the question, despite the fact that the quotation for this class of iron is placed at \$23@24 per ton, No. 2 foundry. Third-quarter iron is not an easy quantity either, and commands over \$20. Fourth-quarter iron is selling right along at \$19 per ton, though some iron at \$18.50 is to be found. The production is still off, with no prospects of an immediate recovery. In addition to furnaces out for repairs some of the companies are suffering from a

short supply of raw materials, especially ore.

The advance in freight rates on iron and pipe out of the Southern territory to the Ohio river, has not disturbed the market. Several furnaces in the Birmingham district had to have hasty repairs made during the past week, losing from three to six days. In cast-iron pipe conditions continue good. In steel there has been a little hesitation in the output.

Chicago

April 8—The demand for pig iron continues light, though the market holds firm. Many shipments of Southern are being brought forward at the request of consignees, and with the supply at Southern yards limited this would seem to indicate a sharp demand for iron. The truth probably is, however, that the melters are running closer and closer to the wind and preparing to place heavy contracts as soon as the market shall be definitely settled.

Supplies of Northern as well as Southern iron are limited, several local furnaces being out of blast. In consequence charcoal iron is largely in demand. A small amount of Scotch iron has been sold at about \$28.50. For quick delivery Northern No. 2 is quoted at \$26@26.50. Southern No. 2 brings about \$22.50, Birmingham, for deliveries in April, and about \$21.50 for May and June. On second-half contract business Southern brings about \$18.50, Birmingham.

Coke is easy and there is plenty of every grade. The best Connellsville sells for \$6.15@6.40, with 48-hour coke at \$5.65 per ton.

Cleveland

April 9—The mills note a stronger inquiry for wire products, nails, etc., due, presumably to the opening of the spring building season. Between 30,000 and 40,000 tons of steel bars have been sold during the week for delivery during the last half.

Pig iron remains stationary on a light demand; spot shipments are commanding steady prices, but as a number of furnaces are yet out of blast the market is rather inactive. Spot foundry iron is quoted \$23.50@24 f.o.b. Cleveland. Cleveland furnaces are sold up to the fourth quarter and ask \$22 for No. 2 foundry for late shipments. Last-half delivery is quoted: Bessemer \$21@21.50; No. 1 foundry \$22.50; No. 2, \$22; No. 3, \$21.50; No. 2 Southern \$22.60; all f.o.b. Cleveland.

Philadelphia

April 10—The keynote of the pig-iron situation this week is the appearance in the market of quite a number of small consumers, who are in the habit of buying from hand to mouth, and who, perhaps, are not well able to do otherwise; they

now want to buy small quantities of iron for delivery this side of June 30. The effect of these inquiries and the manifest necessity for buying for early delivery has stiffened the market, if it needed any strength. It is known that a number of furnaces have it in their power to make the necessary accommodation and the presumption is that the sales will be made at strong premium prices. It is evident, however, that the importers will have a finger in this pie. Prices are inclined to move upward, except for bessemer. Quotations for Middlesboro on dock are today, \$22; basic, \$25; forge, \$23.50; No. 2 X, \$25.

Steel Billets—Quotations for steel billets range from \$32 to \$33, although business has been done as low as \$31.50.

Bar—The heavy ordering that has been the rule for so long past has made consumers of bar iron feel pretty safe. The iron stores throughout all of this territory are stocking up with iron and are buying liberally.

Pipes and Tubes—The demand for merchant pipe is showing evidence of strength. The mills are in sight of an enormous amount of business.

Plates—The extraordinary activity in the steel car plants is reflected in strong prices in iron and steel plates in this territory. Premium quotations are the rule.

Structural Material—The bulk of the business now coming here is for early delivery for buildings and small bridges.

Steel Rails—Most of the business is in light rails and trolley rails. Prices for light rails are strong.

Scrap—There is no perceptible difference; dealers say that they have more inquiry for steel scrap than anything else. Those kinds which are usually bought in small quantities, such as borings and turnings, can be had at slightly reduced quotations.

Pittsburg

April 9—There is no abatement in the urgent demands for deliveries in every line of finished iron and steel products, and the mills do not seem to be catching up on orders. New business is offered, but there is no possibility of getting deliveries inside of three months, and in some lines six months. The American Sheet and Tin Plate Company will not promise black sheets for five months and for galvanized sheets will not guarantee shipment inside of six months. Despite the urgent demand for steel rails the Carnegie Steel Company has again been forced to put its Ohio works at Youngstown on sheet-bars to assist the American company to operate its sheet plants more fully. This week 95 per cent. of the sheet mills and 84 per cent. of the tin-plate mills are running. It is expected that all of the sheet mills will be operating to capacity next week, and the McKeesport

and Monongahela tin-plate plants, which were damaged by the flood, are likely to resume. The scarcity of steel in this district is more acute than ever, and the prices quoted for the past month are merely nominal, as no sales of any consequence have been made.

Pig Iron—Since April 1 sales of pig iron have exceeded 60,000 tons. The bulk of it is for delivery in the second quarter, and the furnaces may have some difficulty in filling the contracts. As expected, the Carnegie Steel Company exercised its option on 14,000 tons of bessemer iron for May delivery, but will receive 4000 tons this month in addition to the 11,000 tons bought a few weeks ago. This iron will be supplied by the Bessemer Pig Iron Association, which also sold this week 10,000 tons for June delivery at \$22, Valley furnaces; this practically puts the association out of the market for second-quarter delivery. Several sales of 1000-ton lots for early deliveries were made at \$23. One large concern renewed its annual contract, involving 12,000 tons of bessemer, deliveries of 1000 tons a month, beginning April 1, subject to the ascertained monthly average. One lot of 1000 tons of bessemer for June delivery sold at \$22.50. Sales for the third quarter were at \$21, or \$1 less than a large sale made the previous week, indicating that lower prices will prevail after July 1, unless there is a change in conditions. The sales consisted of two lots, one of 9000 tons, and the other of 1000 tons. Sales of 8000 tons of basic iron have been made during the week and include 2000 tons for second quarter at \$22, and 6,000 tons for third quarter, at \$21. Foundry iron is decidedly scarce for early delivery, and several 100-ton lots of No. 2 foundry sold at \$25.25, Valley furnace, which is near the record price. The furnaces are well sold up on foundry iron for the rest of the year. The ascertained average of bessemer pig iron for March was \$22.90, Pittsburg. This was 12c. above the February average, and 1½c. lower than the January average.

Steel—Open-hearth billets cannot be had at any price, and bessemer billets are quoted nominally at \$30. Eastern mills are offering bessemer billets in this market at \$31.50 delivered, but no transactions are known to have been made. Steel bars remain firm at 1.60c., and there will be no decline this year. Agricultural-implement makers have about given up the attempt to obtain a concession and one interest has placed a contract for 5000 tons for delivery in the third quarter at the full price. Tank plate remains firm at 1.70c.

Sheets—The mills are congested with business, and it will be several months before they will catch up on deliveries. No change in prices is likely to be made. Black sheets remain at 2.60c., and galvanized sheets at 3.75c. for No. 28 gage.

Ferro-Manganese—The market continues about the same, and for prompt delivery \$75 to \$76 is quoted.

Dusseldorf, Germany

The imports and exports of metallic ores in Germany for the 10 months, March-December, are given below, in metric tons; owing to tariff changes, the full year is not reported:

	Imports.	Exports.	Balance.
Gold ore.....	88	.....	Imp. 88
Silver ore.....	3,777	.....	Imp. 3,776
Copper ore.....	8,830	.....	Imp. 5,142
Lead ore.....	65,224	1,579	Imp. 63,645
Tin ore.....	10,613	174	Imp. 10,439
Zinc ore.....	146,030	35,784	Imp. 110,246
Nickel ore.....	21,953	.....	Imp. 21,953
Tungsten ore.....	1,615	52	Imp. 1,563
Chrome ore.....	15,667	24	Imp. 15,643
Manganese ore.....	303,180	2,002	Imp. 301,178
Iron ore.....	6,730,636	3,212,977	Imp. 3,517,659

Imports of pyrites were 512,663 tons, while exports were 29,673 tons. Imports of slag and slag products were 572,663 tons, the exports being 44,433 tons.

Metal Market

NEW YORK, April 10

Gold and Silver Exports and Imports

At all United States Ports in February and year

Metal.	Exports.	Imports.	Excess.
Gold:			
Feb. 1907..	\$1,027,058	\$ 3,275,933	Imp. \$2,248,875
" 1906..	8,486,330	2,079,683	Exp. 6,406,647
Year 1907..	3,477,130	6,546,438	Imp. 3,069,308
" 1906..	14,227,995	4,685,392	Exp. 9,542,603
Silver:			
Feb. 1907..	4,223,970	3,693,061	Exp. 530,909
" 1906..	6,435,129	4,480,449	" 1,954,680
Year 1907..	8,990,985	7,350,102	" 1,640,883
" 1906..	13,951,797	9,167,160	" 4,784,637

These statements cover the total movement of gold and silver to and from the United States. These figures are furnished by the Bureau of Statistics of the Department of Commerce and Labor.

Gold and Silver Movement, New York

For week ending Apr. 6 and years from Jan. 1.

Period.	Gold.		Silver.	
	Exports.	Imports.	Exports.	Imports.
Week.....	\$ 34,410	\$1,557,969	\$ 663,515	\$ 40,610
1907.....	1,756,336	4,607,228	9,974,974	619,356
1906.....	3,192,425	3,300,918	19,237,977	535,687
1905.....	31,939,270	4,045,826	9,697,608	892,890

Imports of gold for the week were chiefly from Great Britain; of silver from South America. Exports of gold for the week were to the West Indies; of silver chiefly to London.

The joint statement of all the banks in the New York Clearing House for the week ending April 6 shows loans \$1,062,688,800, an increase of \$6,143,600; deposits, \$1,036,713,100, an increase of \$16,895,800, as compared with the previous week. Reserve accounts show:

	1906.	1907.
Specie.....	\$171,768,000	\$206,958,000
Legal tenders.....	76,541,700	71,661,500
Total cash.....	\$248,299,700	\$278,619,500
Surplus.....	.....	\$ 9,441,225
Deficit.....	\$ 2,560,625	.....

The surplus over legal requirements

shows an increase of \$6,309,950, as compared with the previous week this year.

Specie holdings of the leading banks of the world, April 6, are reported as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York.....	.....	.....	\$206,958,000
England.....	\$171,703,565	.....	171,703,565
France.....	516,295,100	\$194,822,765	711,117,865
Germany.....	145,430,000	48,500,000	193,930,000
Spain.....	77,195,000	125,720,000	202,915,000
Netherlands.....	25,729,000	28,265,000	53,994,000
Belgium.....	16,243,335	8,121,565	24,364,900
Italy.....	161,835,000	25,237,500	187,072,500
Russia.....	592,568,000	27,685,000	620,253,000
Aust.-Hungary.....	225,445,000	61,795,000	287,240,000
Sweden.....	20,800,000	.....	20,800,000

The banks of England and Sweden report gold only. The New York banks do not separate gold and silver in their reports.

Shipments of silver from London to the East are reported by Pixley & Abell as follows, for the year to March 27:

	1905.	1906.	Changes.
India.....	£ 5,015,610	£3,860,910	D. £ 1,154,700
China.....	.....	.....	.....
Straits.....	.....	172,560	I. 172,560
Total.....	£ 5,015,610	£4,033,460	D. £ 982,150

Receipts for the week were £172,000 in bars and £14,000 in Mexican dollars from New York; £186,000 in all. Exports were £157,500 in bars and £102,500 in Mexican dollars; £260,000, all to India.

Indian exchange continues strong, and the Council bills offered in London were all taken at an average of 16.09d. per rupee. The demand for silver for India has been small.

On April 5 the United States Mint bought 200,000 oz. silver for coinage at 65.447c. per ounce, delivered at New Orleans. This is the lowest price reported on mint purchases this year.

The Treasury Department's estimate of the money in the United States on April 1, is as follows:

	In Treasury.	In Circul'n.
Gold coin (inc. bullion in Treasury).....	\$ 268,742,602	\$ 690,439,279
Gold certificates.....	42,018,390	610,173,479
Silver dollars.....	7,372,824	82,923,706
Silver certificates.....	4,710,967	466,962,033
Subsidiary silver.....	7,375,520	121,059,533
Treasury notes of 1890.....	10,259	6,271,741
U. S. notes.....	4,934,562	341,746,454
Nat. Bank notes.....	10,388,420	586,823,643
Total.....	\$345,553,544	\$2,906,399,868

Population of the United States April 1, 1907, estimated at 85,720,000; circulation per capita, \$33.91. For redemption of outstanding certificates an exact equivalent in amount of the appropriate kinds of money is held in the Treasury, and is not included in the account of money held as assets of the Government. This statement of money held in the Treasury as assets of the Government does not include deposits of public money in national bank depositaries, to the credit of the treasurer of the United States, amounting to \$154,092,962. The total amount in circulation was \$15,678,646 more than on March 1; and \$229,895,080 more than on April 1 last year.

Prices of Foreign Coins

	Bid.	Asked.
Mexican dollars.....	\$0.49½	\$0.51½
Peruvian soles and Chilean.....	0.45	0.48
Victoria sovereigns.....	4.85	4.87
Twenty francs.....	3.85	3.89
Spanish 25 pesetas.....	4.78½	4.80

SILVER AND STERLING EXCHANGE.

April.	Sterling Exchange.	Silver.		April.	Sterling Exchange.	Silver.	
		New York, Cents.	London, Pence.			New York, Cents.	London, Pence.
4	4.84½	64½	30 1/16	8	4.85½	65½	30 3/16
5	4.85	64½	30 1/16	9	4.85½	65½	30 1/16
6	4.85½	64½	30 1/16	10	4.85½	64½	30

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

Other Metals

Daily Prices of Metals in New York.

April.	Copper.			Tin.	Lead.	Spelter.	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.			Cts. per lb.	Cts. per lb.
4	25 @25½	24 @24½	95½	39½	6.00	6.75 @6.80	6.60 @6.65
5	25 @25½	24 @24½	97½	40	6.00	6.75 @6.80	6.60 @6.65
6	25 @25½	24 @24½	.....	40½	6.00	6.75 @6.75	6.55 @6.60
8	25 @25½	24 @24½	98½	40½	6.00	6.70 @6.75	6.55 @6.60
9	25 @25½	24 @24½	98½	40½	6.00	6.70 @6.75	6.55 @6.60
10	25 @25½	24 @24½	99½	40½	6.00	6.70 @6.75	6.55 @6.60

London quotations are per long ton (2240 lb.) standard copper, which is now the equivalent of the former g.m.b.'s. The New York quotations for electrolytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions as made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The lead prices are those quoted by the American Smelting and Refining Company for near-by shipments of desilverized lead in 50-ton lots, or larger. The quotation on spelter are for ordinary western brands; special brands command a premium.

Copper—Consumers are conspicuous by their absence, and the transactions of the week have been utterly insignificant. For this reason quotations are essentially nominal. The market is still overshadowed by the decline in standard and best selected at London, which has made it possible for American refiners to buy material there and sell against it here at comparatively low prices. Electrolytic copper has consequently been offered here at substantial concessions, and in the absence of buyers quotations have necessarily declined. The markets at London and New York must come more nearly to a parity before conditions will be settled, but whether London will rise to New York, or vice versa is yet uncertain. In the meanwhile the largest American interests profess the utmost confidence in the situation, and are holding out for the equivalent of 25c. for electrolytic, but are making no sales, and as remarked above others are offering at 24c. and even

have made some small sales below that figure. Casting copper also has been sold at low figures. In Lake the situation is different, there not being the low offerings reported in the other grades, which explains the disparity in the quotations. We quote at the close, 25@25½c. for Lake; 24@24½c. for electrolytic; and 22½@23½c. for casting.

The London market displays a more cheerful tone, some large interests having stepped into the breach by buying up the quantities which frightened holders were throwing over. As a result, there has been a considerable bear covering, and the market closes firm and higher at £99 10s. for both spot and three months'.

Refined and manufactured sorts we quote: English tough, £108@109; best selected, £109@110; strong sheets, £118.

Exports of copper from New York and Philadelphia for the week were 3955 long tons. Our special correspondent reports the exports from Baltimore at 878 long tons fine copper. The Baltimore shipments also included 59,764 lb. copper sulphate.

Copper Sheets—The base price of copper sheets is 32c. per pound.

Copper Wire—The base price of copper wire, No. 0000 to No. 8, is 27¼@27½c. per pound.

Tin—Although the market in Europe has shown a great deal of strength throughout the week, prices at the close advancing to £186 15s. for spot and £184 15s. for three months', domestic consumers take no interest in the market and business is still of a retail character, transactions taking place at about 40¾c.

Lead—The market is unchanged at 6c. New York.

The improvement in the London market continues under very heavy inquiry for near-by deliveries, and the close is firm at £19 17s. 6d. for Spanish and £20 for English lead.

St. Louis Lead Market—The John Wahl Commission Company reports as follows: Lead is dull and lower. The latest sales here are on a basis of 5.92½c. for Missouri brands.

Spelter—The market is rather listless and the few lots offered for sale have a depressing influence. The market closes quiet at 6.70@6.75 New York and 6.55@6.60 St. Louis.

The London market is steady and firm at £26 2s. 6d. for good ordinaries and £26 7s. 6d. for specials.

Zinc Sheets—The base price is now \$8.60 per 100 lb. (less discount of 8 per cent.) f.o.b. cars at Lasalle and Peru, in 600-lb. case for gages No. 9 to 22, both inclusive; widths from 32 to 60 in., both inclusive; the lengths from 84 to 96 in., both inclusive. The freight rate to New York is 27.5c. per 100 pounds.

Antimony—The market is lower but

continues dull and local prices are below the cost of import. Prices are: ordinaries, 21@21½c.; Hallett's 21½@22c.; Cookson's, 24½c.

Nickel—For large lots, New York or other parallel delivery, the chief producer quotes 45@50c. per lb., according to size and terms of order. For small quantities prices are 50@65c., same delivery.

Platinum—The market has fluctuated rather sharply and prices are a little uncertain. The latest quotation shows a slight gain, being \$33.50 per ounce for ordinary metal. Scrap is quoted at \$25 per ounce.

Quicksilver—Current prices in New York are \$41 per flask of 75 lb. for large quantities and \$42 for smaller orders. San Francisco orders are \$38@39 per flask, according to quantities, for domestic orders, and \$37@37.50 for export. The London price is £7 per flask, but £6 16s. 3d. is quoted by jobbers.

Aluminum—All price lists on this metal have been withdrawn. Most of the business at present is in deliveries on contract, and the metal is only to be had from second hands for early delivery. Prices are entirely nominal, at 48@50c. per lb. for No. 1 ingots, and 47@49c. for No. 2 metal.

Minor Metals—For minor metals and their alloys, wholesale prices are, f.o.b. works:

	Per Lb.
Cadmium, 99.5% f. o. b. Hamburg....	1.40@1.46
Chromium, pure (N. Y.).....	80c.
Copper, red oxide.....	50c.
Ferro-Chrome (70).....	11½c.
Ferro-Chrome (7-9% carbon, per lb. Cr.)	10½c.
Ferro-Chrome (1% C. for each 10% Cr.)	11@11½c.
Ferro-Chrome (60-64% Cr., 3-4% C.)...	12@12½c.
Ferro-Chrome (60-70% Cr., 1% C. or less)	38c.
Ferro-Molybdenum (50%).....	90c.
Ferro-Titanium (20%).....	80c.
Ferro-Tungsten (37%).....	46c.
Ferro-Vanadium (25-50%, per lb. vanadium contents).....	\$5@10.
Magnesium, pure (N. Y.).....	1.50
Manganese, pure 98@99% N. Y.....	75c.
Manganese-Copper (30@70%) N. Y..	45c.
Molybdenum (98@99%, N. Y.).....	\$1.70
Phosphorus, foreign red (f. o. b. N. Y.)	90c.
Phosphorus, American yellow (f. o. b. Niagara Falls).....	42c.
Tungsten (best) pound lots.....	1.32
Ferro-Silicon (50%) spot. Ex. ship Atlantic ports.....	\$97@100 ton.

Variations in price depend chiefly on size and conditions of orders.

It is interesting to note, says the *Journal of Commerce*, that among the explanations made by the Western Electric Company for the reduction in labor forces is that the cost of materials such as copper, zinc and lead, which are important factors in the manufacture of the company's products, have risen in price to such an extent that further expansion of business at this time has been prohibited. It is pointed out that the abnormally high price of copper metal has caused the curtailment of construction work. "Officials of the company state they do not look for a material improvement in the electrical business during the balance of the current year. There cannot be any as long as the cost of production remains so high."

Missouri Ore Market

Joplin, Mo., April 6—The highest price paid for zinc was \$53.50 per ton, on a basis of \$50 per ton of 60 per cent. zinc, the ore assaying 63.50 per cent. zinc. Other grades ranged down to \$48. The average price was \$48.86.

The highest price reported paid for lead was \$84 per ton, the price weakening at the close of the week, under a light demand, two buyers being out of the market. The average price was \$80.

Following are the shipments of zinc from the various camps of the district for the week ending April 6:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville.	3,197,360	686,650	\$107,399
Joplin.....	2,229,650	350,870	70,890
Alba-Neck City.....	1,348,030	.....	35,374
Galena-Empire.....	1,054,740	214,670	34,428
Duenweg.....	921,600	266,370	33,694
Prosperity.....	346,200	240,850	18,289
Badger.....	497,270	.....	12,929
Aurora.....	477,470	.....	8,809
Spurgeon.....	383,980	25,840	8,745
Granby.....	375,000	75,000	8,675
Oronogo.....	246,430	17,450	6,675
Zincite.....	99,060	.....	2,427
Carthage.....	61,560	.....	1,569
Carl Junction.....	63,700	.....	1,533
Baxter Springs.....	64,050	.....	1,527
Cave Springs.....	54,670	.....	1,339
Stott City.....	49,210	.....	1,156
Wentworth.....	46,350	.....	1,089
Totals.....	11,516,380	1,877,700	\$356,547

14 weeks.....167,200,280 25,827,890 \$5,054,660
 Zinc value, the week, \$281,394; 14 weeks, \$3,980,114
 Lead value, the week, 75,153; 14 weeks, 1,074,516

Average prices for ore in the district, by months, are shown in the following table:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1906.	1907.	Month.	1906.	1907.
January...	47.38	45.84	January...	75.20	83.53
February...	47.37	47.11	February...	72.83	84.58
March.....	42.68	48.66	March.....	73.73	82.75
April.....	44.63	.....	April.....	75.13	.....
May.....	40.51	.....	May.....	78.40	.....
June.....	43.83	.....	June.....	80.96	.....
July.....	43.25	.....	July.....	74.31	.....
August.....	43.56	.....	August.....	75.36	.....
September.	42.58	.....	September.	79.64	.....
October....	41.55	.....	October....	79.84	.....
November..	44.13	.....	November..	81.98	.....
December..	43.68	.....	December..	81.89	.....
Year.....	43.24	.....	Year.....	77.40	.....

Wisconsin Ore Market

Platteville, Wis., April 6—The price of zinc ore remained the same as last week, ranging from \$50 to \$51 per ton for 60 per cent. ore. Just at this particular time this is a surprise, as it was thought the price would be off a little. The local situation has not been affected by any outside conditions, as far as can be determined.

The production of the entire district continues to hold its own, showing increases at some camps. The slight difference from previous week in the reported tonnage is due almost entirely to the inability to load all the ore produced; again, at several of the mines the concentrates are allowed to accumulate for roasting. Buyers buy all the ore offered, the pro-

ducers in a majority of cases are just as anxious to sell. The highest price paid for zinc ore reported was \$52.50.

The camps of the district loaded ore for the week ending April 6, as follows:

Camps.	Zinc, ore lb.	Lead, ore lb.	Sulphur, ore lb.
Platteville.....	270,760	.....	.....
Cuba City.....	236,900	.....	.....
Linden.....	199,855	.....	.....
Benton.....	197,470	.....	.....
Highland.....	132,000	43,500	.....
Galena.....	129,400	.....	.....
Mineral Point.....	121,250	.....	.....
Livingston.....	102,000	.....	.....
Rewey.....	54,500	.....	.....
Total for week.....	1,444,135	43,500	.....
Year to April 6.....	22,936,949	1,032,500	143,160

Owing to the condition of the wires it was impossible to get the ore report from Hazel Green and Buncombe.

Chemicals

New York, April 10—Heller, Hirsch & Co., of New York, have given up the agency for the potash salts of the Kali syndicate and in the future will distribute the salts of the Sollstedt mines, Germany.

Copper Sulphate—The market is still steady and strong. There is no change in prices, and we continue to quote \$7.50 per 100 lb. for carload lots, or over; \$7.75 per 100 lb. for smaller parcels.

Nitrate of Soda—Messrs. Mortimer & Wisner, of New York, give the following statistics of nitrate for the United States, as of date April 1, in long tons:

	1906.	1907.	Changes.
Stocks, Jan. 1.....	13,100	13,050	D. 50
Imports, 3 mos.....	78,600	45,734	D. 32,866
Total.....	91,700	58,784	D. 32,916
Deliveries.....	82,900	53,909	D. 28,991
Stocks, April 1.....	8,800	4,875	D. 3,925
Afloat for U. S.....	70,000	120,000	I. 50,000

The quantities afloat include all cargoes due to arrive by July 15 next

Phosphates—Exports of phosphate rock through the port of Savannah for the month of March are reported by Wm. Lang & Co. as follows: Holland, 4384 tons; Italy, 2988; Germany, 12,709; total, 20,081 tons.

Mining Stocks

New York, April 10—The general stock markets are still uncertain. For a few days there seemed to be a stronger tendency, but this was met by large offerings of stocks, and there was a general fall, although money was easy. The buying of stocks at the low prices for investment seems to have stopped for the time, and trading is largely professional. Amalgamated Copper touched \$95½; American Smelting common, \$128½; Tennessee Copper, \$39; United States Steel, \$37½ for the common, and \$101 for the preferred.

On the curb business was rather quiet, with the chief trading in the lower-priced

stocks. The coppers generally showed a weaker tendency.

Boston

April 9—Outside of a day or two of weakness the middle of last week, mining shares show improvement, but the market has gotten into a period of dullness. The break in copper in London one day last week, followed by another sharp decline the following day, caused an unsettled feeling in stocks; but in most instances prices tonight are above those of a week back. Trinity furnished a sensation Wednesday by opening off \$7 from the previous night's closing, at \$20; it touched \$19.50 a few moments later, but recovered to \$23.25 the same day. No explanation was vouchsafed for this sharp break, and the only reason can have been the fact that T. W. Lawson, its president and main voucher, sailed for Europe last Saturday. Since then it has remained steady, closing at \$21 tonight. Two curb stocks were placed in the unlisted department of the exchange Thursday, Balaklala and Greene-Cananea. The former had an active time, and rose to \$12.50, although it was off to \$10.75 today. Greene Cananea, from an opening at \$16 on the exchange, rose to \$17.62½, reacting to below \$17 tonight.

The curb furnished a sensation in a company called the Boswyocolo Company, a security-holding Wyoming corporation, with \$1,000,000 capital, par 10c., or 10,000,000 shares. Its president, Isaac Van Horn, saw fit to let the public get the stock through curb brokers only, and delegated one to supply all the wants. The first day's trading in it, Monday, April 5, was 1,172,400 shares, all at 10c., and the second totalled 233,270 shares at the same price. Amalgamated, in this market, after touching \$90, spurted to \$99, and closed at \$96.25 tonight. There are not many in this city who believe that the rate will be increased at the regular quarterly meeting next week. Copper Range recovered from a low at \$79.25 to \$84, closing tonight \$2 below the latter. North Butte fell \$2.62½ to \$87.87½, since recovering to \$95, and closing tonight at \$91.62½. Old Dominion fell \$2.75 to \$51, and spurted to \$56.50, closing within \$2 of this. There is little likelihood of an increase in the next Quincy dividend. The Boston Consolidated is said to be earning at the rate of \$20,000 net per month on the present price of copper.

San Francisco

April 4—The San Francisco Mining Exchange was formally opened on Monday, April 1, with 126 members. It is understood that it is in active opposition to the San Francisco Stock and Exchange Board, although several are members of both organizations. It is the object of the new exchange to make itself the medium by which the speculator can safely buy

and sell and the capitalist invest his money in the mines of eastern and southern Nevada with a certainty of good results. It is the intention of the exchange, as expressed by its president, Walter Turnbull, to list only such properties as are certain producers, or have undoubted prospects. The prices of mining stocks on the market were about the same in both the exchanges.

Colorado Springs

April 6—The local mining market has been spotted this week. Prices have held steady, but the trading has been dull. The only stocks that have shown any indication of an advance are El Paso, Portland and Jennie Sample, and these advances were only fractional.

STOCK QUOTATIONS

NEW YORK Apr. 9		BOSTON Apr. 9	
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine.....	1 1/4	Adventure.....	3 3/4
Am. Nev. M. & P. Co.	3 3/4	Allouez.....	55
Amalgamated.....	96 3/4	Am. Zinc.....	39 1/2
Anaconda.....	63	Arcadian.....	7
Balaklala.....	10 1/2	Atlantic.....	20
British Col. Cop.	8 1/2	Bingham.....	25
Buffalo Cobalt.....	2 1/2	Boston Con.....	165
Butte & London.....	2	Calumet & Ariz.*	33
Butte Coalition*.....	28 1/2	Calumet & Hecla*	37
Butte Cop. & Zinc.....	5 1/2	Centennial.....	82
Cobalt Contact.....	3 1/2	Con. Mercur.....	16 1/2
Colonial Silver.....	9 1/2	Copper Range.....	17 1/2
Cum. Ely Mining.....	13 3/4	Daly-West.....	16 1/2
Davis Daly.....	13 3/4	Franklin.....	16 1/2
Dominion Cop.....	6	Greene—Can. cdfs.	20
El Rayo.....	5 1/2	Isle Royal.....	16 1/2
Foster Cobalt.....	1 1/2	La Salle.....	5 1/2
Furnace Creek.....	1 1/2	Mass.....	14 1/2
Giroux Mine.....	9	Michigan.....	81
Gold Hill.....	1 1/2	Mohawk.....	2
Granby, Nev.....	1 1/2	Mont. C. & C. (new)	14 1/2
Greene Gold.....	1 1/2	Nevada.....	91 1/2
Greene G. & S.....	1 1/2	North Butte.....	103
Greenw'r & D. Val.	4 1/2	Old Colony.....	54 1/2
Guanajuato.....	230	Old Dominion.....	113
Guggen. Exp.....	1 1/2	Osceola.....	23
Hanapah.....	1 1/2	Parrot.....	122 1/2
McKinley Dar.....	4 1/2	Phoenix.....	6 1/2
Micmac.....	1 1/2	Quincy*.....	3 1/2
Mines Co. of Am.....	3 1/2	Rhode Island.....	18 1/2
Mitchell Mining.....	11	Santa Fe.....	110
Mont. Sho. C. (New)	4 1/2	Shannon.....	21
Nev. Utah M. & S.	19 1/2	Tamarack*.....	63 1/2
Newhouse M. & S.	13 1/2	Trinity.....	10 1/2
Nipissing Mines.....	3 1/2	United Cop., com.	55 1/2
Old Hundred.....	1 1/2	U. S. Oil.....	44 1/2
Silver Queen.....	2 1/2	U. S. Smg. & Ref.	62
Stewart.....	3 1/2	U. S. Sm. & Re., pd.*	8 1/2
Tennessee Copper	3 1/2	Utah Copper.....	8 1/2
Union Copper.....	5 1/2	Victoria.....	160
Utah Apex.....	12	Washington.....	8 1/2
West Columbus.....	12	Winnona.....	160
		Wolverine.....	1 1/2
		Wyandotte.....	1 1/2

N. Y. INDUSTRIAL

Am. Agri. Chem.....	136 3/4
Am. Smelt & Ref.....	109
Am. Sm. & Ref., pf.	36 3/4
Bethlehem Steel.....	89
Colo. Fuel & Iron.....	61 1/2
Federal M. & S., pf.	13 1/2
National Lead.....	13
National Lead, pf.	86 3/4
Pittsburg Coal.....	54 1/2
Republic I. & S.....	520
Republic I. & S., pf.	145
Sloss-Sheffield.....	19 1/2
Standard Oil.....	38 1/2
Tenn. C. & I.....	100 3/4
U. S. Red. & Ref.....	29
U. S. Steel.....	76 1/2
U. S. Steel, pf.....	
Va. Car. Chem.....	
Va. I. Coal & Coke	

ST. LOUIS Apr. 6

N. of Com.	High.	Low.
Adams.....	.40	.25
Am. Nettle.....	.08	.06
Center Crk.....	2.15	1.80
Cent. C. & C.....	65.00	63.50
C. C. & C. pd.....	80.00	78.00
Cent. Oil.....	125.00	110.00
Columbia.....	5.00	4.50
Con. Coal.....	27.25	25.00
Doe Run.....	170.00	150.00
Gra. Bimet.....	.30	.20
St. Joe.....	17.00	16.00

***Ex. Div. †Ex. Rights.**

BOSTON CURB

Ahmeek.....	26 1/2
Ariz. Com.....	6
Black Mt.....	10 1/2
Cananea Cent.....	10 1/2
East Butte.....	10 1/2
Hancock Con.....	10 1/2
Republic I. & S.....	3 1/2
Raven.....	1 1/2
Shawmut.....	17
Superior.....	18 1/2
Superior & Pitts.....	2
Troy Man.....	

LONDON Apr. 10

Name of Com.	Clg.
Dolores.....	£1 11s 3d
Stramp's Ind.....	0 3 6
Cramp Bird.....	1 4 6
Esperanza.....	2 0 0
Tomboy.....	1 4 0
El Oro.....	1 7 6
Oroville.....	0 18 0
Somera.....	0 6 3
Utah Apex.....	1 6 10 1/2
Ariz. Cop., pf.....	3 15 0
Ariz. Cop., def.....	3 12 6

Cabled through Hayden, Stone & Co., N. Y.

S. FRANCISCO Apr. 3

Name of Comp.	Clg.
COMSTOCK STOCKS	
Belcher.....	.50
Best & Belcher.....	1.40
Caledonia.....	.40
Chollar.....	.13
Con. Cal. & Va.....	1.25
Crown Point.....	.34
Exchequer.....	.85
Gould & Curry.....	.32
Hale & Norcross.....	.89
Mexican.....	.97
Ophir.....	2.50
Overman.....	.18
Potosi.....	.17
Savage.....	.99
Sierra Nevada.....	.72
Union.....	.68
Utah.....	.08
Yellow Jacket.....	.90
TONOPAH STOCKS	
Golden Anchor.....	.32
McNamara.....	.46
Montana-Pitts.ex	.19
North Star.....	.35
Rescue.....	.14
GOLDFID STOCKS	
Black Ants.....	.10
Blue Bull.....	.45
Columbia Mt.....	.88
Comb. Frac.....	4.22
Conquerer.....	.19
Daisy.....	2.00
Florence.....	4.00
Frances-Mohawk.....	1.05
Goldfield Con.....	8.00
Grandma.....	.27
Great Bend.....	1.02
Red Hills.....	.32
St. Ives.....	1.52
BULLFROG STOCKS	
Amethyst.....	.45
Bonnie Claire.....	.44
Mayflower Con.....	.49
Montgomery Mt.....	.29
Original.....	.18
MANHATN STOCKS	
Gold Wedge.....	.11
Manhattan Mg.....	.14
Pine Nut.....	.20
Ruby Wonder.....	.32
Stray Dog.....	.29
Yellow Horse.....	.07

NEVADA Apr. 10

Name of Comp.	Clg.
TONOPAH STOCKS	
Tono'h Mine of N.....	19.00
Tonopah Exten.....	4.00
Montana Tonop'h	3.75
Belmont.....	4.75
Tonopah Midway.....	1.80
West End Con.....	1.42
Jim Butler.....	1.13
GOLDFID STOCKS	
Sandstorm.....	.74
Kendall.....	.44
Red Top.....	4.00
Jumbo.....	4.00
Goldfield Mining.....	1.50
Dia'ldfield B. B. C.	.40
Atlanta.....	.75
Mohawk.....	16.00
Silver Pick.....	1.24
Laguna.....	1.80
BULLFROG STOCKS	
Mont. Shoshone C.....	11.00
Tramps Con.....	1.15
Gold Bar.....	1.20
Bullfrog Mining.....	.28
Bullfrog Nat. B.....	.43
Homestake Con.....	1.20
MANHATN STOCKS	
Manhattan Con.....	.80
Manhat'n Dexter.....	.25
Jumping Jack.....	.17
Stray Dog.....	.30
Indian Camp.....	.16
COLO. SPRINGS Apr. 6	
Name of Comp.	Clg.
Acacia.....	10 1/2
Black Bell.....	5 1/2
C. C. Con.....	5 1/2
Dante.....	5 1/2
Doctor Jack Pot.....	56
Elkton.....	44 1/2
El Paso.....	65 1/2
Findlay.....	7
Gold Dollar.....	23 1/2
Gold Sovereign.....	8 1/2
Isabella.....	3 1/2
Index.....	3 1/2
Jennie Sample.....	4 1/2
Jerry Johnson.....	1.18
Mary McKinney.....	7 1/2
Pharmacist.....	90
Portland.....	16 1/2
Un. Gold Mines.....	
Vindicator.....	
Work.....	

New Dividends

Company.	Pay-able.	Rate.	Amt.
Am. Smg. & Ref., com.....	Apr. 15	\$1.75	\$875,000
Anaconda, Mont.....	Apr. 18	1.75	2,100,000
Bunker Hill & Sullivan.....	Apr. 4	1.60	180,000
Central Coal & Coke.....	Apr. 15	0.50	76,875
Central Coal & Coke, pf.....	Apr. 15	1.25	23,438
Doe Run Lead, Mo.....	Apr. 15	0.50	29,531
Esperanza, Mex.....	Apr. 22	1.32	600,600
Inter. Nickel, pf.....	May 1	1.50	131,123
Nipissing, Ont.....	Apr. 20	0.15	180,000
Nova Scotia Steel & Coal.....	Apr. 15	1.50	74,555
Penna. Salt Mfg.....	Apr. 15	3.00	180,000
Philadelphia Co.....	May 1	0.75	434,296
Portland, Colo.....	Apr. 15	0.04	120,000
Tenn. Coal, Iron & R.R.....	May 1	1.00	225,536
Tenn. C. I. & R.R., pf.....	May 1	2.00	4,960
Tonopah Co., Nev.....	Apr. 22	0.35	350,000
Tonopah-Belmont.....	Apr. 1	0.10	129,501
United Copper.....	Apr. 29	1.75	787,500
U. S. Red. & Ref., com.....	Apr. 15	0.87 1/2	656,250
U. S. Red. & Ref., pf.....	Apr. 15	0.87 1/2	656,250
U. S. Sm., Ref. & Mg.....	Apr. 15	0.87 1/2	656,250
U. S. Sm., Ref. & Mg., pf.....	Apr. 15	0.87 1/2	656,250
Utah Con.....	Apr. 15	1.50	450,000
Va.-Carolina Chem., pf.....	Apr. 15	2.00	360,000
Vindicator Con. Colo.....	Apr. 25	0.03	45,000
Vulcan Detinning, pf.....	Apr. 20	1.25	18,750

Assessments

Company.	Delinq.	Sale.	Amt.
Alpha, Nev.....	Apr. 3	Apr. 24	\$0.05
Belcher, Nev.....	Apr. 16	May 9	0.15
Caledonia, Nev.....	Apr. 10	May 1	0.10
California, Cal.....	Apr. 3	Apr. 20	0.05
Chollar, Nev.....	Apr. 22	May 16	0.10
Confidence.....	Apr. 23	May 14	0.20
Gould & Curry, Nev.....	Apr. 10	May 1	0.10
Hale & Norcross, N.....	Apr. 3	Apr. 30	0.15
Herkimer Gravel, C.....	Mar. 29	Apr. 15	0.04
Lloyd-Searchlight, N.....	Mar. 29	Apr. 18	0.01
Mexican, Nev.....	Apr. 3	Apr. 25	0.15
Naildriever, Utah.....	Mar. 30	Apr. 24	0.03
Oro Blanco, Cal.....	Feb. 25	Apr. 22	0.03
Posay Canon, Cal.....	Apr. 1	Apr. 15	0.01
St. Joe, Utah.....	Mar. 28	Apr. 16	0.02
Seg. Belcher.....	Apr. 9	Apr. 29	0.05
Yellow Jacket, Nev.....	Apr. 13	May 22	0.10

Monthly Average Prices of Metals

Month.	New York.		London.	
	1906.	1907.	1906.	1907.
January.....	65.288	68.673	30.113	31.769
February.....	66.108	68.835	30.464	31.852
March.....	64.597	67.519	29.854	31.325
April.....	64.765	66.976	29.984	30.968
May.....	65.394	65.976	30.185	30.113
June.....	65.105	65.949	30.529	30.529
July.....	67.927	67.927	31.483	31.483
August.....	69.523	69.523	32.148	32.148
September.....	70.813	70.813	32.671	32.671
October.....	69.060	69.060	32.003	32.003
November.....				
December.....				
Year.....	66.791	66.791	30.868	30.868

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

AVERAGE PRICES OF COPPER

Month.	NEW YORK.		LONDON.	
	Electrolytic	Lake.	1906.	1907.
January.....	18.310	24.404	18.419	24.825
February.....	17.869	24.869	18.116	25.236
March.....	18.361	25.065	18.641	25.541
April.....	18.375	18.688	84.793	84.793
May.....	18.475	18.724	84.867	84.867
June.....	18.442	18.719	83.994	83.994
July.....	18.190	18.585	81.167	81.167
August.....	18.380	18.706	83.864	83.864
September.....	19.033	19.328	87.831	87.831
October.....	21.203	21.722	97.269	97.269
November.....	21.833	22.398	100.270	100.270
December.....	22.885	23.350	105.226	105.226
Year.....	19.278	19.616	87.282	87.282