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New Swedish Hammer Drills

By Carl A. Bergman*

SYNOPSIS—Swedish drilling practice has shown hammer drills to be preferable. A complete new line includes a mounted model, stoper, different types of pluggers and an automatically rotating plugger for soft ground. The commonest valve is the hollow-spool type. One plugger is valveless. The automatically rotating model has a ball and hollow cylinder valve. The mounted drill has novel type of telescope feed and rotation.

During the decade past a great change in drilling practice at Swed sh mines took place. At the beginning of this period, piston drills were in general use all over the country in both mines and quarries. The first hammer drills then made their appearance on the market and now that type has been adopted everywhere with the exception of a few mines, where the old piston drills are still used for large-scale stoping requiring heavy machines. The chief advantages of the hammer drills are their small weight, low air consumption, high drilling capacity, and the opportunity offered to lay the rock dust by flushing water through the drill steel. Thorough tests between the different machine types have been made in almost every mine and a few of the results obtained may be of interest. The data on drilling a raise 16 ft. 5 in. by 11 ft. 9 in. in iron ore are as follows:

	Piston Drill	Hammer Drill
Piston diameter	2¾ in.	1⅝ in.
Weight of machine	215 lb.	60 lb.
Total depth of holes drilled	3800 ft.	2800 ft.
Number of machine-shifts	243	132
Feet drilled per machine-shift	15 ft. 7 in.	21 ft. 2½ in.
Number of machines	2	2
Number of workmen	4	2
Height of raise driven	111 ft.	83 ft.
Wages paid per foot of raising	$7.32	$4.78

Another company gives the following as the average results of some trials, drilling uppers in hard iron ore:

	Piston Drill	Hammer Drill
Diameter of piston	2¾ in.	1⅝ in.
Weight of machine	215 lb.	70 lb.
Depth of holes per machine-shift	18 ft. 11 in.	27 ft. 5 in.
Ratio net drilling time to total time	25.1	41.1
Wages per foot drilled	9.0c.	4.1c.
Cost of compressed air per foot drilled	1.4c.	1.0c.
Cost of drill steel per foot drilled	0.25c.	0.5c.
	10.65c.	5.6c.

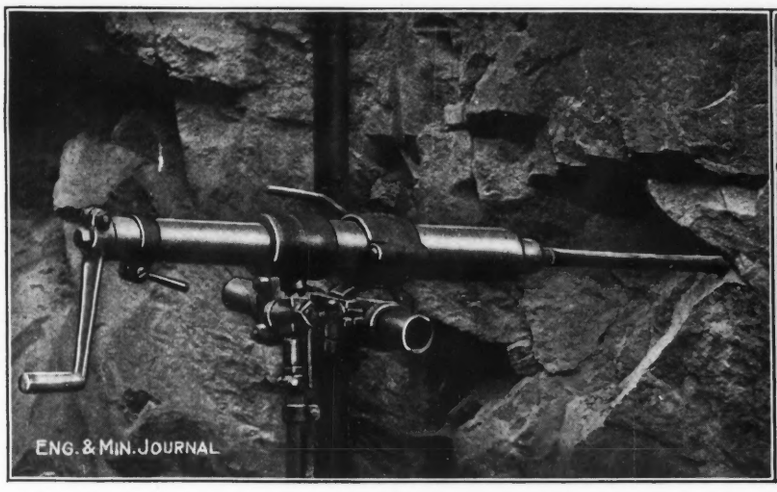


Fig. 1. Side View of Mounted Model. Note Clamp and Rotating Handle

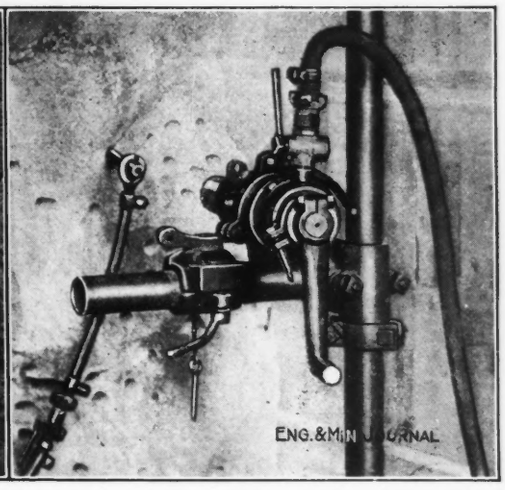


Fig. 2. Drill Swung to One Side for Extracting Steel

Another test made in 1910 gave the following result:

	Piston Drill	Hammer Drills	
Diameter of piston	2½ in.	1¼ in.	1⅝ in.
Total depth of holes drilled	9900 ft.	14,300 ft.	2100 ft.
Total depth of hole drilled per shift	19 ft. 8 in.	26 ft. 9 in.	30 ft.
Total cost per foot drilled	10.3c.	5.3c.	4.5c.
Saving made by hammer drills per foot drilled		5.0c.	5.8c.

In many of these tests the hammer drills were run by laborers used to working with piston drills, and, furthermore, the air pressure was sometimes too low to allow the hammer drills to develop their maximum power. As all

*511 St. Hypolite St., Baton Rouge, La.

trials were made some years ago, the result cannot be taken as a measure for present capacity of the hammer drills, the design of those machines having steadily improved during the last few years.

New Series of Machines

A new series of machines, the result of many years' experience and designed in accordance with the miners'

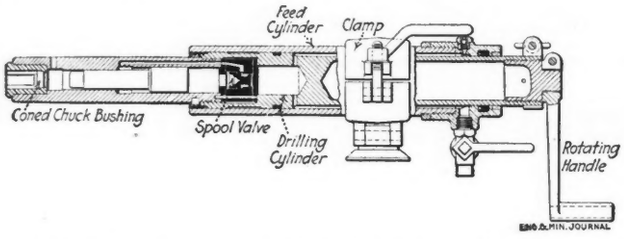


Fig. 3. Model for Bar or Column Mounting

views, was put upon the market last year and will be described here. The design of the valve mechanism is the same for all but two of these machines and may be considered by itself. The differences in the models are those of size and of detailed design to meet different working conditions.

The Valve

The valve, as shown in Fig. 3, is a spool valve, made with spools of two different diameters. Suppose the piston or hammer to be resting against the valve housing at the cylinder end and the valve moved back away from the piston. On opening the intake valve, the compressed air is admitted through an air port in the valve housing to the back of the piston, and drives it forward. The piston will soon uncover an air port, through which live air will be admitted to the small end of the valve. The valve then remains completely balanced as the sum of the areas subject to pressure on one end is equal to the area of the larger end and the air pressure the same on all. As the piston moves farther forward and uncovers the exhaust port in the cylinder wall, the pressure behind it decreases and consequently also the pressure on the larger end of the valve, so that the latter moves forward. The compressed air now passes from the chamber behind the valve through a port to the front of the cylinder and forces the piston backward. As soon as the piston on the return stroke covers the exhaust port, compression will take place between it and the valve, causing the valve to move back again and start the cycle of operations once more.

Mounted Model

Figs. 1, 2 and 3 show a mounted machine, adapted for drilling in tunnels and similar work. Compressed air is here used also for feeding the drill forward. This is effected by placing the piston cylinder inside another cylinder. The compressed air passes first into the latter cylinder and acts on the drilling cylinder as on a piston to force it and the steel forward against the rock. The machine is secured to the column in the usual manner except that the clamp is made with a hinge so that the whole machine can be swung to one side when necessary, as shown in Fig. 2, and then swung back again to perfect alignment. Rotation is obtained by means of the handle at the rear; this looks like a feed crank, but is not one. The handle is attached to the drilling cylinder and turns it and the steel. This arrangement has been found to be more satisfactory when drilling in hard rock than automatic rotation. The dimensions of this machine are: Piston diameter, 1⅝ in.; stroke, 3 in.; total length of machine, 37 in.; length of feed, 16 in.; weight, 65 pounds.

Stoper Model

On account of its short length, the machine just described is to be preferred in narrow places; where more space is available, a machine of the stoper type shown in Figs. 4 and 5 is more suitable, since it can be used for more different kinds of work. The feed cylinder is here placed behind the hammer cylinder. This machine is principally used unmounted for drilling upward. If used with a column, the clamp is fastened around the feed cylinder. For drilling deep horizontal holes this design is not wholly satisfactory; the machine with its great overhang has a tendency to rest on the steel, causing it to bend a trifle so that the hole will not be drilled exactly straight. The machine is provided with two stopcocks; by opening one, air is admitted to the feed cylinder and the drill steel pressed against the rock; drilling does not begin until the second is opened.

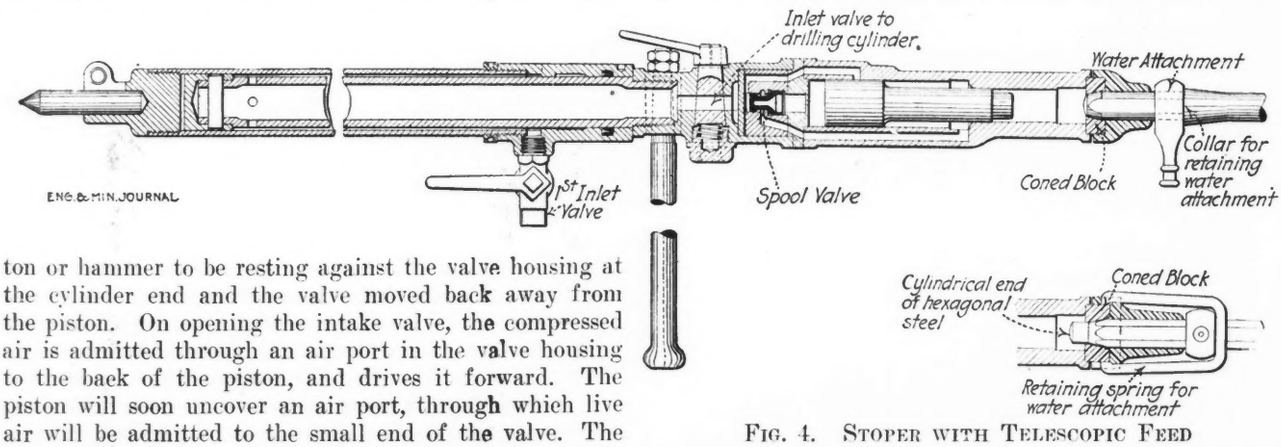


Fig. 4. Stoper with Telescopic Feed

Front Head

The bushing for the drill shank was at first made as shown in Fig. 3, being turned, hardened and then shrunk into the cylinder. At present it is usually made loose and secured to the cylinder with two side bolts and springs. To prevent the steel from entering the cylinder, the drill shank has a coned end which fits a ring with a taper bore. This ring is made of high-grade steel and hardened carefully, as it is subject to severe wear during drilling. Two different shanks are shown; one for round steel has two flats on the sides and a coned end, while that for hexagon steel is simpler, consisting simply of a coned portion and, extending from this, a short cylindrical part for the

piston to strike; the latter arrangement is cheap to manufacture.

Water Attachment

When drilling underground, the rock dust is usually removed from the hole by water under pressure, the device for this purpose being shown in Fig. 6. The hollow drill steel is closed at the shank end and a hole is drilled in from the side a few inches down. An attachment for a ⅜-in. or ½-in. water hose is slipped over the steel and makes connection between the hose and the hole in the drill steel. To prevent leakage, this attachment contains a rubber packing ring made so that the water, in passing through it, also presses it against the steel. Depending upon which kind of steel is to be used, this water attachment will be kept in place either by a shoulder on the steel or by a spring, Fig. 4. The dimensions of this machine are: Piston diameter, 2 in.; stroke, 3½ in.; total length, 50 in.; length of feed, 18 in.; weight, 75 pounds.

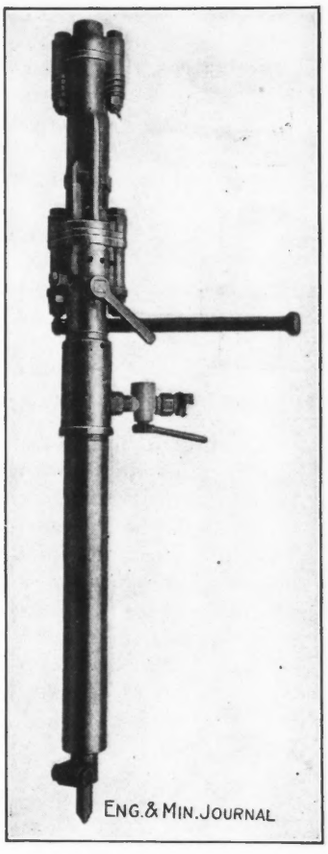


Fig. 5. The Stoper

Plugger Models

Fig. 8 shows a machine of the plugger type used for drilling above ground in quarry work and for sinking shafts. With this machine, holes 30 ft. deep and with a bottom diameter of 1¼ in. can be drilled. For cleaning the holes the compressed air is used instead of water, for which purpose the shank bushing is provided with a cup leather to prevent leaking of the air between the bushing and the shank. The exhaust air is led through the hollow drill steel to the bottom of the hole. The intake valve is a three-way cock, which in one position allows the live air to pass directly through the steel, without moving the piston. Before changing steel, air should be thus used in order thoroughly to clean the hole. If the hole is unusually deep or if the cuttings get mixed with water, this operation must be repeated more often.

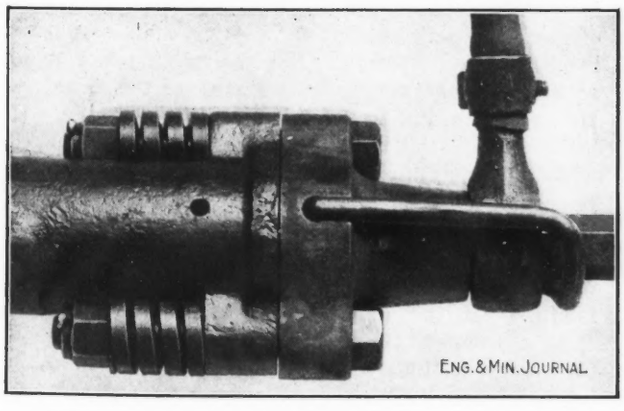


Fig. 6. Water Connection Held on with Spring

To increase its drilling capacity, and also to absorb the shock and vibration, this machine is equipped with a weight made to fit the outside of the machine, being secured with a hinge and bolt attachment. The dimensions of this larger plugger are: Piston diameter, 2 in.; length of machine, 21½ in.; stroke, 4 in.; weight of machine, net, 45 lb.; weight of counterweight, 35 lb.

These machines have all been tried with an anvil block between the hammer and the steel, but this was found not to be satisfactory. Both drilling capacity and air consumption decreased, but the drilling capacity decreased faster, the result being 20 to 25% decrease in drilling speed to 10% decrease in air consumption.

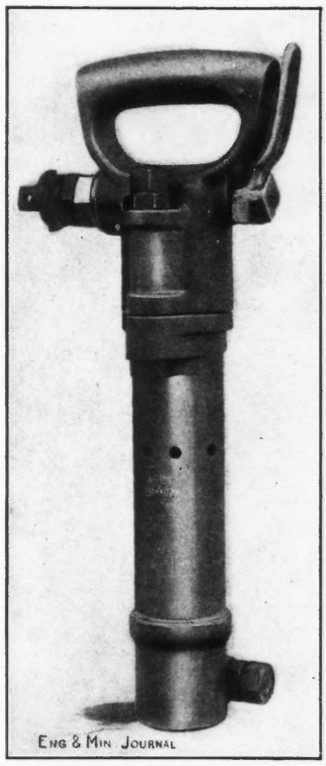


Fig. 7. Light Plugger Model

For breaking up boulders, smaller machines are used, shown in Figs. 7 and 9. The difference between these two machines is in the handles; for vertical drilling, a handle control for the intake valve, Fig. 7, has proved superior; for horizontal holes, a trigger-controlled intake valve, Fig. 9, proved more satisfactory. These machines will easily drill holes 10-12 ft. deep. Their dimensions are: Piston diameter, 1⅜ in.; stroke, 3¾ in.; total length 18 in.; weight, 26 pounds.

Valveless Model

The drill shown in Fig. 10 is different from those just described in being a valveless machine; the reciprocating movement of the hammer is controlled by the hammer itself. This is turned to several diameters like a spool valve, by means of which the opening and closing of ports and the production of differential pressures is effected. The machines are of about the same size as the one shown in Fig. 8. The two largest piston diameters are $2\frac{5}{16}$ in. and 1½ in., while the smallest is $1\frac{1}{32}$ in., the stroke being 2¾ in. The drilling capacity is also the same as for the machine of Fig. 8, the only drawback with this cheaper type of construction being that the machine will not stand wear so well as one with a valve. When the lower part of the cylinder begins to wear and becomes somewhat larger in diameter, the drilling capacity will decrease. Hence, the cylinder is made in

two parts, so that it is necessary to discard only the front part.

Automatic Rotation

All the drills described are intended for drilling in hard rock. A hammer drill, suitable for soft-rock drilling, will be seen in Fig. 11. It is a valve machine with automatic rotation. The valve consists of a short cylinder, hollow at each end, which moves between two adjustable steel balls. This arrangement has proved satisfactory, giving a positive movement of the hammer without air leakage. The automatic rotation mechanism is shown in the cross-section. It differs from that commonly seen in the United States in being all contained in the front head. Cylinder, hammers and similar parts are either drop-forged or turned out of solid steel, hardened and ground.

Except for soft rock, where Z or double-chisel bits are used, hexagon star bits are employed most extensively. The size of steel varies from 1 in. to 1¼ in. with a flushing hole of about ¼ in. The common air pressure is 6 to 7 atmospheres, 7 atmospheres being preferred as the capacity of the drills is greater at this higher pressure.

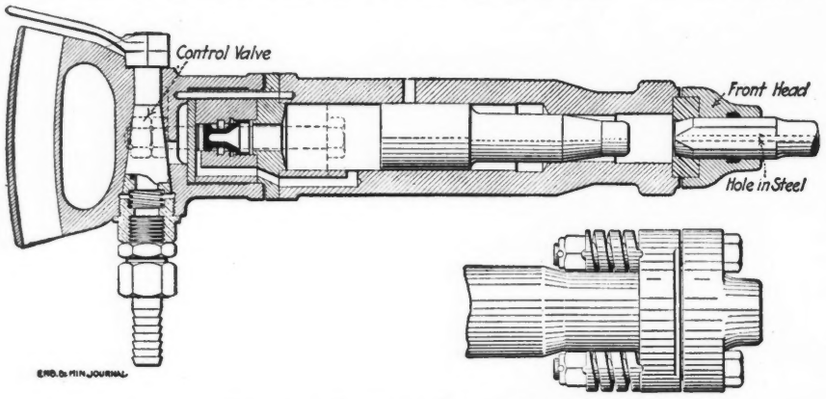


Fig. 8. Type of Heavy Plugger

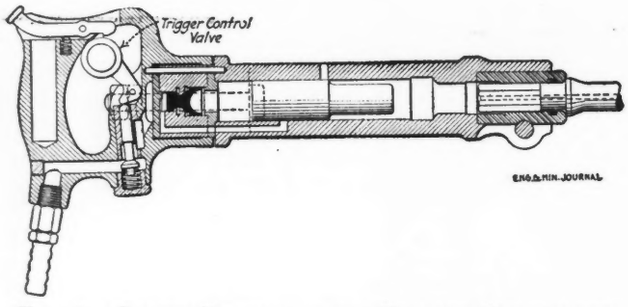


Fig. 9. Light Plugger with Trigger-Controlled Valve

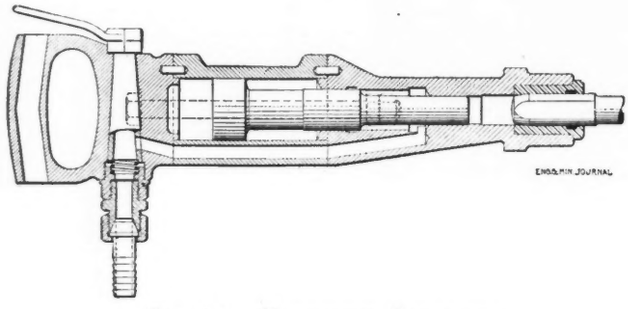


Fig. 10. Valveless Plugger

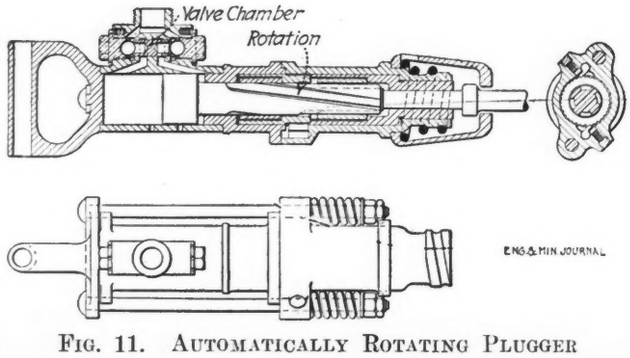


Fig. 11. Automatically Rotating Plugger

Radium in Salvador

Washington Correspondence

According to the Bureau of American Republics, information has just been obtained that in the Central American Republic of Salvador, a reasonably certain find of radium has been located. This deposit was discovered at Cerro Pelon, in one of the northern departments, Sensuntepeque, not far from its chief town. The discovery was made by an English engineer who some years ago made careful studies of the mineralogy of the district, and took home with him samples from the mines there. An assay of these samples showed a highly complex mineral, but at that time little value was placed on it. Recently this engineer made further analysis in the light of his larger experience, and the sample marked "Cerro Pelon Sensuntepeque" gave undoubted evidences of containing radium according to his report.

New Mine Experiment Stations

Washington Correspondence

As a result of the constant agitation during the past two or three sessions of Congress for the establishment of mining experiment and mine safety stations practically identical bills providing for the creation of a number of such stations have been reported to the Senate and House by the mining committees of those bodies. It is believed that a bill will be adopted before the expiration of the present Congress. Under its terms there would be 10 mining experiment stations in public-land states and 15 mining safety stations on the rescue cars designed to carry out the educational work of the Bureau of Mines with reference to mining accidents, as well as to afford facilities for the actual relief of those suffering from mine accidents. In addition the provision is made for the operation of the eight mine-rescue cars now in commission, upon a new basis.

The committee in making its report to the House says that the bill has been prepared with considerable care and that it is not based upon the plans or wishes of any one person or organization, but has been drawn up as a result of a series of conferences among the mine owners, mine operators, miners, engineers and surgeons from different parts of the country.

The Old Dominion Smelting Works

By Richard H. Vail

SYNOPSIS—This is an old plant that treats the ores of the Old Dominion and United Globe mines. Last year, a basic-lined upright converter was installed and a remarkable production has been obtained from upright shells, both in the production of copper per lining and in the daily output.

The Old Dominion smelting works at Globe, Ariz., comprises five blast furnaces and three stands of converters, two of which are for the old 84x126-in. barrel-type acid shells that are now basic lined. These were retained as insurance against any possible accident to the new 12-ft. upright converter installed last year.

Converter Work Noteworthy

This is an old plant and the most noteworthy feature is the work that is being done in the new Great Falls type converters. The first upright shell produced 14,501,962 lb. of copper last summer before the basic lining required repairs. This was, at the time, the best record that had been made in the Southwest with Great Falls type converters; the record was the more interesting from the fact that practically the entire production of this company was being made in this one shell. In July, the second upright shell was put in the stand, and produced over 24,000,000 lb. of copper up to Apr. 1, 1914, and was expected to make several million pounds more copper before patching of the lining is necessary.

This Upright Converter Had Made More Than 24,000,000 Lb. of Copper without Repairs, and Was Still Blowing in April

The smelting plant of the Old Dominion Copper Mining & Smelting Co. treats the ores both of this company and of the United Globe Mines, as well as handling some custom ore. The two companies mentioned are closely affiliated, being controlled by a holding corporation, the Old Dominion Co., of Maine. The Old Dominion property is practically surrounded by the workings of the United Globe Mines, and while the properties are separately operated, the various orebodies are practically identical in character. The properties produce both oxide and sulphide ores of varying grades, as many as from nine to 13 classifications being made in the production for a single month. The average smelting ore carries about 6% copper and the ores sent to the concentrating mill average about 4%. As mined from month to month, there is likely to be a great variation in the proportion of the different ores.

Important improvements costing approximately a half million dollars were made during 1913 in the crushing, sampling and concentrating departments, and skip hoisting has been substituted for cage hoisting at the "A" shaft, now the principal outlet for ore from these properties. The ore is taken from the skip pockets by belt conveyor to the crusher building; after reduction to 3 in. in gyratory crushers and to 1 in. in disk crushers, the ore is delivered by belt conveyor to the top of a tall sampling mill where four cuts will be made by gravity, the reject passing to concrete storage bins. A feature of the new ore-handling arrangement is the provision made for mixing the ores when they are loaded into cars for transfer to the reduction department. The ore is loaded by belt conveyor and tripper into a train of cars producing a lot of more uniform character than was formerly obtainable. The new concentrating mill, which will have a capacity of about 500 tons per day, is expected to be completed in September. Like the other two buildings, it will be constructed of concrete and steel, after the plans of H. Kenyon Burch. The old concentrator will not be dismantled, although it is expected that the new mill will be sufficient for the present mine tonnage. Tests are being made with the Minerals Separation process in one section of the new mill; while these have been fairly successful, no decision has been reached in regard to a permanent installation.

Blast-Furnace Practice

The smelting plant proper comprises five blast furnaces and three stands of converters. Three of the blast furnaces are 44x198 in. at the tuyeres, and the other two furnaces are 44x231 in. The furnace charge is exceedingly fine and a portion of it, at least, could be better smelted in a reverberatory furnace and it seems a little strange that such has not been established in view of the fact that concentrates are being shipped out of the district and more will soon be produced by the Inspiration

mine; however, a new reverberatory smelting plant is now being built by the International Smelting & Refining Co. to handle the Miami and Inspiration concentrates. Also, it is expected that improved metallurgical results will follow from the better mixing of the ores and from a contemplated extension of dust-settling facilities, so that an expensive reverberatory installation will be avoided.

The ores and concentrates are delivered to the stock bins in steel dump cars drawn by an oil-burning locomotive. Each bin is equipped with weighing hoppers, operated by one man on a platform above the charge track. The furnace charges are collected in 44-cu.ft. side-roll cars, drawn by electric locomotives. The gates from the weighing hoppers are controlled by compressed air, it being possible to operate six at one time, thus expediting the collection of charges after a train has been "spotted" under the hoppers. The coke, which amounts to 12%, is loaded on top of the ore. The charges are dumped from the cars directly into the furnaces, the feed doors being operated by hand. The furnace tops are air jacketed, as may be noted in one of the accompanying illustrations.

On account of the fineness of the charge, only 22 oz. of blast are used, each furnace receiving about 14,500 cu.ft. of air per min., and the tonnage per furnace day is limited to about 300 tons. Even by the use of the Old Dominion and United Globe concentrates on the blast-furnace charge, there is usually not enough sulphide to carry the siliceous ores of these mines and sulphide ore is shipped in from Bisbee, Ariz. The principal constituents of the Old Dominion charge are: Quartz ore, concentrate and "iron ore." The quartz ore constitutes about 70% of the charge and in a typical month averaged as follows: Cu, 8%; SiO_2, 30%; Fe, 24%; CaO, 1%; Al_2O_3, 8%; S, 4%. The concentrate averaged: Cu, 9%; SiO_2, 18%; Fe, 30%; CaO, 1%; Al_2O_3, 6%; S, 28%. The iron ore averaged: Cu, 2%; SiO_2, 17%; Fe, 43.5%; CaO, 1%; Al_2O_3, 4.5%. The sulphur on charge is in the proportion of two of sulphur to one of copper, and the sulphur elimination is 70%. An average monthly slag at this works has the following composition: Cu, 0.42%; SiO_2, 37.6%; Fe, 31%; CaO, 7%; Al_2O_3, 9.4%; MgO, 2.0%. The matte fall is about 12%, and the average grade for the month in question was 43% copper, 0.1 oz. gold and 5.5 oz. silver.

About 60 tons daily of flue dust is made and this, after briquetting in Chisholm, Boyd & White presses, is returned to the blast furnaces. Converter slag is also fed to the blast furnaces except when an acid-lined shell is used, in which case the slag is poured into the blast-furnace settlers. The tapping blocks used in the settlers at this plant consist of a plain block of copper cast around a center of magnesite bricks, the tap hole being made by cutting out a portion of two bricks, which are then placed together before the copper is poured around them. This is a modification of the Douglas practice where chrome brick is used in place of the magnesite. The tapping blocks give satisfactory service, and ordinarily do not have to be changed oftener than every two weeks. The furnace settlers are elliptical in shape and are placed at the ends of the furnaces, so that one settler may serve two furnaces in case of emergency. They are of the usual steel-bound type, lined with magnesite and firebrick.

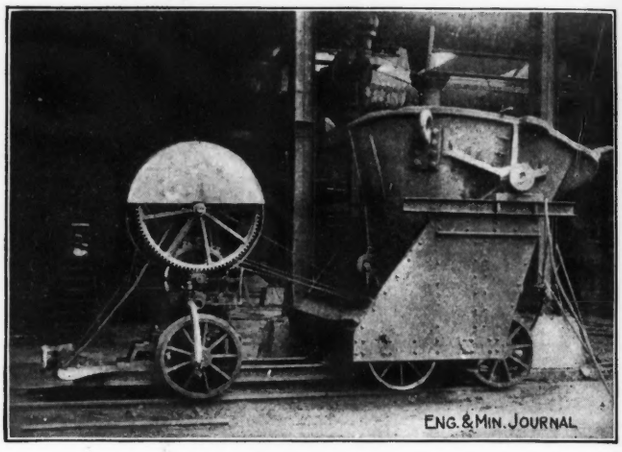
Converting on Magnetite Coating

Until last year, converting was done in three stands of acid-lined converters, 84x126 in. Two of the old stands have been retained for use in emergeney. Practically all matte is now converted at one stand where a 12-ft. upright converter, with concentric mouth, has been installed. The first shell started blowing on Jan. 6, 1913, and continued until June 29, before requiring repairs to the lining, producing during this period over 7250 tons of copper, the average grade of matte having been about 44%. It is interesting to give the production of this converter by months:

RECORD OF FIRST CAMPAIGN WITH UPRIGHT CONVERTER

Month	Grade of Matte	Air Pressure, Lb.	Average Actual Blowing Time Hr.	Min.	Blowing Time per Ton Cu Min.	Bullion per Blow Tons	Bullion Produced Tons
Jan.	44.5	12	3	28	19.5	10.68	865.7
Feb.	44.0	14	4	7	22.8	10.87	1141.4
Mar.	43.1	14.5	3	57	22	10.85	1410.4
Apr.	44.5	13.8	4	3	21	11.50	1483.9
May.	43.0	12.5	4	26	23.5	11.30	1363.1
June.	42.8	12.5	4	35	24.5	9.92	1140.8
Average.	43.9	13.3	4	03	22.5	10.8	.....

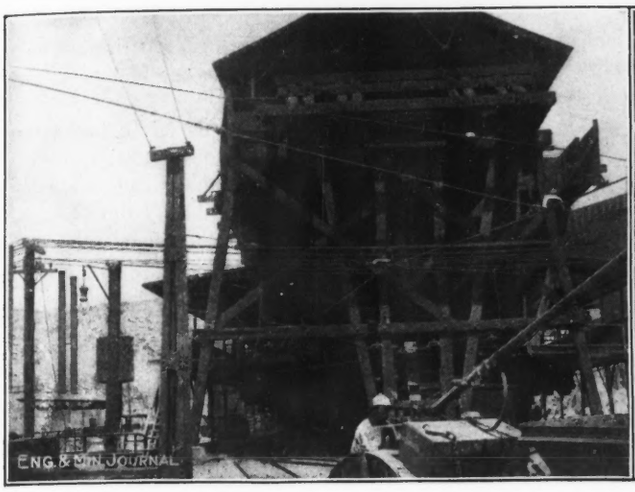
The largest daily run for this converter was the production of 66.4 tons of copper from 50% matte; for three days it averaged 60 tons of bullion from 47% matte. The wear of brick at the tuyeres was measured after two million pounds of copper had been produced and also at succeeding periods and averaged 1.65 in. per million pounds of copper; there was about 5 in. of brick left at the tuyeres when the converter was taken out. Corrosion of the brick lining was greatest, as above stated, along a belt about 22 in. above the tuyeres where the lining was only about one inch thick at the end of the campaign. The lining was also thinner at the sides than at the tuyeres.



Improvised Copper-Pouring Apparatus

As already noted, the second upright shell is making a remarkable record. Up to the first of April, 1914, it had made over 24,000,000 lb. and was still considered good for a production of several million pounds, notwithstanding the severe duty to which it has been put. The converter handles the entire matte production and has made as high as 70 tons of copper in a day. For a month it averaged 57 tons per day. During the last fortnight in March, it produced over 60 tons of copper per 24 hr. from 43% matte. This daily output is about double that reported[1] by Messrs. Wheeler & Krejci at Great Falls in shells of the same size.

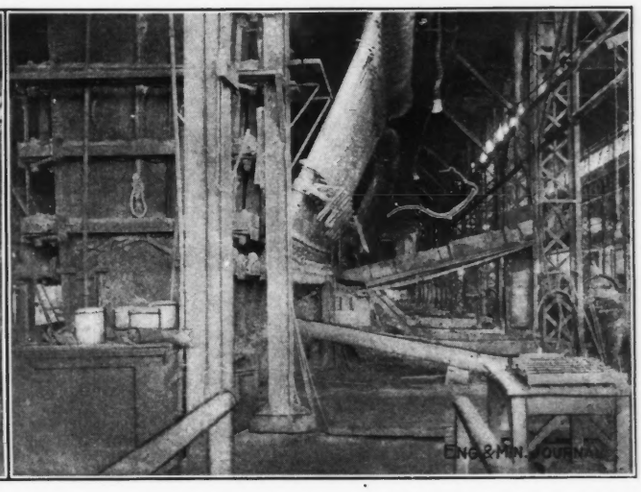
[1]Bull. 80, A. I. M. E., August, 1913.



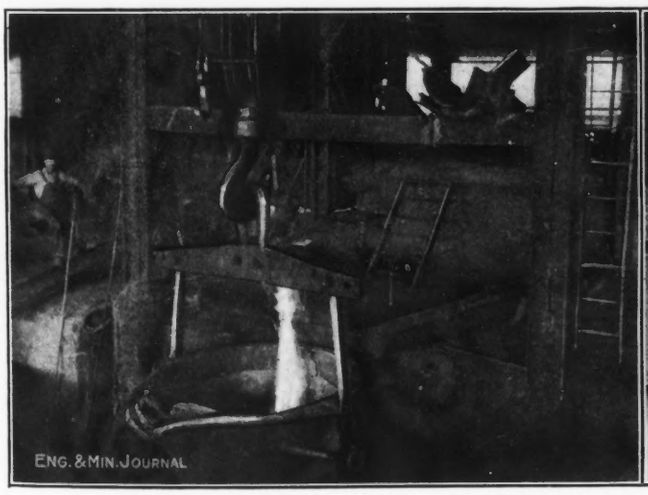
OLD DOMINION STOCK BINS

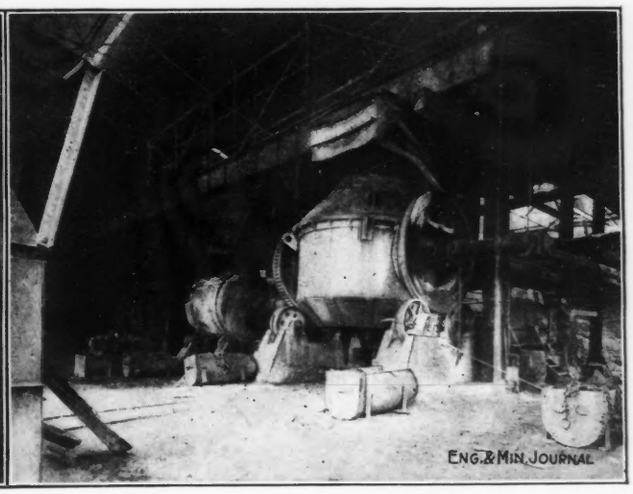
WEIGHING HOPPERS UNDER STOCK BINS

The blast-furnace charges are collected in electric-trammed trains that are spotted under the weighing hoppers so that six hoppers may be opened simultaneously by air-operated mechanism.



FEED AND TAPPING FLOORS OF THE OLD DOMINION BLAST FURNACES

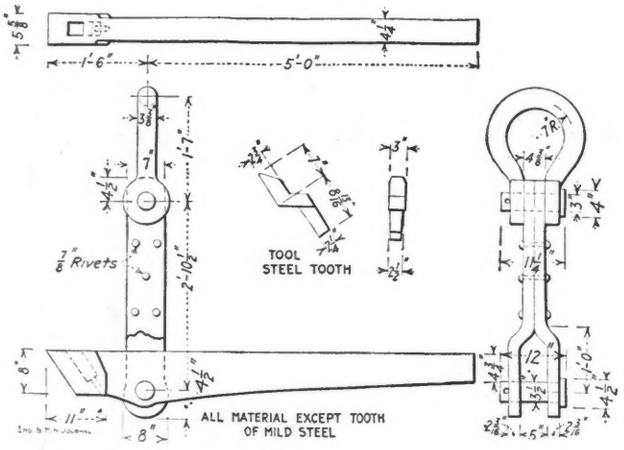




TAPPING MATTE FOR THE NEW UPRIGHT CONVERTER

In starting the upright basic-lined converters at this plant, the practice has been practically the same as at Great Falls, namely, to charge a ladle of matte and blow without silica with the express intention of producing a coating of magnetic oxide on the brick, this being assisted by tilting the converter and swashing the charge until the bricks are covered with Fe_3O_4. There is no objection to the formation of a coating as much as five or six inches thick. Bottom building has not been serious and in fact there has been no difficulty in disposing of any objectional iron sows.

The first upright converter was started with the bottom 10 in. below the tuyeres but Supt. L. O. Howard expects to make this distance 15 in. when the converter is freshly lined again. The average air pressure used in the converting department is 12.5 lb. at the converters and about 205,784 cu.ft. of air is blown into the converters per ton of blister copper produced. This is necessarily rather high on account of the fact that only one converter is blown most of the time and the



Old Dominion's Converter Collar Puller

blowing engine is in such condition that it is inadvisable to throttle the engine abruptly on turning down the converter.

The copper is cast into 320-lb. bars, and averages 99.16% copper, 0.24 oz. Au, and 13 oz. Ag. The converter slag for a typical month ran: Cu, 3%; SiO_2, 22%; Fe, 52%; Al_2O_3, 1.3%. The siliceous ore fed to converters averaged: Cu, 5%; SiO_2, 75%; Fe, 5.5%; CaO, 2%; Al_2O_3, 3 per cent.

The use of the 12-ft. basic-lined converter required a change in the method of pouring copper, as it was found that too much time was lost while the finished charge was being poured. From miscellaneous old equipment about the works, the superintendent improvised the pouring machine shown in one of the accompanying illustrations. With this machine in operation, the finished charge was immediately poured into the ladle, which was then lifted by the crane to the pouring car, and the copper poured at leisure into molds on a train of cars at the rear of the smelting building. While this rig was not ideal, it has served the purpose of taking the copper charge as soon as finished, and releasing the converter shell for a new blow. The capacity of the converter per 24 hr. was thus materially increased, and the cost of the equipment was limited to "assembling" the improvised pouring machine from old equipment that had been put on the scrap heap.

When a large basic converter was placed in operation at the Old Dominion works, it was found that the converter collar puller used on the acid shells did not work satisfactorily in pulling the larger collars from the upright converter. The new collar puller consists essentially of a heavy steel bar suspended near one end, which carries a tempered steel point, so that it will "bite" into the collar incrustation. The "tail" keeps the pointed end upward so that a good "bite" is secured, and when the crane continues to pull, the "tail" assists in lifting off the collar. With the new device, little difficulty has been experienced with converter collars, which are usually pulled after each blow. This device is also in use, with slight modifications as to dimensions, at the Copper Queen works at Douglas.

Prior to the introduction of the basic-lined converter, some interesting work was done at this plant in using flue dust with the converter lining, reducing the cost of converting to a point nearly equaling the converting cost at small basic-lined operations.

The Old Dominion operations are under the general direction of P. G. Beckett, general manager; L. O. Howard, superintendent of reduction works, and I. K. Barkdoll, mine superintendent.

Itinerary, Rescue Car No. 5

The U. S. Bureau of Mines' Mine Rescue Car No. 5 is at Washington State College. It will proceed next, according to announcement issued by H. M. Wolflin, mining engineer and mine inspector of the California Industrial Accident Commission and Bureau of Mines, to the University of Idaho to give training in mine rescue and first-aid work to mining students. The car will then proceed to the Bearcreek and Red Lodge districts, in Montana, after which it will go to Nevada.

The tentative itinerary in Nevada is as follows: Copper Flat near Ely, June 22 to 27; McGill, June 29 to July 3; joint Ely and McGill maneuvers, July 4; Virginia City, July 6 to 11; Goldfield, July 13 to 18; Tonopah, July 20 to Aug. 22.

While the car is at Tonopah, the crew will visit Manhattan, July 27 to Aug. 1; Blair, Aug. 3 to 8; Wonder, Aug. 10 to 15; Fairview, Aug. 17 to 22. It will then proceed to Reno and Sparks, Aug. 24 to 29.

On completion of the work at the University of Idaho, Mr. Boardman, first-aid miner, will proceed to California to give first-aid instruction in some of the mining camps which are remote from the railroads. Boardman will probably be sent first to the southern part of the state where he will visit the following mines: Tumco and American Girl near Yuma, Dale and vicinity, Atolia, Randsburg, Skidoo, Tropico mine and Mojave Consolidated. He will probably be sent to the Mother Lode district where he will visit the mines at Plymouth, Amador City, Sutter Creek and Jackson, after which he will visit other districts where there are mines at some distance from railroads. If there are districts in which the services of Mr. Boardman are particularly desired, applications to have him visit them should be made to the Industrial Accident Commission, Underwood Bldg., San Francisco.

Cylindrical Ore Chutes of Wood Staves

SYNOPSIS—Reasons of economy forced a change at the South Mine, Broken Hill, from ore chutes of square section to a cylindrical type with vertical staves. These are longer lived, cheaper and can often be recovered when a stope is finished. Round timber for staves preferable to sawed. Methods of preparing staves and assembling chutes described. Four types of chute evolved with varying diameters and thicknesses adapted to varying conditions. Inclined chutes receive metal reinforcement. Special protection at point where vertical chute changes to inclined. Methods of repair. Costs. Special applications.

The ore chutes formerly used in the South Mine at Broken Hill, New South Wales, were either square sets lined inside and out in the timber stopes, or squared timber cribbing in the open stopes with 2-in. spaces between adjacent pieces. These two types of chute are shown in Figs. 1 and 2 respectively. The lining boards of the square-set chutes cut out rapidly, especially where side-dumping cars caused excessive local wear, and they also came off frequently through failure of the spikes. Repair was therefore excessive and even 4-in. lining boards did not eliminate the trouble altogether. The cribs of the open stopes were made of Oregon pine with the direction of the grain at right angles to the flow of the ore; they wore so rapidly that they did not last for the life of the stopes unless built at frequent intervals. Their repair either by replacement or by relining was difficult, slow and expensive.

Adoption of Cylindrical Chutes

The fact that these defects existed and that it was necessary to provide chutes for 150-ft. stope lifts forced the adoption of a cylindrical chute, made of a stringy-bark timber set on end, in spite of prejudice against it.

In this design each section of the chute is practically a barrel, or a small tank without bottom or top, made of staves with beveled edges. The position of the grain of the timber being vertical, cutting action is a minimum. The staves are bound together with double hoops of fencing wire until the filling surrounds and holds them, and are built up in sections as required.

After experimentation, four standard types of chutes were evolved: (1) Chute of 4-ft. internal diameter, and 10-in. thickness; (2) chute of 3-ft. internal diameter and 10-in. thickness; (3) chute of 3-ft. internal diameter and 6-in. thickness; (4) chute of 3-ft. internal diameter and 5-in. thickness. The length of staves is in all cases 4 ft. This length is light and handy, even in the thickest sizes, and does not hang up when thrown down a winze into a stope; it is furthermore an aliquot part of the average height which the chute must be raised for each filling operation. While sections of this length are rather short, they have not proved unstable in practice, and in case of any distortion through a fall of ground, only a 4-ft. section has to be restored. The three thicknesses are adapted to varying conditions, 5 in. being the minimum permissible for sufficient bearing surface between sections and for resistance to collapse. The 4-ft. diameter type is particularly available for the bottom portions of chutes, as it minimizes the danger of "hanging-up."

Applications of Types

Type 1 is used up to a height of 35 ft. in open stopes for both vertical and inclined chutes. Type 2 is used in open stopes for vertical chutes for the sections from 35 ft. to 70 ft., when the stope lift is 150 ft.; it is also used in modified style for all heights above 35 ft. in inclined chutes. Type 3 is used in square-set stopes for the section from 35 to 70 ft., where the stope lift is 100 ft. and from 70 to 120 ft., where the stope lift is 150 ft. Type 4 is used for effecting repairs to old crib chutes which have failed. The fact that no type of chute is specified for the last 30 ft. of stope lift is due to the fact that this portion of the deposit is removed by underhand stoping, requiring no chutes.

The staves are made from either round or sawed stringy-bark, the latter, 10x5-in.; 10x6-in., or 10x10-in. For green sawed timber the templates shown in Fig. 3 are used, according to the cross-section. The 10x10-in. piece, when cut, is reversed and put together as in Fig. 4. If the stringy bark is seasoned on the surface, an advisable proceeding, it shrinks so that different templates have to be provided, as shown in Fig. 5. The shrinkage causes the use of an extra stave in a chute, 10 in. in thickness, but makes only a slight alteration in size in the thinner sections.

Staves of Round Timber

By the use of round timber it is possible to place the staves so that the rings of growth are parallel to the circumference of the chute and better results are obtained. In cutting the round timber at first, two cuts were made as shown in Fig. 6, and four ½-in. dowel holes were bored in each stave for a guide to the timbermen in assembling the sections. This is illustrated in Fig. 7. The dowels were bored by template and irregularities were kept outside rather than inside the completed chute.

It was found much slower to erect this chute than one of sawed timber on account of the time necessary to fit the dowels. Consequently, dowels were discontinued and the staves were bound together with fencing wire and blocks used to fill the irregularities; since in this method, however, the timbermen had no guide for placing the staves correctly, the number of saw cuts was increased to three as in Fig. 8, the outside being left round. This furnished a guide for the timbermen, but the irregular outside surface made trouble in wiring and therefore the saw cuts were finally increased to four as in Fig. 9. The templates used for the sawing are shown in Fig. 10. With round timber the rings of growth are placed in the correct position, and a smaller number of pieces goes to form a chute section, the reduction in

Note—An abstract of an article by Andrew Fairweather in the Proceedings of the Australasian Institute of Mining Engineers. No. 12, 1913.

number of staves being from 30 to 20 in a 3-ft. chute and from 38 to 24 in a 4-ft. chute.

For erecting a chute of this type the foundation is a round-log crib extending up for 13 ft. from the sill floor, Fig. 11. On this is placed a framed set of four 10x10-in. Oregon pine pieces, dovetailed, and spaced as shown in Fig. 11. On top of this again is a ring of eight "chute blocks," consisting of 4x10-in. by 2 ft. 4½-in. pieces of stringy-bark drilled for spike holes, Figs. 12 and 13. This ring is both a foundation for the chute and a guide to the timbermen.

In erecting a section of cylindrical chute, one 4-ft. stave is stood on end, its inside face flush with the inside of the chute-block ring. One timberman holds this while the other timberman sets the second piece against it and the two are locked together by driving a little timber dog at the top, as in Fig. 14, the form of the dog being shown in Fig. 15. The men then add staves, one working at each side, binding each new stave to the previous by the use of a dog. When all the rings are in place, two lengths of fencing wire are cut, each a little more than twice the outside circumference of the chute, each of these is put twice around the chute, one 12 in. from the top and one 12 in. from the bottom, a certain amount of slack being allowed. Two ¾x2-in. holes are drilled and 3-in. pieces of round scrap iron driven into them. The slack of the wires is caught up by a short drill and twisted around these ¾-in. pins. When both are fairly tight, the dogs on top of the staves are extracted, one timberman hits the staves on the outside with the back of his axe, while the other puts the final strain on the wires by twisting. With the staves closed up tight, the end loops of the wires are spiked to the wood.

The next section is erected in a similar way, and it is found that the fact that the connection between the two sections is flat, has not been a weak feature, there being no tendency to lateral movement when the chute has been finally inclosed with filling. The two sections completed appear as in Fig. 16. An 8- or 9-ft. layer of filling is distributed evenly about the chutes, some care being taken not to allow it to build higher on one side than on the other; although with 10-in. timber, this is not so necessary, since if the chute becomes tilted, it is straightened by relieving the pressure on one side, and giving it a few blows with a hammer; if seriously tilted, it is taken apart and rebuilt. When this happens the man responsible is discharged.

Protection of Chute Tops

When the filling is completed, the chute tops are normally buried about a foot deep, this protects the stave ends against heavy blasting, and distributes better the pressure from a sudden fall of ground. A further protection of the top section is shown in Fig. 17; two rectangles of sawed timber are placed around the stave tops, the bottom set flush with the top of the staves; the upper flush with the top of the filling. These were first bound together with bolts, but experience showed this to be unnecessary. The lower ring is bound by 10x2-in. timbers spiked to its top with the corner joints made in the opposite way. The upper ring is left loose. This collaring has not been found always necessary, and if timbermen are scarce, or there is a rush of work, it is omitted.

At a point in a chute 30 to 40 ft. above the sill floor in an open stope, a change is made from a 4-ft. to a 3-ft. diameter. This change is effected similarly to the method in which the chute was started on the bottom cribbing; a framed set is used, 3 ft. square in size, and on this, a ring of eight chute blocks is placed, with the inside approximating a 3-ft. circle as shown in Fig. 18. The first 3-ft. section is erected on this.

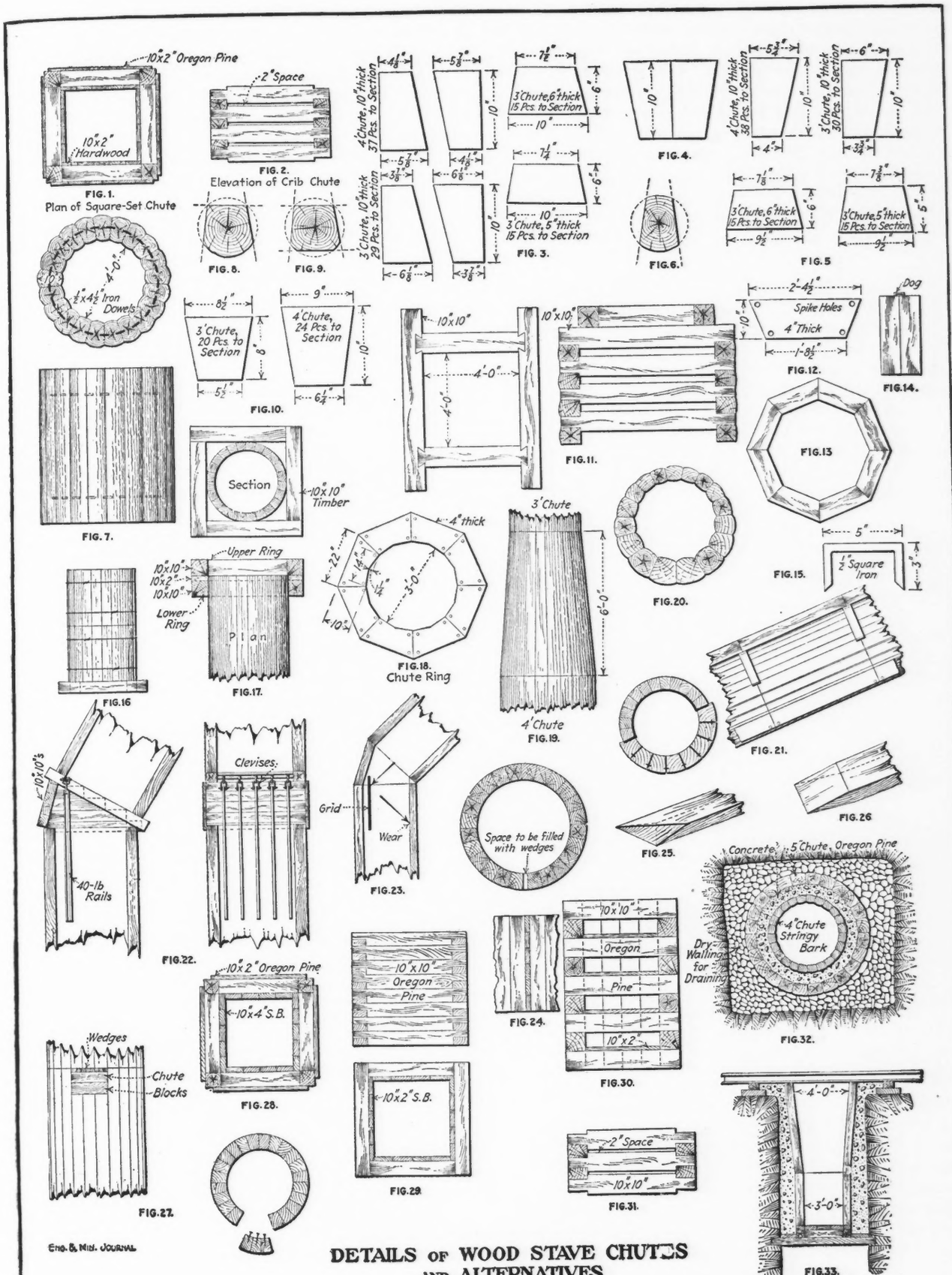
Another method of making this connection is that shown in Fig. 19, by means of a tapered section 6 ft. long, the ends of the staves being cut to different lengths. It proved inconvenient to keep in stock the pieces for this, and it was abandoned.

Inclined Chutes

It was attempted at first to make all the chutes vertical, but this was found impracticable, economy and convenience requiring that they be inclined, if possible, parallel to the dip of the walls. This introduced new problems. It was first suggested to use round staves of varying diameters as shown in Fig. 20, and this method has been used and will be extended when certain alterations have been made in timber cutting and supply. At present, however, the difficulty is overcome by inserting ¼-in. plates of mild steel, 9 in. deep between 10-in. staves on the lower half of each section, and holding them in position by two ⅝-in. dowels, near their lower edges as shown in Fig. 21. The ore cuts troughs about an inch deep between the adjacent plates, and thereafter the edges of the plates take the wear and protect the timber. No attempt is made to alter the size of the stave to allow room for the plate and the increase in diameter is found not to be an inconvenience. The upper half of each section is made of 6-in. staves without the steel insert, but with steel arch-supports at each joint, shown in Fig. 21, the arch-bars being of ⅝x4-in. iron bent to an 18-in. radius or a little less, and provided with 6-in. lugs at their bottom, ¾x4x6-in. recesses cut in the top staves of the lower half receive the bottom lugs of the arch bars. The bars act both as a guide and support during construction and as a reinforcement against failure from heavy falls of ore after erection. In some cases, the top section is made of 10-in. timber like the bottom. This plate and arch construction is that previously referred to as Type 2, modified.

The change from vertical to inclined chutes is made with a single angle instead of a gradual sweep, since this can recieve extra protection against the excessive wear which the change in direction causes. Fig. 22 shows how the inclined chute is given its correct inclination by resting on an ordinary framed set, 3 ft. square inside, blocked up on one side with 10x10-in. timber. The side openings are closed with 2x10-in. lagging spiked to the blocking and the framed set. Across the high side of the framed set, parallel with the 10x10-in. blocking, is a piece of 40-lb. rail, 3 ft. 10 in. long, in recesses 5 in. deep in the framed set. Through five holes in this rail, are hung double clevises of ⅞-in. iron supporting 7-ft. lengths of 40-lb. rails. These rails take the wear of the falling ore and being hung loose are found more satisfactory than the fixed grid first tried, which shot the ore to the opposite side of the vertical chute as shown in Fig. 23, and caused excessive wear.

The vertical cylindrical chutes have as yet given no trouble by necessitating repairs. They provide a ready



DETAILS OF WOOD STAVE CHUTES AND ALTERNATIVES

method of repairing old rectangular chutes. In this operation, the old chutes are cut out some distance below the worn section, so as to make a seating for a 3-ft. square framed set on which segmental chute blocks are placed to form a base for a 3-ft. cylindrical chute of 5-in. staves. As each section of this is stood in place, its top is covered and tailings are run in around it and rammed tightly into place. When the worn sections are passed, a framed set of 10x10-in. stringy-bark is placed over the top of the staves as a protection, let into the timber of the old set and securely blocked. This work costs $3.75 per linear foot for material and at $1.50 for labor.

Repairing Inclined Chutes

The inclined cylindrical chutes sometimes need repair. The method of effecting this first adopted, was to replace all staves full size except one which was cut slightly smaller than was necessary to fill the space and had one side squared, not beveled. This long, narrow opening was then filled with "plug" wedges of 2x10-in. timber of a length equal to the thickness of the chute timber, as shown in Fig. 24. The method of cutting the plug wedge is shown in Fig. 25 as distinguished from the ordinary wedge of Fig. 26. Its advantage is that it twists tight when driven home.

This method of repair has been changed to that shown in Fig. 27. Suppose that three staves need replacing, the old pieces are removed, the filling behind them worked away for about 6 in. and three new staves stood in this place, as shown. These are cut 10 in. short and into each two spikes are driven. By means of these spikes, the staves are pulled into position, and are tightened by beating with a hammer through the 10-in. opening left at the top. The space behind is then filled with tailings rammed in place. The 10-in. opening is filled with two chute blocks, their inside curves approximating the diameter of the chute, cut to fit the width of the three staves; the top 2 in. is closed with plug wedges. These blocks require solid backing and if tailings cannot be put in, timber blocking is provided. If the whole section has failed, a complete set of staves is stood up, except two which are made short, inserted and plugged as described. It is possible to make the closing with even one short stave. When a number of sections have failed, work begins on the lowest; the sections are replaced just as new sections are stood in the first place, except that the last stave of each section has to be dropped in from the top; the top section is then repaired as just described.

In square-set stopes, the chutes are erected as in open stopes, there being no blocking against the set frame, no outside lining to the set.

Costs

In computing costs for the various types of cylindrical chutes used, allowance has been made for bars, plates, fencing wire, spikes and nails, and timber has been calculated at the ruling price. The costs per linear foot are as follows: 4-ft. chute of 10-in. timber, $9.35 for material, $0.75 for labor; 3-ft. chute of 10-in. timber, $7.35 for material, $0.75 for labor; 3-ft. chute of 6-in. timber, $4.40 for material, and $0.35 for labor; 3-ft. chute of 5-in. timber, $3.70 for material, $0.35 for labor; 3-ft. incline chute of 10-in. timber, $8.60 for material, $1 for labor, old square-set chute lined with 4x10-in. stringy-bark inside and 2x10-in. Oregon pine outside, $8 for material, and $1 for labor; solid cribbing of 10-in. Oregon pine, $11.80 for material, $0.20 for labor; open cribbing 10x10-in. Oregon pine with 2x10-in. spreaders and 2x10-in. stringy-bark lining, $10 for material, $1 for labor; cribbing with 2-in. spacing, of 10x10-in. Oregon pine, $9.50 for material, $0.20 for labor. The square-set type is shown in Fig. 28; the closed cribbing in Fig. 29; the open cribbing in Fig. 30 and the spaced cribbing in Fig. 31.

For a stoping lift of 100 ft., the chutes consist of 35 ft. of 4-ft. section with 10-in. timber and 35 ft. of 3-ft. section with 6-in. timber, the average cost per foot being about $7.50. This figure is much lower than for any of the rectangular designs, in addition to the fact that its life is much longer.

A further advantage is the fact that the cylindrical chute can be easily and rapidly withdrawn when a stope is finished. This has been frequently done, although usually, a chute has to be abandoned. When an inspection shows the desirability of removing it, the work is done by contract. In one instance, 70 ft. of a 10-in. chute was removed and the hole filled for $75. The timber was valued at 75% of its new price or about $425. Removal is an easy matter, there being no nails or spikes to extract, and only a strand or two of wire to cut. The operation consists of cutting out the bottom section and filling up its height, removing the second section, filling that up and so on to the top. In cases where a chute cannot perform its task, its timber warrants recovering and a profit always results. This fact further lowers the cost of the cylindrical chute in comparison with the rectangular. A probable future reduction in the cost of round timber will result in a further 35% cut in cost.

Miscellaneous Uses

Cylindrical chutes have also been found serviceable for lining winzes and for filling-chutes. Certain specific instances will illustrate this. On one occasion a waste chute was hung up, due to a large rock having fallen into it. The ground for 100 ft. in depth from the chute collar was broken and liable to further movement. The rock was blasted away, the sides of the chute well barred down, a strong set of bearers and a framed set were put across the chute in solid ground under the broken portion and a 4-ft. cylindrical chute of 10-in. material was reared in the rock chute and filled around with tailings. Thereafter the tailings filling was run through the chute and no trouble was had. The opening in the rock was at least 12x12 ft. in section, and there was no chance for bearers in the unreliable side.

In another instance a waste-chute in wet ground would have proved unserviceable, unless the water was excluded. The wet section was therefore lined with concrete, backed with a dry wall for drainage purposes, and two wooden chutes used as forms and permanent retainers for the concrete, the inner chute being also a replaceable wearing surface as shown in Fig. 32.

In a third case, Fig. 33, the chute has been used to make a winze watertight so that waste filling in the stopes can be more easily handled. Bearers and a framed set are placed in the winze about 10 ft. below the level and a cylindrical chute of 4-in. timber is raised as high as the outside of the rails on the level. The opening between the bottom bearers and the outside of the framed set is

carefully covered and the space between the chute and the ground is filled with concrete. Water is thus diverted into drains on the level instead of running into the winze. The chute in this case usually consists of two sections, the lower one of 32-ft. inside diameter, and the upper one of an inverted tapering type similar to that described as used at first for reducing the section from 4 ft. to 3 ft. for the ordinary ore chute. This larger mouth at the top gives plenty of room for dumping the cars.

A Giant Steam Shovel

In the Kansas coal fields, where the overburden above the flat beds is relatively thin, steam shovels have been developed to a size far beyond anything heretofore known. Some information on these machines furnished by the Marion company is published in *Engineering News,* Apr. 1, 1914, from which the following description is obtained:

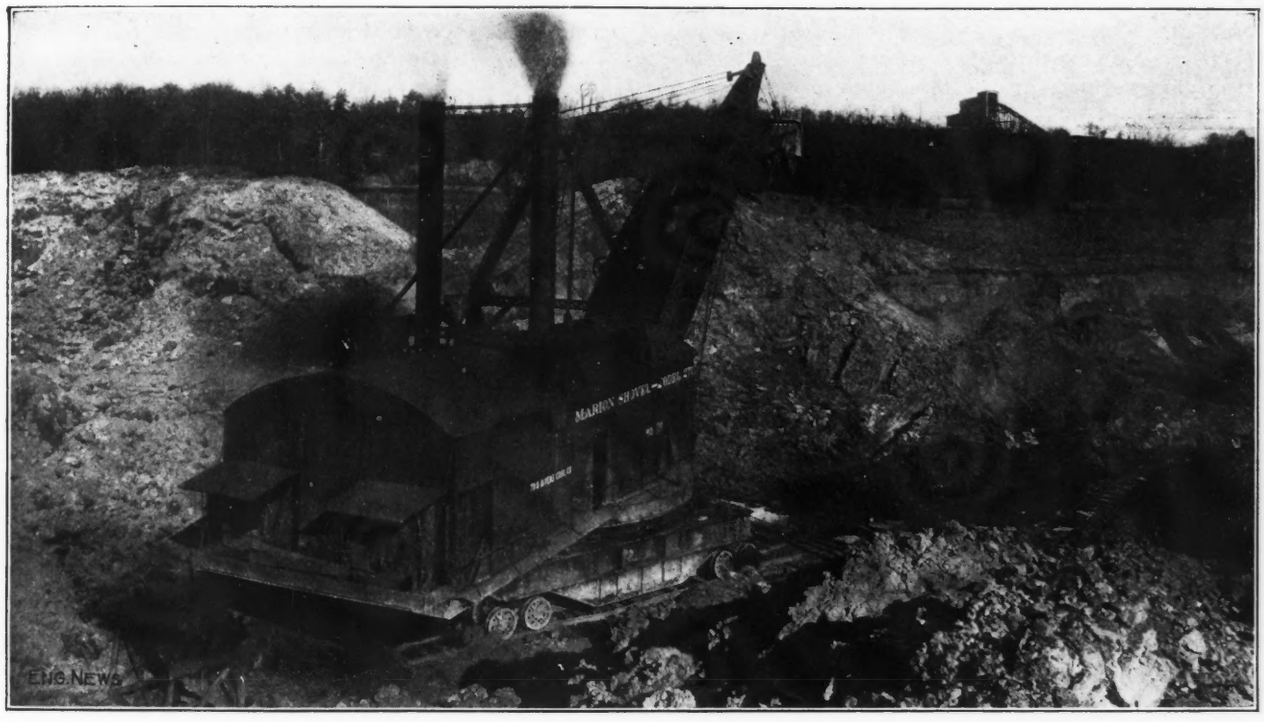
The shovels are of the revolving type; the largest weighs 270 tons and can handle an 8-yd. bucket on an 80-ft. boom or a 5-yd. bucket on a 90-ft. boom. In the system of working followed, the large shovel strips off the overburden in a wide cut and a smaller revolving shovel on traction wheels follows and removes the coal. This leaves a clear space in which the overburden from the next cut is discharged.

One of the 270-ton machines makes a cut 24 ft. wide in overburden 20 to 30 ft. deep, the material comprising 10 ft. of a soft shale and 10 ft. of sand and loam. The length of cut is about ¼ mile. Another machine of the same type makes a cut 80 to 106 ft. wide, working in side-hill ground where the depth of overburden is from nothing to 24 ft.

The builders have figures which show that some operators are moving the overburden at costs as low as 2.3 to 2.6c. per cu.yd.

The lower or fixed frame is 30 ft. square, built up of four 56-in. plate-girders and 30-in. diagonal corner beams, with eight 24-in. radial beams riveted to a central steel casting which carries the turntable-pivot pin. Upon this lower frame is the lower roller path of the turntable. The upper or revolving frame is 21x50 ft., with the engine and hoist mounted over the pivot pin and the boiler mounted on the rear end to act as a counterweight. This frame is built of I-beams and channels, and to its under side is attached the upper roller path of the turntable. The roller paths are 30 ft. in diameter and have between them a live ring of 60 high-carbon cast-steel rollers 11½ in. in diameter.

The lower frame is carried on four tracks, each having four double-flanged 30-in. wheels. The machine travels on two tracks of 39-in. gage, spaced 26 ft. center to center. The axles of all the trucks are utilized for propulsion. The shafts have telescopic and universal joints, so that the machine can travel on curves and irregular tracks. A hydraulic equalizing or leveling device provided for the rear trucks gives the flexibility of a three-point support.



270-Ton Revolving Steam Shovel with 8-Yd. Dipper for Stripping Work

The hoisting drum is 38 in. in diameter and of such a length that only a single wrap of the cable is required to raise the dipper to its highest position. It is driven by two 14x16-in. cylinders. The boom-hoisting drum is 15 in. in diameter. The rotating engine has two cylinders 10x11 in. There are two boilers of locomotive type, 6 ft. diameter and 19 ft. long.

The steel boom is of box-lattice construction. The crowding engine is of similar design to the rotating engine, but has cylinders 9½x9 in. The 48-ft. dipper handle is composed of two oak timbers with steel plates on the sides and heavy steel bars on the top and bottom. The 1¼-in. steel hoisting cable passes over a sheave on the bottom dipper bail and a double sheave at the boom end.

Stephenson-Bennett Hill, New Mexico

SILVER CITY CORRESPONDENCE

Stephenson-Bennett Hill is on the western side of the Organ Mountains, 12 miles northeast of Las Cruces, N. M., and 43 miles north of El Paso, Tex., where the ore is smelted. Carboniferous limestone, porphyry dikes, silicified limestone, quartzite and shale outcrops are visible at six places from foot to the crest of the hill. The formation is said to resemble that of the Park City, Utah, mining district. The main Organ Mountain range lying to the east is granite.

The history of Stephenson-Bennett Hill dates back to 1849 when the croppings were worked for galena and have been worked spasmodically ever since for lead and silver, copper being a comparatively recent discovery. One of the finest specimens of wulfenite in the world was taken from the upper workings of the Bennett vein and is now exhibited at Smithsonian Institution. On account of lack of milling facilities, wulfenite has never been an important product, but the plans of present operators are to save it.

Some development work has been done. The Stephenson mine has been opened to a depth of 300 ft., the lead and silver ore averaging 10 ft. in width. It is estimated that the surface ore shipped from this mine brought $250,000. The Henderson mine lies below and west of the Stephenson and is a well defined vein in limestone. A 50-ft. shaft and a tunnel from which several carloads of lead-silver ore have been shipped, comprise the development work. One carload of ore from this tunnel netted $42 per ton. The Page vein, on the southwest side of Stephenson-Bennett Hill between limestone and porphyry, has been opened by a raise from the mill level, a distance of 500 ft. The Bennett mine is opened to the 400-ft. level. The vein can be traced for 1000 ft. and has proved to be a true fissure, opened to a depth of 900 ft. below the apex. On the 400-ft. level, it is from 5 to 30 ft. wide and is opened for 600 ft. in length with ore in each end of the drifts. This vein has produced ore worth approximately $1,000,000. A shoot of high-grade copper ore was discovered on the 400-ft. level; it contained 40% copper and 30 oz. silver.

The property is equipped with a 250-ton concentrator, air compressor and air drills, three hoists and pumps. The total cost of development work and improvements on the hill is estimated at $213,920. Lessees are now working the upper levels and the owners will sink the 3-compartment shaft 400 ft. deeper and develop the lower levels. The property has been in litigation for some time but a clear title is now held by the Organ Mountain Mining Company.

Transportation costs were recently reduced enough to warrant the shipment of low-grade ore and extensive work is to begin. Auto trucks will haul the ore to the Santa Fé R.R. station at Las Cruces for $1 per ton and the freight rate to the El Paso smelting works from Las Cruces is also $1 per ton. The former total transportation cost to the smelter was $4 per ton.

Plans for future development and improvements on the property comprise sinking a 3-compartment shaft from 400- to 800-ft. depth, and crosscutting from the 800-ft. level of the Bennett vein to cut the Page, Henderson and Stephenson veins at a depth of 1200 ft., thereby opening up a series of oreshoots, and the installation of machinery for the separation of the wulfenite from the lead and silver.

STEPHENSON-BENNETT HILL, IN THE ORGAN MOUNTAINS, NEW MEXICO

Chronology of Mining for May, 1914

May 1—First shipment of copper from Hidden Creek smelting works, of Granby Consolidated company.

May 2—All ore docks in Lake Superior iron country open.

May 4—U. S. Circuit Court of Appeals in San Francisco rendered decision holding Mineral Separation Co.'s froth-flotation patent invalid.

May 14—Oil struck at Calgary, Alta.

May 21—Court of mediation in Mexican political situation convened at Niagara Falls, Canada.

May 23—Fire in Pocahontas mine, Joplin, Mo.

May 26—Stockholders of Anaconda Copper Mining Co. having voted on May 20 to purchase and take over the International Smelting & Refining Co.; certificate of surrender of charter of International company was filed in New Jersey.

May 28-31—Celebration of the 50th anniversary of the founding of the School of Mines of Columbia University.

Employer's Responsibility for Accident

The rule of law, which requires an employer to use a reasonable degree of care to provide a reasonably safe place of work for his employees, does not extend to mine work, in which employees are engaged in making places safe for other employees, according to the decision of the Michigan Supreme Court, in the case of Andrews vs. Tamarack Mining Co., 146 Northwestern Reporter 394.

Details of Practical Mining

Built-Up Wooden Pulleys

A. Livingstone Oke*

Circumstances often arise in mines remote from centers of supplies when the making of a wooden pulley for some particular work becomes necessary. The drawing illustrates the construction of a 16-in. pulley with a 4-in. face. It is built by cutting out segments of a circle from planking which, in the case illustrated, is ½ in. in thickness. It is usual to cut these segments either one-sixth or one-eighth of the total circle; when planking of sufficient width is available, the former division is the more convenient, as it permits of the complete use of the lumber as shown by the diagram *A*. It will be seen that

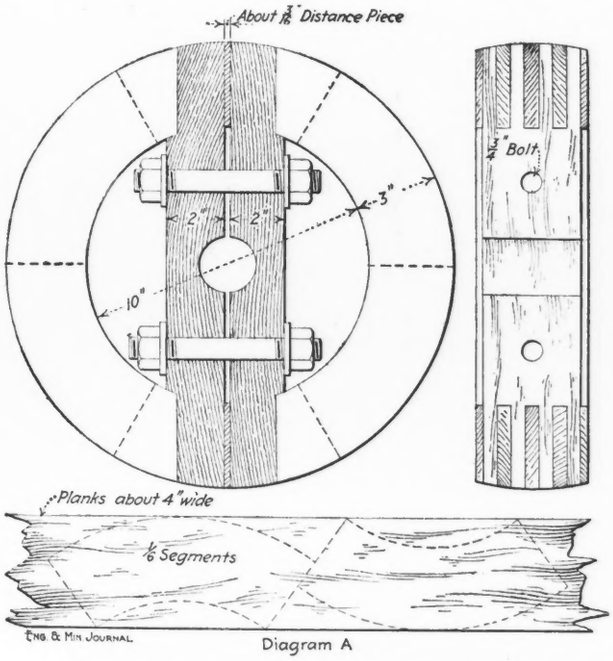


Diagram A

Construction of Small Wooden Pulley

there are eight sections to make the width of face required, and the joints of each section are staggered around, breaking either by half lengths alternately, or by thirds of lengths in threes, or in some other suitable order. The planking should be planed to as even a thickness as possible before cutting out, and only seasoned timber should be employed. The sections should be first glued together and then also nailed by nails of a sufficient length to go through three or more sections and allow for clinching as well. The sectional drawings show the method of fixing in the two pieces of wood forming the spokes and hub. A distance-piece of $\frac{3}{16}$ in. should be placed as shown between the two halves of the pulley, previous to placing on the shaft and then the whole bolted on tight and turned up true to the right diameter and crown.

*Mining engineer, Penzance, Corwall, Eng.

Concrete Bulkheads For Pillar Extraction

The soft-ground mines of the Joplin district are worked by a system which involves leaving a large portion of the ore in the form of pillars to be extracted later. The profitable extraction of the pillars is a serious problem. Temple Chapman, one of the most progressive operators in the district, is developing a new method for conducting this operation, which involves the construction of concrete bulkheads through bore holes from the surface. For the following account of the project we are indebted chiefly to an article by Mr. Chapman in the *Joplin Daily Globe*.

From a soft-ground mine where the ore remaining in pillars was believed to be equal in value to that already taken out, the profit on the half of the orebody first mined was $200,000, while on the second half of the ore, that which was left in pillars, it was only about $20,000. The reason for the poor profit from the pillars was due to several circumstances: The caving of the ground mixed together pay ore and waste rock; heavy and costly timbering was made necessary in mining the pillars because of the weight and pressure of the caved ground; much rich ore was lost in the caved mass of ore, soapstone, rock and mud. Big pens of oak logs, built at heavy cost, were crushed flat and mashed like matches by the enormous weight of the ground. To have sunk the shafts deeper and drifted out under all the pillars through barren rock would have cost thousands of dollars and would have recovered only part of the ore, and that mixed with much waste, mud and rock.

This experience showed that in soft-ground mining, the great problem is the getting out of the second half of the ore at moderate cost and without danger to the men.

In the Longacre-Chapman mine at Neck City and the Century mine adjoining, a situation exists similar to that just described. About half of the ore is being left in big pillars of considerable value. To attempt extracting these with no other support than ordinary timbering and penning would allow the ground to cave, jeopardizing both the miners and the ore. Log pens and timbers where the drifts are 30 to 40 ft. high, have generally failed to hold up the ground after the pillars have been cut out. Nor are log pens of such size at all cheap to put in. The cost of both logs and labor counts up fast.

Therefore, an attempt is being made to support the roof in the following manner: Holes are being drilled between pillars from the surface of the ground to the roof of the drift below, 6-in. drill casing being left in each hole. Forms for concrete, about 15 ft. square, wired across, are being built under each drill hole. Tailings and water happen to be conveniently situated within a few feet of the tops of the drill holes and cement bought in carload lots will be distributed at the rate of 200 bbl. for each pen.

A sidewalk contractor, with his gasoline-engine-driven

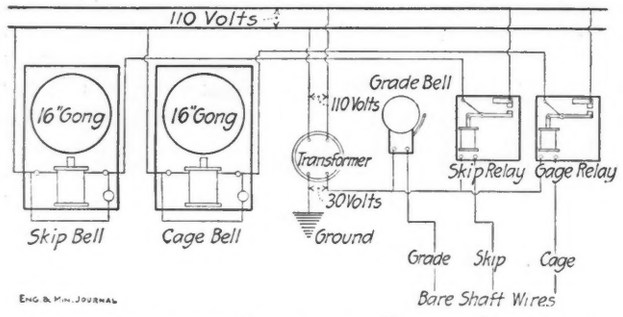
concrete mixer, has been engaged to mix the concrete on top and pour it down the drill holes. A man will be stationed in each form below to spread and tamp the concrete as it comes down the hole. When the form is nearly full, a platform will have to be built to stand on near the roof, and the last remaining concrete filling will be rammed tight against the roof with a special tamping bar. Empty powder boxes (Independent preferred) will be set in the concrete near the top, several on each side to serve as hitches in which to place timber caps reaching from one concrete pen to another. These timbers will catch up the roof between pens and can be additionally supported by posts set under their middle points. A number of concrete pens will be put in now and allowed to set for several months before any pillars are taken out.

The cost of the concrete pens will be held down by the cheap method adopted for mixing and delivering the concrete and will probably little exceed the cost of timber pens. A cubic yard of concrete will cost about $2, whereas the value of a cubic yard of ore is about $12.

The experiment is worth making and if successful at Neck City and not too expensive, may prove useful at other similar mines.

Bare-Wire Electric Signal System

The Penn Iron Mining Co. in Michigan uses a rather unusual and highly interesting system of electric signaling (*Bull.* A. I. M. E., February, 1914). An alter-



Connections for Relay and Direct Signaling

nating current of 110 volts taken from the lighting system is reduced to 30 volts through a small transformer. This 30-volt circuit is used to ring what is called a grade bell, i.e., a signal to indicate the class of ore hoisted, and also to operate two relays, one of which rings the skip bell in the hoist house by closing a 110-volt circuit, while the other similarly rings the cage bell.

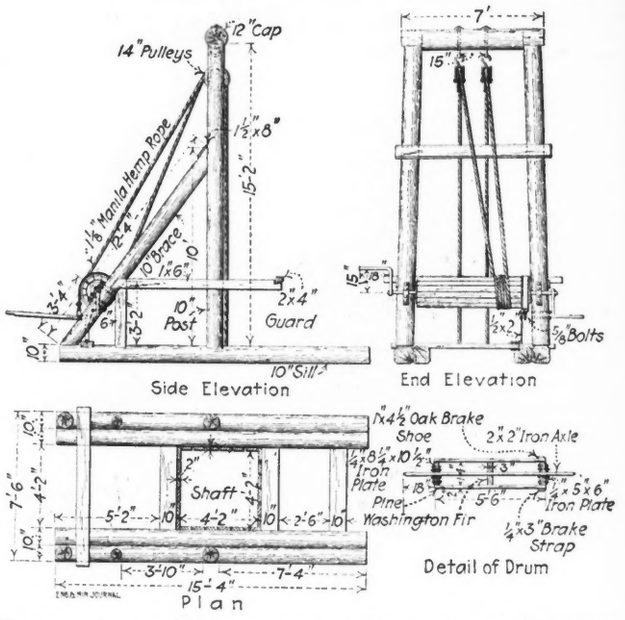
One side of the 30-volt circuit is grounded, the other connected to the grade bell and the relays. The other sides of the grade bell and the relays are connected to No. 4 bare copper wires supported on insulators down the shaft. By grounding any one of these copper wires, a current will flow through the grade bell or a relay and give a signal.

The bell wire for the cage is near the center of one side of the compartment so that it is almost impossible to reach and ring it unless one stands on the cage. This prevents ringing the cage bell when the cage is not in sight, a frequent source of accidents. A short piece of flexible wire with a piece of bare No. 4 wire on its end is fastened to the iron work of the cage so that the shaft signal wire can be grounded from any point in the shaft, whether the cage be moving or at rest.

The skip and cage bells are 16 in. in diameter and are set in a local 110-volt circuit, which is closed and opened by the relays mentioned. The blow on the gong is struck by a bar in a heavy solenoid. An indicator which registers the number of bells rung is also actuated and a lamp is lighted.

Lowering in Balance through Timber Shaft

In the iron mines of the Mesabi range the timber and boards used underground are seldom handled in the main hoisting shafts. Instead one or more timber shafts are sunk at different points affording ventilation and saving underground tramming. There are several different



Timber-Shaft Headframe for Lowering in Balance

styles of timber shaft ranging from the inclined slide to the more elaborate type with counterweighted cage.

The accompanying drawing shows a simple headframe used on the timber shafts of one of the larger mines. The 1⅛-in. manila rope is passed five or six times around the drum and made of such a length that one end is at the bottom of the shaft when the other end is at the top. There is, therefore, no labor wasted in raising the empty rope as there is in most timber shafts. Two men work together, one operating the drum and the other handling the timber or boards.

The headframe and drum are constructed by the mine carpenter and assistants in from two days to 2½ days. The length of the drum should be carefully determined in proportion to the depth of the shaft so as to prevent a lateral travel of the rope greater than the length of the drum. One of these headframes is now being used to lower timbers 160 ft., with perfect success.

In Setting Carbons for Diamond Drilling beating should be avoided, as, although carbons will resist extremely high pressures, they can be broken by blows, according to J. K. Smit & Zonen. Stones of cubical, spherical or oblong shapes are preferable.

Room and Pillar Mining at Ray

The Ray Consolidated Copper Co., of Arizona, has developed a most interesting system for mining the bulk of its ore. The company report for 1913 illustrates this system with ideal sections and plan and describes it to a certain extent. The illustrations are reproduced herewith and the following description is obtained from a study of them and from the report.

The system consists essentially of cutting up the orebody into a series of alternating rooms and pillars, mining the rooms on the shrinkage systems and caving the pillars afterward. The drawings represent six stages in the combined processes of development and mining.

In the first stage a number of parallel drifts for motor haulage are driven in the orebody at 50-ft. centers and timbered.

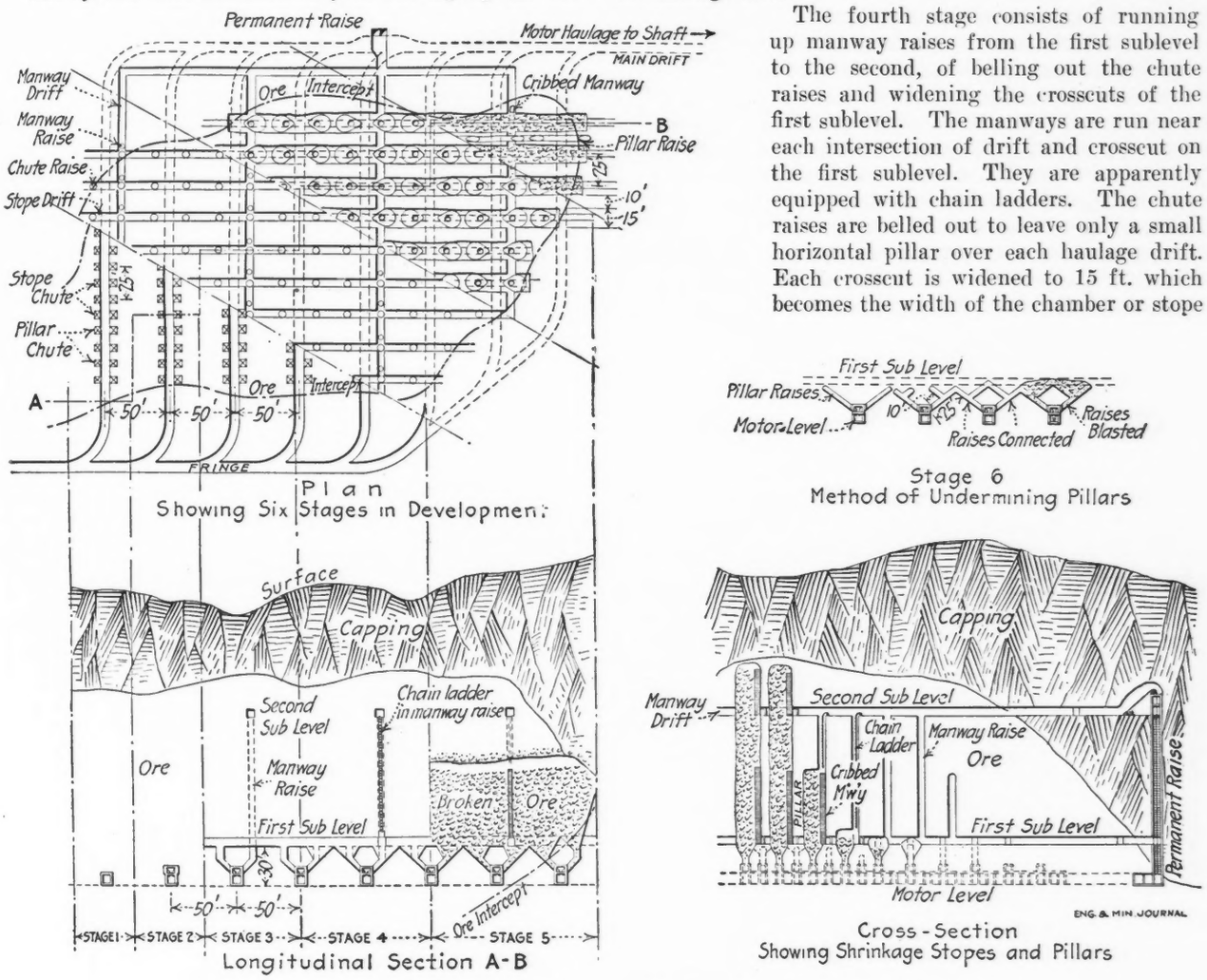
The second stage consists of erecting the chute sets and building the chutes on 12½-ft. centers, along these haulage drifts on both sides. These chutes are for rooms, or stopes, and for pillars, in alternate pairs, as indicated. Thus the stope chutes will be on 25-ft. centers and the pillar chutes, the same.

The third stage consists of opening out the two sublevels simultaneously, these being 100 ft. apart aparently, and of running up the chute raises from the haulage level to the first sublevel. The first sublevel is opened up by drifts parallel to the haulage drifts, offset a little from every other one of the latter, so as to be on 100-ft. centers, and also of crosscuts at right angles to these on 25-ft. centers. On the second sublevel apparently only the drifts on 100-ft. centers parallel to the haulage drifts are run and these are designated as manway drifts. The chute raises, it will be noted, run up inclined a few feet and then turn vertical. The first sublevel is 30 ft. above the haulage level.

The fourth stage consists of running up manway raises from the first sublevel to the second, of belling out the chute raises and widening the crosscuts of the first sublevel. The manways are run near each intersection of drift and crosscut on the first sublevel. They are apparently equipped with chain ladders. The chute raises are belled out to leave only a small horizontal pillar over each haulage drift. Each crosscut is widened to 15 ft. which becomes the width of the chamber or stope to be mined above it. This leaves 10 ft. as the thickness of the pillar.

In the fifth stage, the slopes are mined consecutively up to the capping, the broken ore being drawn off only so as to give headroom between its surface and the back.

The sixth stage is the undermining of the pillars. Inclined raises are started up from the pillar chutes in the haulage drifts, extended to the first sublevel and connected. From a point part way up each inclined raise, another raise inclined in the opposite direction is carried through to the sublevel. By blasting out small corners a continuous cut is made under the pillar, so that it is completely undermined. The successive stages in this operation are illustrated. The pillars either crush from the weight of the ore or may be blasted to assist in their caving.



IDEAL PLAN AND SECTIONS, SHOWING MINING METHODS FOLLOWED

The work described is practically all in ore. The drifting, crosscutting and raising are, of course, relatively expensive. Even the carrying up of the stopes does not give by any means the cheapest ore, since of that broken, only a part is available immediately. The cheapest ore is that drawn off after the pillars have caved, being derived partly from the stopes and partly from the pillars. The amount of capital tied up in so elaborate a system is a point of the greatest importance. Thus the report estimates 5,000,000 tons of broken ore in the mine at the time of writing. The total development footage to the date of the report was 377,000 ft., but of this, 135,000 ft. had been destroyed in the process of mining, so that only 46 miles remained open for use. The cost of putting the ore on the surface for 1913 was about 70c. per ton, covering all classes and including fixed and general charges. The average cost is increased by that of the high-grade body, which is mined on the square-set system. In mining out certain small areas, the extraction was found to be 96% of the estimated copper content. The tonnage, however, was over 100%, due to the mixture of low-grade material. The actual cost of breaking the ore is not to be ascertained from the data given.

Hoisting over End of Shaft

By Frederick Foote*

With the long, narrow type of shaft, it is customary to set the hoist oposite the long side. Circumstances sometimes arise, however, in which it becomes necessary to

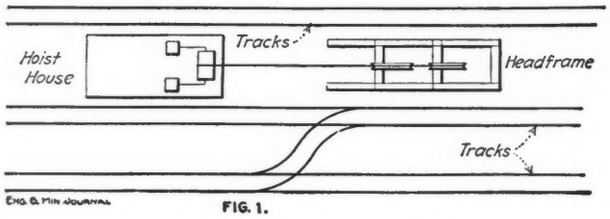


FIG. 1.

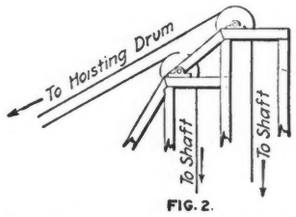


FIG. 2.

Headframe with Sheaves in Same Plane

hoist over the end of the shaft. Thus at the Simpson mine, Lafayette, Colo., the arrangement of railroad tracks made it impracticable to use a headframe of the usual design and one was built that permitted the hoist to be set between the tracks, as illustrated in Fig. 1.

The disposition of the sheaves so as to allow the ropes to lie in the same plane is interesting, the sheave farther from the hoisting end being placed higher than the other. Two ropes are used on the single drum. The rope entering the drum is wound in the groove next to that just vacated by the outgoing rope. This keeps the two in practically the same plane and gives a turn around the drum. Fig. 2 shows a diagram of the sheave arrangement.

*Box 614, Golden, Colo.

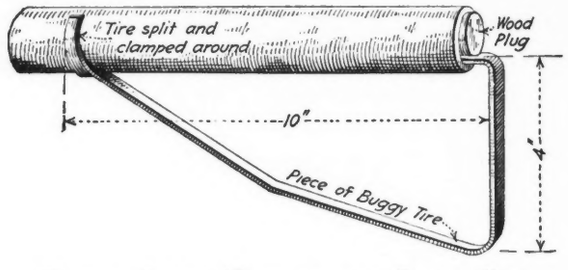
Air-Operated Underswung Gate

The chute gates at the Crean Hill mine, Sudbury, Ont., are of the type here illustrated ("The Nickel Industry," published by the Canadian Department of Mines). The gate is an underswung arc actuated by a compressed air cylinder as shown. The ore is allowed to flow into the car until it assumes a position of rest, when the air is turned on and the gate pulled up through the ore, leaving the car full and the gate closed, so as to shut off more flow. No adjustment of the load is necessary and no delay occurs. The whole operation of loading a 3-ton car consumes about one minute.

Method of Closing Gate through the Ore Stream

Hand Guard for Wheelbarrow

A cheap, simple and efficient guard for wheelbarrow handles is shown in the accompanying illustration. A piece of flat iron or steel, such as a piece of buggy tire, is bent as shown. One end is split and clamped around the handle, the other is bent into the handle and secured by a wood plug. The guard requires no bolts or rivets to fasten it. A few minutes will suffice to fashion and adjust a pair, and the cost is almost nothing, while the protection afforded a man wheeling in a narrow tunnel or around construction work is of considerable value.



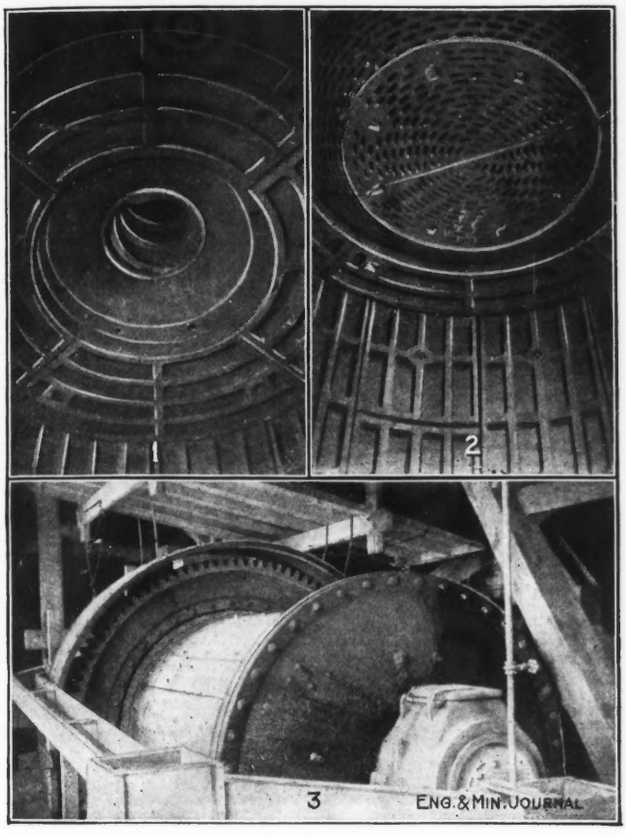
Safety Guard Made from a Buggy Tire

Angle Measurements Begin at Due West, in Rand surveying practice, instead of due North, according to Bull. 115, I. M. M. Thus the azimuth of a north line is 90° instead of 0°, as in common practice. In the coördinate records, however, the east-west differences and the north-south differences are placed in the same column as in standard systems.

Details of Milling and Smelting

A Short Tube Mill of Large Diameter

In accordance with the present-day tendency to modify the tube mills in use, both in manufacture and in practice, it is interesting to note a mill of large diameter and short length which has been installed by the Butte & Superior Copper Co., Butte, Mont. The mill is 7 ft. in diameter by 10 ft. long overall. The gear is 14 in. wide on the face.



SHORT TUBE MILL

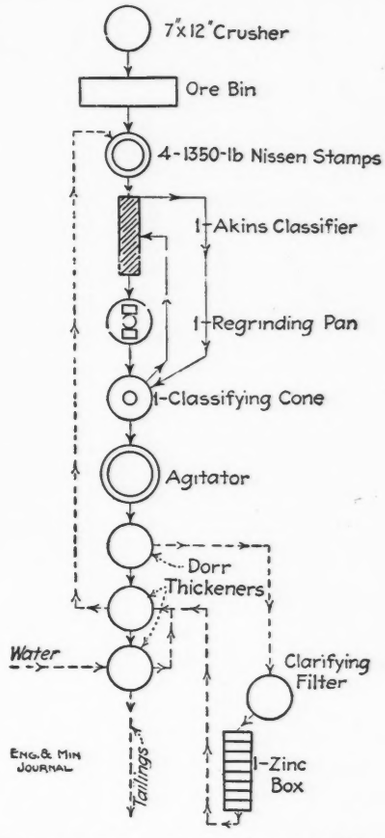
1. Inside of feed end.
2. Inside of discharge end.
3. Outside of mill.

The feed scoop is of the three-cup spiral type, so that with the mill operating at 22 r.p.m., it is fed oftener than one each second. The mill is lined with a Forbes type liner redesigned to suit local conditions and will use No. 5 Danish pebbles. The mill has developed an average capacity of approximately 300 dry tons of ore per day, of which quantity approximately 75 tons are returned to the mill as a circulating load.

A second mill, almost identical with this one, is now being installed. The type has proven economical and satisfactory. The accompanying photographs show a view of the outside of the mill, and one each of the inside at the feed end and the discharge end.

Duncan Mill, Atlantic City, Wyoming*

The mill of the Beck Mining Co., at the Duncan mine, was originally designed and built to crush with Nissen stamps and amalgamate the gold, using both inside and outside plates. Several months' operation, however, proved that the best obtainable extraction was not more than 75%, and it required much care to keep it above 60%. To improve results, a simple cyanide mill was built according to the design shown in the accompanying flow sheet. An attempt was made to crush in cyanide solution and continue the use of plates, but the usual difficulties were encountered, and amalgamation was dispensed with.



FLOW SHEET OF THE DUNCAN MILL

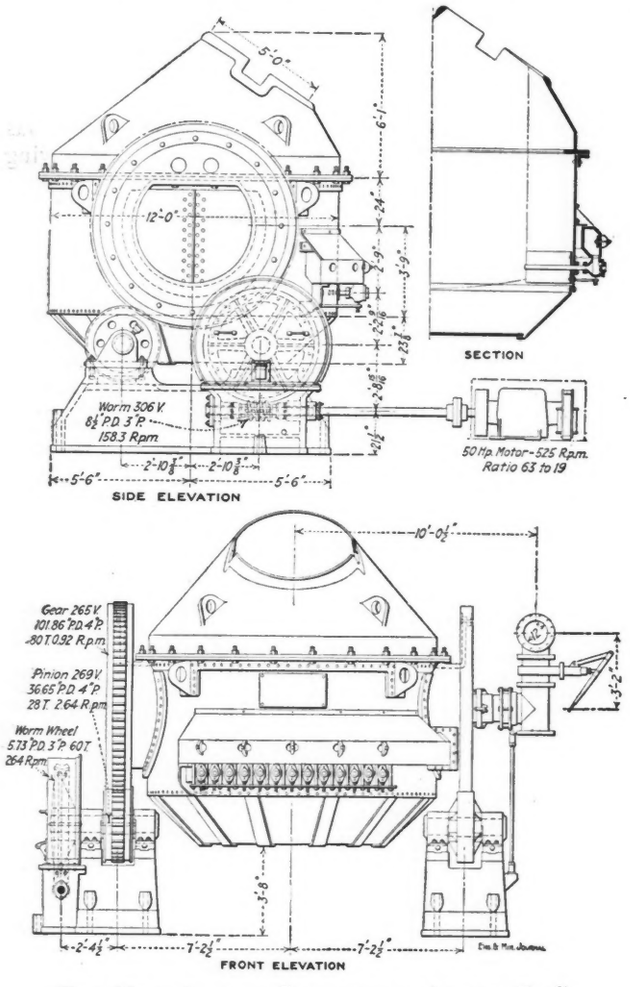
The mill is a good example of a simple and economical arrangement for cyaniding small quantities of gold ore. Its capacity is 30 tons per day and total costs are only a little more than $2 per ton. The crushing is done in solution containing 0.8 lb. KCN per ton, and the tailings are washed by counter-current decantation, there being no slime filter. Dissolved value in gold lost amounts to $0.12 per ton, and that in cyanide to about $0.088. Con-

*Abstract of an article by D. C. Kelso, Supt., in Bulletin No. 7, State Geologist's Office, Wyoming.

sumption of zinc is 0.41 lb. per ton treated; of lime, 7 lb.; of sodium cyanide, 0.44 lb.; and of lead acetate, 0.003 lb. per ton. The ores are easy to treat and the installation does the work satisfactorily.

The New Granby Converters

One of the principal difficulties in the operation of basic-lined converters has been the formation of collars. These accretions, unless removed, eventually cause much trouble, especially in the small-mouthed shells formerly used with acid linings. At the Grand Forks plant of the Granby Consolidated Mining, Smelting & Power Co., a great deal of trouble was experienced when the acid shells were first used with basic lining. To remedy the collar troubles, the top was cut off so as to make a larger mouth. As this did not eliminate the trouble, four recesses were cut in one of the converter caps. As far as the collars were concerned, this was a success, but the parts left were warped badly. The experiment was next tried of cutting only two recesses in the converter mouth. It was then found that the warping was not excessive and all old converter caps were cut in this way. The caps were lined with brick up to the lower edge of the opening, and from there to the top, the inside was plastered and the openings filled with clay. After the collar forms and the mouth gets too small, the recesses are broken into with a hammer and when the crane hook is inserted, the collar comes off easily or is broken into two pieces and the halves are readily removed.



THE NEW GRANBY CONVERTERS, ANYOX, B. C.

The new converters, made by the Traylor Engineering & Manufacturing Co., for the Hidden Creek works, of the Granby company, at Anyox, have tops of cast steel. When these converters were ordered, W. A. Williams, superintendent of smelters for the Granby company, specified that the caps should have a recess, 8x12 in., in each side of the mouth near the trunnion. One of these new converters is shown in the accompanying drawing. The tuyeres are large and comparatively few in number, there being only 13 tuyeres each 2 in. in diameter. The tuyeres are of the Shelby flap-valve type, but Mr. Williams has improved the method of connection so as to permit of quick removal of the body of the tuyere from the tuyere pipe.

The windbox of the converter is set off about six inches from the converter shell, leaving ample working space for the removal of tuyeres. The end of the pipe is upset and machined to fit a bronze sleeve or half-union that passes over the pipe and connects with the threaded projecting end of the tuyere. Thus in removing a tuyere, it is not necessary to turn or cut off the tuyere pipe, which usually has become frozen to the lining.

The worm and worm wheel of the new converters are of nickel steel, machine cut, and both are so assembled that they may be readily removed. The joints between the cast-steel and sheet-steel parts are machine faced, as are also all cast-steel flanges. The roller carriers, for the converters are of heavy construction, with shafts of large diameter and with the end of the bearings tightly closed against dust.

Saving Centrifugal-Pump Shafts

When centrifugal pumps are operated on sandy pulp, the usual result is the cutting out of the impeller shafts at the point where the packing bears upon them. One of the most popular methods of reducing this wear factor and, in fact, about the only one which has so far proved effective, is to feed water or solution constantly into the gland, thus washing back the sand into the pump.

At the plant of the Deloro Mining & Reduction Co., at Deloro, Ont., this procedure is impossible, as the extra liquid added would soon run the tank over. The difficulty is surmounted by using a spiral metallic packing in the gland and feeding hard grease into it by constant pressure. The feeding arrangement is so adjusted that the pressure is just sufficient to keep any solids from entering the gland. Centrifugal pumps so equipped use one shaft for about nine months, whereas before the idea was conceived they would cut out in a few days.

Arsenic and Antimony in Basic Converting

An increased elimination of arsenic and antimony in copper converters when using basic lining is claimed by a writer in *Revue de Métallurgie*. An inquiry at one of the leading American copper refineries brought the response that its records did not indicate any material difference in the arsenic and antimony contents of converter copper produced before and after the general adoption of basic converting.

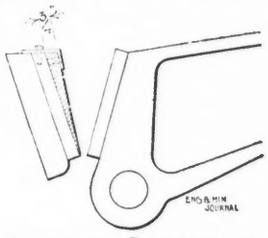
The Assayer and Chemist

Jaw Liner for Dodge Laboratory Crusher

By R. F. Wood*

The accompanying sketch illustrates a little device in use in our laboratory; it probably is not altogether new, but as I have not seen it elsewhere, it must be unknown to some readers.

Coarse crushing in preparation of samples is done with a Dodge crusher with a 4x6-in. jaw opening. In handling samples of materials of low specific gravity, such as coal, some inconvenience and delay was caused, especially with large samples, by the tendency of the material to ride free between the jaws, the latter failing to bite. The expedient of placing a wedge-shaped iron plate on the face of the stationary jaw, thereby reducing the angle between the crushing faces by about 20 per cent., has overcome the difficulty. This plate is easily inserted or removed as occasion requires.



Liner for Laboratory Crusher

Mercury Determination by Potassium Xanthate

If a solution of potassium xanthate be treated with a known excess of N/10 hydrochloric acid and left for 10 min. to insure the complete decomposition (into alcohol and carbon bisulphide) of the liberated xanthic acid, the excess of hydrochlorie acid may be titrated with baryta in presence of phenolphthalein or methyl red, and the quantity of xanthate calculated. The method may be utilized for the determination of metals, especially mercury, which form insoluble xanthates, an excess of a standardized solution of potassium xanthate being added and then the exeess determined as deseribed above, says B. Holmberg (*Ber.*, 1913, p. 3853; abstr. *Journ. Soc. Chem. Ind.*, 1913, p. 45). In the case of mercuric bromide, chloride or sulphate, it is not necessary to filter off the mercuric xanthate, but this must be done in the case of mercuric iodide, as mercuric xanthate is decomposed slowly by acids in presence of iodides. Provided no other metal which forms an insoluble xanthate and no oxidizing agents (*e.g.*, nitric acid) are present, mercury can be determined in this way more rapidly and simply than by any other method. Potassium xanthate keeps well in dry air and ean be readily purified by re-erystallization from absolute aleohol.

Ignition of Chromic Oxide

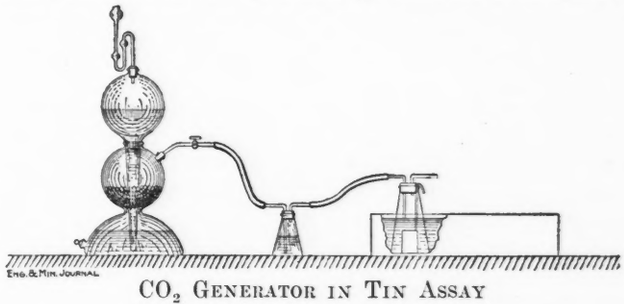
The gravimetrie determination of chromium as oxide is found invariably to give somewhat high results owing to the absorption by the preeipitate, dnring ignition, of a small proportion of atmospheric oxygen, with the formation of chromic chromate (Cr_2O_3, $3\,CrO_3$), says G. Rothang (*Zeit. anorg. Chem.*, 1913, p. 165). Accuracy is secured, however, by igniting in a current of hydrogen.

*Chief chemist, Quincy Smelting Works, Hancock, Mich.

The Volumetric Determination of Tin

By R. L. Hallett*

Perhaps the most reliable and accurate method of determining tin is by electrolysis of the oxalic-acid solution of ammonium-stannic oxalate, but this method is tedious and requires considerable time and there is a wide field of usefulness for a quick volumetrie method of reasonable accuracy which is applicable to ores, furnace products, alloys and other materials containing tin. Several such methods have been advanced but the one most generally used in this country is based on the titration of stannous-chloride in hydrochlorie-acid solution with standard iodine solution. This method has been discussed and presented in various forms by different authorities[1],



CO_2 Generator in Tin Assay

and my intention in this paper is to describe the theory of the method and the manipulation which I have found most satisfactory in my own experience with it.

This method is based on the faet that stannous chloride in hydrochlorie-acid solution is oxidized by iodine to stannie chloride, aceording to the following equation:

$$SnCl_2 + 2\,HCl + I_2 = SnCl_4 + 2\,HI$$

The iodine is charged to hydriodic acid until the reaction is complete when any further addition of iodine gives the eharacteristie blue color with the starch solution, which is used as an inside indicator. The titration is performed in a clear solution, pale green in color, and the end point is very sensitive and easily distinguished.

When the material containing tin is brought into solution, the tin will generally be found in the stannic condition and must be reduced to the stannous condition before titration. This reduetion is usually accomplished in one of three ways, either by the use of iron in the form of rods or niekel or aluminum in the form of sheets or strips. Metallie iron or aluminum will satisfaetorily reduee stannie chloride, but they are very soluble in the solution and are dissolved rapidly. For this reason a

*National Lead Co., Brooklyn.

[1]Assay of Tin and Antimony," L. Parry. "Technical Methods of Ore Analysis," A. H. Low.

supply of the iron rods or aluminum strips must constantly be kept on hand. As the iron rods become irregularly eaten away, small pieces of iron are liable to break off and remain in the solution and if this happens the solution has to be heated until these particles are completely dissolved or some of the tin which is oxidized during the titration will again be reduced, thus consuming more iodine than the reaction requires and giving high results. Aluminum is generally used in the form of strips and only a small amount is added which is allowed to dissolve completely. This is somewhat unsatisfactory, as it necessitates adding enough aluminum to complete the reduction and still not so much as to prolong the operation unnecessarily. It will, therefore, be seen that the use of aluminum renders this part of the method somewhat uncertain and makes it difficult for the chemist to control the operation. Metallic nickel, on the other hand, is not very soluble in the solution, hardly at all in the cold, and the danger of pieces breaking off is slight. Also the strips of nickel last a long time and are always ready for use, which adds to the convenience of the manipulation. The operator leaves the strips in the solution for any desired length of time, removing them at will, and, therefore, has the method under perfect control. For these reasons, I have found it best to use metallic nickel as the reducing agent. The reduction and titration are best performed in a solution containing not less than 25% nor more than 40% by volume of free strong hydrochloric acid. In this article the term "strong hydrochloric acid" will be used to denote acid having a specific gravity of 1.19, and "strong nitric acid" an acid having a specific gravity of 1.42.

Stannous chloride is readily oxidized to stannic, mere contact with the air being sufficient to bring this about, so after the tin has been reduced it is absolutely essential to keep air away from the solution until after the titration has been completed. This is accomplished by maintaining an atmosphere of carbon dioxide in the flask in which the determination is made. The carbon dioxide is allowed to flow from a Kipp generator and the flask is fitted with a rubber stopper in which two glass tubes are inserted, one connecting with the Kipp generator and reaching almost to the surface of the tin solution, and the other opening into the air and extending just through the stopper into the flask.

The Method

For all materials which are completely soluble in hydrochloric acid or hydrochloric acid and potassium chlorate, such as alloys, etc., the method is carried out in the following manner. Weigh 0.25 gram to 1 gram (depending on the percentage of tin) of the finely divided or finely ground sample into a 12-oz. wide-mouth conical flask. Treat with 20 c.c. of water and 20 c.c. of strong hydrochloric acid or strong hydrochloric acid alone and boil until the soluble portion of the sample is dissolved. Add 0.5 gram of potassium chlorate and allow to boil a few minutes longer. If this does not completely dissolve the sample, add another 0.5 gram of potassium chlorate and continue doing so until everything is in solution. Add more hydrochloric acid from time to time if necessary to maintain the volume. When the sample is completely dissolved boil off all the free chlorine, add 50 c.c. of strong hydrochloric acid and dilute with water to a volume of 200 c.c. Prepare a nickel coil by rolling six square inches of heavy sheet nickel (1½x4 in.) into a loose roll of such a size that it may be easily inserted into the flask. Leave a narrow strip of nickel attached to one side of the coil and long enough to reach above the top of the flask. Place this coil in the flask containing the tin in solution, bend the nickel strip over the edge and cover with a small watch glass. Heat to boiling and maintain gentle ebullition for 30 min. after all the iron which may be in the solution is reduced, which may be told by the yellow color of the solution changing to a pale green. Remove the flask from the hot plate and at once while the solution is still hot and hydrogen still being evolved, place the rubber stopper carrying the tube from the Kipp generator, in the neck of the flask. Start the current of carbon dioxide and place the flask in the cooling trough. An atmosphere of carbon dioxide is thus maintained during cooling and all danger of oxidation by the air is eliminated. The arrangement of the apparatus will be readily understood from the illustration.

When the solution in the flask has cooled to room temperature remove the stopper and drop in two ½-in. cubes of crystalline marble. Remove the nickel coil, washing it with cold hydrochloric-acid solution (1 strong acid to 3 water), as it is withdrawn from the flask. This washing solution must be boiled to expel any free chlorine and then cooled before using. Add a little starch solution and titrate at once with standard iodine solution until the characteristic blue color indicates the end point. The carbon dioxide generated by the pieces of marble will maintain an atmosphere of carbon dioxide in the flask during the titration.

When analyzing insoluble materials, such as ores, furnace products, residues, etc., the following procedure is used. Fuse about 8 grams of caustic soda or caustic potash in a 60-c.c. spun-iron crucible over a bunsen burner at a low red heat until all the water is driven off and the fusion is quiet. Allow to cool and weigh in 0.25 gram to 1 gram of the sample, which has been finely ground in an agate mortar. The sample must be carefully spread in a thin layer all over the surface of the caustic soda or it will cake and not fuse perfectly. The failure of the caustic fusion to give complete decomposition of tin oxide can nearly always be ascribed to the neglect of this precaution as incomplete decomposition will nearly always result if the sample is added in a lump. Cover the crucible, fuse and keep at a red heat for 10 min. after the fusion is complete. Withdraw the flame, remove the cover and pour the melt into a nickel dish floating in a beaker of cold water. Cover the dish to prevent mechanical loss by the cake cracking and flying apart when it cools. If treated in this way the cake will not stick to the nickel dish but will separate from it and remain in the dish in loose pieces. Place the crucible in a 4½-in. casserole, cover with a watch glass and dissolve the melt in water and a small amount of hydrochloric acid. Wash and remove the crucible. Clean and wash the cover in the same way. After crucible and cover are removed, add the cake from the nickel dish, being careful to keep the casserole well covered. Add about 30 c.c. of strong hydrochloric acid and when the cake is completely dissolved wash off the cover and transfer the solution to a 12-oz. wide-mouth conical flask. Everything should be in solution except perhaps some scales of iron from the crucible. When pouring the solution into the flask retain these scales of iron in the casserole,

add a few cubic centimeters of strong hydrochloric acid, warm and the iron scales will completely dissolve. Pour this solution into the flask and wash out the casserole. Complete solution shows that the ore is perfectly decomposed. If any residue remains it must be filtered out and given the same fusion treatment or a new fusion must be made, starting with another sample. It will be found, however, that if the sample is finely ground and the fusion performed according to the above directions the most refractory tin oxides will usually be perfectly decomposed. The flask now contains the entire sample in hydrochloric-acid solution. Add 50 c.c. of strong hydrochloric acid and make up to a volume of 200 c.c. with water. Continue the determination as already described for materials completely soluble in hydrochloric acid, finishing the reduction and titration in the usual way.

The standard iodine solution most convenient for this titration is prepared by dissolving 10.7 grams of iodine in 50 c.c. of water containing 20 grams of potassium iodide in solution, and making up to one liter with water. When a half-gram sample is taken for analysis, 1 c.c. of this solution will equal 1% of tin.

The iodine solution may be standardized with pure tin, dissolving it in hydrochloric acid with the aid of potassium chlorate and carrying it through in the same manner as an alloy. A convenient amount of tin to use for this purpose is 0.2 gram. Pure tin is not readily soluble in hydrochloric acid and a drop or two of strong platinum chloride or antimony-chloride solution added to the tin before adding the acid will materially shorten the time required for solution. This treatment can also be used to good advantage with alloys, which are not readily dissolved by hydrochloric acid.

Another good way[2] to standardize the iodine solution is to weigh 0.2 gram of pure arsenious oxide into an 8-oz. flask. Add 5 c.c. of strong hydrochloric acid and warm until the arsenious oxide is completely dissolved, but do not boil. Dilute with a few cubic centimeters of water, add a small piece of litmus paper and make just ammoniacal. Again make just acid with acetic acid. Cool to room temperature, add 4 grams of sodium bicarbonate, a little starch solution and titrate with the standard iodine solution to a permanent blue color. A brown tinge at the end may be disregarded as the end point is a deep blue. Two-tenths gram of arsenious oxide equals 0.2404 gram of tin, from which the tin value of the standard iodine solution may be calculated. The iodine solution is fairly permanent, but for extremely accurate work it should be standardized every four or five days.

The simplest and most reliable method of standardizing the iodine solution is by titration against a standard solution of sodium thiosulphate if such a solution is available.

The starch-solution indicator is best prepared by mixing three grams of water-soluble starch into a thin paste with cold water and pouring it into 500 c.c. of boiling water. Boil this for a minute and then allow to cool and settle. Pour off the clear liquid into a glass-stoppered bottle and shake well with about 15 drops of oil of cassia, which will preserve it indefinitely.[3] I have found this to be a most satisfactory starch-solution indicator.

[2]A. H. Low, "Technical Methods of Ore Analysis," p. 210.
[3]A. H. Low, "Technical Methods of Ore Analysis," p. 81.

Few of the elements which are ordinarily found in materials to be analyzed for tin, interfere with this method. Nickel, cobalt, manganese, molybdenum, tungsten, uranium, titanium, chromium, aluminum, zinc, iron, lead, bismuth, sulphates, phosphates, iodides and bromides have no effect unless present in so large amount that their color masks the color of the indicator.[4] Arsenic and antimony in the *ous* condition in weak acid solution consume iodine, but in a hydrochloric acid solution of the strength used in this method they have no effect.[5] If antimony is present in the solution in large amount (over 0.1 gram) the nickel will precipitate metallic antimony in a slimy condition, which does not settle and masks the end point. This may be prevented by using a solution containing more hydrochloric acid. If, therefore, the sample taken contains 0.1 gram or more of antimony, add 75 c.c. of strong hydrochloric acid instead of 50 c.c. in making up the final solution before reduction. If this is done, the precipitation of slimy antimony will be prevented and no trouble will be experienced. If the antimony content is not known and the slimy antimony begins to precipitate during the reduction, an additional 25 c.c. of strong hydrochloric acid may be added, which will cause the antimony to go back into solution and prevent further precipitation.

Copper in small amounts has no effect on the method, but if 0.1 gram or more is present in the solution, it will be incompletely precipitated during the reduction, the titration will consume more iodine than is required by the tin and the results will be erratic and high. If copper is present in the sample in large enough amount to interfere in this way the sample must first be treated in a casserole with enough nitric acid (1 strong acid to 1 water) to get all the copper into solution. Evaporate the solution to dryness and bake thoroughly to render all the tin insoluble. Take up with a few cubic centimeters of strong nitric acid and again evaporate to dryness and bake. Take up with dilute nitric acid (1 strong acid to 5 water) and heat until all the copper is in solution. Filter through an ordinary filter paper and wash with hot water. The copper will all be in the filtrate and the tin will remain on the paper as insoluble oxide. Melt some caustic soda in an iron crucible as already described under ores, dry the paper containing the tin oxide and place it in the iron crucible. Cover the crucible and perform the fusion as already described. The paper will be destroyed and the tin oxide will be decomposed and rendered soluble in hydrochloric acid. Finish the determination in the regular way.

This method for tin can be run through completely and results obtained in about 1½ hr., and as it is quite easily accurate to 0.1%, the analytical chemist will find it useful.

I am indebted to A. H. Low, of Denver, for many of the details of this method, and I have taken from different sources whatever seemed most desirable.

A New Indicator is afforded by the new potato, Solanum commersoni, which is being grown in France, which contains a violet coloring matter, according to the "Chemical Engineer." If the potatoes are boiled in water, the ferments are destroyed and the resultant blue solution keeps well. As an indicator it is very sensitive, turning green with alkalies and bright red with acids.

[4]J. W. Mellor, "Quantitative Inorganic Analysis," p. 312.
[5]A. H. Low, "Technical Methods of Ore Analysis," pp. 210.

Columbia School of Mines Anniversary

The fiftieth anniversary of the founding of the School of Mines of Columbia University, in New York, was celebrated May 29. The attendance was good, the most noticeable feature being the preponderance of returning "old timers" over the younger men. Officially the celebration began Thursday, May 28, with the registration of alumni; but few men were about. The evening before there had been a smoker at the Columbia University Club, 18 Gramercy Park. The reception Thursday evening was the best attended event of the celebration. It was with it that real observation of the anniversary began. The dances following were of the old and new to suit all tastes.

Friday morning, May 29, alumni assembled in University Hall for the conferring of the honorary degree of Master of Science upon John A. Church, '67; Wheaton B. Kunhardt, '80; Carl A. Meissner, '80; Arthur H. Elliott, '81; Francis B. Crocker, '82; J. Parke Channing, '83; Robert V. A. Norris, '85; Arthur S. Dwight, '85; Rudolph P. Miller, '88; Frederick W. Denton, '89; Karl E. Eilers, '89; and Gano Dunn, '91; while the degree of Master of Arts was conferred upon Henry F. Hornbostel, '91, and Goodhue Livingston, '92.

Prof. Henry S. Munroe being in Europe, Nicholas Murray Butler, president of the university, delivered the commemoration oration, stating how, in 1864, Egleston, Vinton, Chandler and their colleagues in themselves found the means of establishing the School of Mines, aided by "certain strong men of New York," and how by their industry and courage they had laid the foundation of the school as it is today, a department of the university the annual running expenses of which are $400,000, or greater than the law school and school of medicine together. President Butler spoke of the impression that seems to prevail that the name of the School of Mines has been changed. He said no change of name has been made, has never been thought of and never would be so long as there remained men to equip with the fundamental knowledge on which all engineering is based.

Thomas A. Rickard brought greetings from the Royal School of Mines, London, and Dr. Friedrich Kolbeck represented the Koenigliche Bergakademie, Freiberg. Hennen Jennings addressed the convocation on the subject "Mining as a Profession," followed by T. A. Rickard, who spoke on the subject "The Miner as a Pioneer of Civilization."

After the luncheon served in the University Commons the Chandler lectureship was formally founded. Dr. Leo Baekeland delivered the first lecture in Havemeyer Hall, after which the older graduates of the School of Mines presented a tablet to the university in commemoration of the founders of the School of Mines. Later, there were informal departmental gatherings, and in the evening there was an alumni dinner at the Waldorf-Astoria. On Saturday morning, May 30, the electrical engineers celebrated the twenty-fifth anniversary of the establishment of the Department of Electrical Engineering and in the afternoon there was a baseball game between the Varsity and the Chinese University of Hawaii.

The Tonopah Belmont Development Co.'s New Mill at Tonopah, Nevada, has saved, according to the report for the year ended Feb. 28, 1914, more than $25,000 over its original cost, in increased extractions and lessened treatment expenses.

Burma Corporation, Ltd.

The Bawdwin mines, in Burma, are owned by the Burma Mines, Ltd. The Burma Corporation, Ltd., has acquired a majority of the debenture capital and 97.2% of the issued share capital of the Burma Mines company, with an option on a further interest. (*Mining Journal*, May 9, 1914.)

It is announced in a circular from the secretary, D. Anderson, that the nominal capital has been increased to £1,000,000, the additional 300,000 shares being contracted for or optioned, at par. The directors of the company now consist of H. C. Hoover, R. Tilden Smith, F. A. Govett, R. Gilman Brown, Theodore J. Hoover, and Dr. E. Heberlein. The technical committee comprises R. Gilman Brown, Theodore J. Hoover (alternate A. F. Kuehn) and Dr. E. Heberlein.

The development work on the Bawdwin mine from the Chinaman tunnel and the vertical shaft, during the past eight months, has disclosed large bodies of ore, although a comparatively small portion of the ore-bearing area has so far been exploited. The difficulties in treatment of the ore have now been overcome through the distribution of some 7000 tons of ore among European smelters, and, as a result, large contracts at remunerative prices have been offered the company for its purchase for shipment to Europe. Investigation of special methods of treatment are also in hand, from the success of which a higher range of profits should be obtained. In addition to this shipping ore, more recent developments in the Chinaman section have disclosed a large body of concentrating ore, and an important body of high-grade copper ore has been developed at the vertical shaft, in addition to the lead-zinc ores on the Burman lode in that section.

Developments to date indicate oreshoots with a total tonnage of 576,995 and a gross value given as about $30,000,000 per 100 ft. of depth, the profit, however, being contingent on metallurgical results.

It is impracticable at the present moment to make any estimate of the total tonnage of ore in sight, but it would not seem too much to assume a total vertical extension of 200 ft., equivalent to a total of 1,154,000 tons of ore reasonably assured. The Tiger tunnel will enter the orebody at about 500 ft. below the Chinaman tunnel, and would thus give between 500 ft. and 800 ft. vertical extension of backs above its horizon. The technical committee considers that the time has now arrived for the systematic equipment of the property with a view to large production, and they recommend that the program to this end should be divided into two portions: (1) The making of immediate additions to railway rolling stock, mining equipment, etc., by which the ore shipments will be increased up to between 3000 and 5000 tons per month. In addition, it is expected that the present lead-smelting plant can be supplied with either the lead slags or lead concentrates, or that it can be altered so as to smelt the copper ore. The earnings from these operations should contribute materially to the company's resources; (2) an extended program covering a period of from 2 to 2½ years, involving the driving of the Tiger tunnel to enter the orebody at a further depth of 500 ft., the erection of a hydro-electric power plant, further equipment and realignment of the railway, erection of concentration plant, etc. It is anticipated that with these works completed, the mine should be in a position to produce in the neigh-

borhood of 300,000 tons of ore per annum. Considering the extraordinary gross value of these ores there lies a wide field for expansion of profits by the development of special metallurgical methods for the recovery of the metals, and it is yet too early to make any positive statement as to what ultimately can be done in this direction. The shipment of the average grade of zinc-lead ore, without any attempt at hand picking, running 30% zinc, 26% lead and 23 oz. of silver, will show a profit of from $10 to $12.50 per ton of ore with combined metals at $190. From experience it appears that by hand picking the ore, the grade may possibly be raised to 34% zinc, 24% lead, and 24 oz. of silver, this being the average grade hitherto shipped. In such a case the profit would work out about $2.50 higher. A rise of $5 in the combined price means an addition to profits of about $1 per ton. The lead-zinc ores must be concentrated locally, prior to shipment. This ore is of higher average grade than that of Broken Hill, but of much the same general metallurgical character. The copper-silver ores can be smelted locally, but it is too early yet to consider what equipment will be necessary for this purpose. Ore of this grade, 7.8 oz. of silver, 15% copper, should yield a profit of over $15 per ton.

This corporation has acquired 90% of the company owning the Mahochang mines, which are situated some 20 miles to the north of the Bawdwin mines. There are extensive ancient workings, with showings of ore of the same character as that at Bawdwin, and a considerable amount of slags from the ancient smelting plants. A small furnace has been erected, and is now producing lead from these slags, and systematic development work is now being undertaken.

St. Joseph Lead Co.

During the fiscal year ended Apr. 30, 1914, the St. Joseph Lead Co., operating lead mines in the Bonne Terre and Leadwood districts of the Flat River lead-producing area in southeastern Missouri, produced, according to the annual report, 964,984 tons of ore, which yielded 114,971,751 lb. of dry concentrates containing 75,823,944 lb., equal to 37,911.97 tons of metallic lead. Of this total production, the Bonne Terre district furnished 43.4%, or 16,521 tons of lead, and the Leadwood district 56.6%, equal to 21,391 tons of metallic lead.

In the Bonne Terre district operations were concentrated in Mine No. 1, the other mines being closed one after another, except those which were not operated at all. This concentration enabled the same output to be maintained with considerable reduction in operating and maintenance costs. Of the total ore mined and milled, a large proportion came from areas previously worked. The total of 6.726 acres of ground mined furnished a total of 475,133 tons of mill ore. Previously worked ground furnished 73,648 tons of ore per acre, while virgin ground furnished 67,415 tons per acre, an average of 70,641 tons produced per acre. The mill crushed all ore mined, or a total of 475,133 tons and produced therefrom 33,041,587 lb. of metallic lead, so that a yield of 69.53 lb. of metallic lead was obtained per ton of ore milled, equal to a recovery of 3½% metallic lead. The average amount of metallic lead produced from one acre of ground worked was 2456.26 tons. The average cost of mining was 86.5c. per ton, the average cost of milling, 35.38c., and of rail road service and freight, 6.18c., a total of $1.28 per ton.

Comparing the year's results with those of the previous year, the yield per ton was raised from 57.1 lb. to 69.53 lb., and the cost per ton of ore mined and milled was reduced approximately 20c. By far the largest reduction was made in the cost of mining.

Diamond-drill prospecting was carried on during most of the year, and 112 holes, aggregating 40,793 ft., were drilled. One-third of the holes proved workable ground. The drilling was carried on mostly in the immediate vicinity of the mine workings to aid in their development, and considerable ore was discovered. Close drilling of some of the oldest mine workings still being carried on, is not alone proving an extension of the ore into virgin ground, but considerable ore above and below the old workings, which was either overlooked or considered too low grade to be worked, is being discovered. Development of the various orebodies consisted of 1473 ft. of drifts, and 375 ft. of raises. The mine is in good condition today to furnish a steady tonnage of good ore to the mill.

While several minor improvements in the Bonne Terre mill are still to be made, its construction has practically been completed, so that it can now safely treat 1800 tons per day. The installation of the oil-flotation process has added considerably to the efficiency of the mill, and a material reduction in slime losses, heretofore considered unavoidable, has been accomplished. An addition to the flotation plant may, however, be advisable in order to take care of the entire amount of slime made in the mill. Some experiments will have to be carried on, however, before an estimate of the addition to the flotation plant can be made.

In the Leadwood district, a total of 489,850 tons of ore were mined and hoisted from three shafts. The total area mined for the year was 8.736 acres, yielding an average total of 56,072 tons per acre. From a total of 489,745 tons of ore milled, 42,782,357 lb. of metallic lead was produced, so that one ton of ore yielded 87.3 lb. metallic lead equal to a recovery of 4.87% lead per ton of ore. The average amount of lead produced per acre mined was 2448.6 tons. The average cost of mining was 78c. per ton, cost of ore, including freight to mill, was 82.45c., of milling, 29.92c., giving a total cost of mining and milling, $1.1237 per ton.

Comparing the cost of mining and milling with that of the previous year, a reduction is noted of 6.15c. per ton in mining cost and 1.4c. per ton in milling, or a total reduction in cost of 7.55c. per ton. Comparing the cost of mining and milling of 1914 with cost of mining and milling of 1912, which was a total of $1.05 per ton, it will be noticed that there has been an increase of 7.37c. per ton of ore. The yield of metallic lead per ton of ore in the year 1913 was 87.3 lb. as against 83.4 lb. the previous year. Diamond-drill prospecting was carried on for the greater part of the year in the vicinity of the mine workings in order to aid in development work. Holes were drilled to the number of 91, approximating 37,709 ft. drilled, which covered a total area of 80.2 acres, developing an area of 11.4 acres of mineral-bearing ground containing an estimated tonnage of 447,800 tons of profitable ore.

The generally even character of the ore deposits as mined during the year did not require much drift development work, and only 373 ft. of drifts were driven. During

1914 more work of this nature will be required, especially on account of the uneven mineralization of the territory situated to the north and northwest of No. 14 shaft.

While the capacity of the mill was not increased, and no changes were made in the milling system, it was necessary to install four middlings crushing rolls, in order to reduce the lead losses in the coarser tailings, caused by the exceedingly fine dissemination of the mineral in some of the mill ore. By finer grinding of a larger amount of jig middlings by the four larger middlings rolls, it was possible to reduce these losses to a fair average. The heretofore unavoidable losses in the fine slimes have been materially decreased by the installation of the flotation plant, and when this is in complete running order, the recovery of the mill will be equal to any plant in the district.

Mining Dividends for May

Twenty-two United States mining companies making public reports, paid $1,826,064 in dividends in May, 1914, as against $1,964,318 paid by 29 companies a year ago. Steel, smelting and holding companies paid $9,568,-895, a decrease of $249,500 from last year's figures, and Mexican and Canadian companies paid $1,778,960, as

United States Mining Companies	Situation	Per Share	Total
Alaska Mexican, g.	Alas.	0.20	$35,000
Alaska Treadwell, g.	Alas.	1.00	209,000
Alaska United, g.	Alas.	0.20	36,040
Arizona, pf. B., c.	Ariz.	...	53,842
Bunker Hill & Sullivan, l.s.	Ida.	0.25	81,750
Bunker Hill Con., g.	Calif.	0.02	10,000
Elkton, g.	Colo.	0.02	50,000
Fremont, g.	Calif.	0.02	4,000
Golden Cycle, g.	Colo.	0.03	45,000
Grand Central, g.	Utah	0.05	25,000
Hecla, l.s.	Ida.	0.02	20,000
Homestake, g.	S. D.	0.65	163,254
Miami, c.	Ariz.	0.50	373,379
Nevada Wonder, s.	Nev.	0.10	140,699
Parrot, c.	Mont.	0.15	34,477
Stratton's Independence, g.	Colo.	0.06	60,750
Tonopah Belmont, g.s.	Nev.	0.10	150,000
Tom Reed, g.	Ariz.	0.06	54,473
United Verde c.	Ariz.	0.75	225,000
Yellow Aster, g.	Calif.	0.05	5,000
Yellow Pine, l.z.s.	Nev.	0.01	10,000
Yosemite, g.	Calif.	0.01	2,400
Canadian, Mexican and Central American Companies	**Situation**	**Per Share**	**Total**
Amparo, g.s.	Mex.	0.03	60,000
Casey Cobalt, s.	Ont.	0.12	30,753
Cobalt Lake, s.	Ont.	0.02½	75,000
Cobalt Lake (holding company)	Ont.	0.24	72,900
Cobalt Townsite, s.	Ont.	0.48	240,000
Coniagas, s.	Ont.	0.45	360,000
Crown Reserve, s.	Ont.	0.02	35,376
Dominion Steel	Can.	1.50	105,000
Greene Con., c.	Mex.	0.50	500,000
Hollinger, g.	Ont.	0.15	90,000
Lucky Tiger, g.	Mex.	0.07	50,074
Seneca Superior, s.	Ont.	0.12½	59,860
Standard, s.l.	B.C.	0.05	100,000
Iron, Industrial and Holding Companies	**Situation**	**Per Share**	**Total**
Amalgamated, c.	Mont.	1.50	2,308,319
Cambria Steel	Penn.	0.62½	562,500
International Nickel, pfd.	N.J.	1.50	133,689
International Sm. & Ref.	U.S.	2.00	200,000
U. S. Steel, pfd.	U.S.	1.75	6,304,919
Warwick Iron & Steel	Penn.	0.40	59,468

compared with $1,188,841 in 1913. Totals for the first five months of the year are: Mining companies, $25,-515,566 in 1914, $30,884,487 in 1913; metallurgical and holding companies, $38,769,096 in 1914, $38,404,805 in 1913; Canadian, Central American and Mexican companies, $8,876,332 in 1914, $9,494,122 in 1913.

Old Freibergers in America

All former students of the Freiberg Bergakademie are invited to attend a dinner in honor of Dr. Friedrich Kolbeck, Professor of Mineralogy and Blowpiping and present Rektor of the old mining school. The dinner will take place at the Hofbräu Haus, Broadway and 30th Street, New York, June 13, at 7 p.m. Dr. Kolbeck came to America to attend the 50th Anniversary of the School of Mines of Columbia University, New York City. He expects to embark for Europe about June 15. All former students are welcome and are asked to notify C. L. Bryden, 1701 Jefferson Ave., Scranton, Penn., secretary of the association.

Alfred E. Barlow

Dr. Alfred E. Barlow and his wife sailed from Quebec May 28 on the "Empress of Ireland" on their way to spend a few weeks in England, and were among those lost in the disaster of the following morning. Their loss will be deeply and widely regretted. Dr. Barlow was well known in Canada as a geologist and explorer and was generally esteemed and liked. He served as president of the Canadian Mining Institute in 1912-13, and had been an active and useful member of the Institute from its foundation.

Dr. Barlow was born in Montreal in 1861, and graduated from McGill University with first-class honors in natural science in 1883, when he entered the service of the Canadian Geological Survey. He was engaged in many important investigations and made some important reports. He left the Survey about three years ago and settled in Montreal, where he practiced as a consulting geologist, and also lectured on geology at McGill University.

He was a member of the commission which investigated the Chibogamou Country in Northern Quebec, and had had many other important commissions. Few men knew more about the economic geology of Eastern Canada.

The Tap-Line Decision

WASHINGTON CORRESPONDENCE

More importance is being attached to the decision of the Supreme Court in the tap-line cases handed down a few days ago. The growing opinion among lawyers is that the decision, since it affects the relation of trunk lines and industrial roads, will oblige Interstate Commerce Commission to revise its decision respecting the division of through rates between the trunk lines and the short industrial railroads owned by the United States Steel Corporation, the coal roads and other companies in like position.

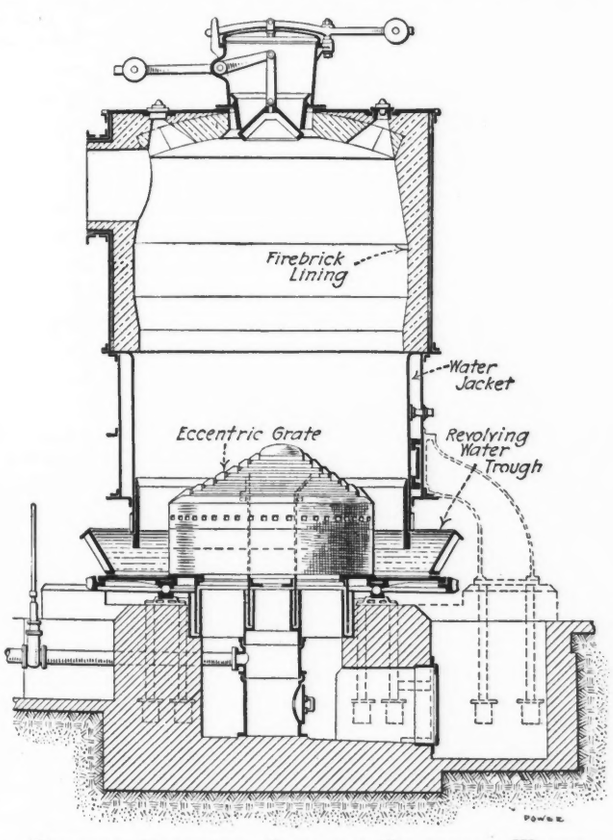
What is considered the essential part of the opinion is found in those paragraphs which have to do with the definition given by the commission to the tap lines. In discussing the question whether tap lines are plant facilities or common carriers, the court says that it was insisted that the roads were not common carriers because most of their traffic was in their own items of production. The final draft of the opinion as published, however, goes on to note that the conclusion already indicated above. "loses sight of the principle that the extent to which a railroad is in fact used does not determine the fact whether it is or is not a common carrier. It is the right of the public to use the road's facilities and to demand use of it, rather than the extent of its business which is the real criterion determinative of its character."

If the division of rates allowed should result in unfair advantages to the owners of some tap lines and to discrimination against the owners of others; or if the

divisions are such as to amount to rebates or discriminations in favor of the owners of the tap lines, because of their disproportionate amount, in view of the service rendered, it is within the province of the commission to reduce the amount so that the tap lines shall receive just compensation only.

Kerpely Gas Producer*

The use of a water trough to seal the bottom of a pressure gas producer, while allowing the ashes to be raked out, is not new, but a feature of the Kerpely producer, shown in the accompanying drawing, is that the water trough is made to revolve on ball bearings, so that the ashes are carried around against a fixed scraper arranged in a sloping position, which automatically conveys the ashes out of the trough and dumps them into a chute. Taking advantage of the rotary motion provided for this purpose, the inventor designed a grate, which is placed eccentrically on the water trough and revolves with it.



KERPELY PRODUCER, SHOWING REVOLVING WATER TROUGH

The grate is elliptical and its periphery is polygonal, so that, as the grate rotates, it crushes the clinkers against the apron of the water seal, breaking them up into lumps which fall into the trough and are removed as described. Provision is also made for the control of the steam and air supply to the various portions of the grate, so as to secure uniform combustion over the whole grate. The conical grate is flattened on the top, to keep the CO_2 zone as low as possible. The lower part of the casing consists of a water-cooled jacket, to which the clinker cannot cling as it does to a brick lining.

Owing to the ability of this producer to gasify coal more rapidly than the ordinary type, a smaller plant suffices to do the same work; the automatic removal of the ashes and the self-clinkering action of the grate reduce labor costs; repairs are also eliminated, and gas of good quality can be obtained from fuel containing as much as 35 per cent. of ash. The gas is also of very uniform composition, owing to the steady and continuous operation of the producer. In the course of a test of one of these plants, at Vienna, gasifying coke breeze, the net efficiency of the producer was found to be 89.8 per cent., 75.37 per cent. of the heat energy of the fuel being made available in the form of gas and 14.43 per cent. being used for the production of steam.

E. G. Appleby & Co., the British agents for the Kerpely producer, have devised a poke hole for use on any pressure producer, which can be opened without allowing gas to escape or air to enter. The hole is provided with compressed-air jets, which are adjusted so as to secure equilibrium between the gas pressure and that of the jets.

*Abstract of an article by Arthur H. Allen, in "Power," Mar. 17, 1914.

Sulphur Production in 1913

The U. S. Geological Survey reports the "marketed production" of sulphur in the United States in 1913 as 311,590 long tons, valued at $5,479,849. Sulphur was produced in 1913 by three states: Louisiana, Texas and Wyoming. Almost the entire production was from Louisiana; Texas, a new producer, ranked ahead of Wyoming.

The Survey states that "by production is meant actual sales of sulphur, which enter and affect the market. The unsold sulphur stocked at the mines is not included." This is a rather circuitous way of saying shipments and has the further disadvantage of being misleading when the table headed "Production of Sulphur in the United States, 1880-1913" is re-published, as frequently happens, without the Survey's definition of production. Confusion may also arise from the Survey's statement: "It is interesting to note, therefore, that the United States is rapidly gaining on Sicily, which at the present time is the leading sulphur-producing country in the world."

As a matter of fact, the United States has been the leading producer of sulphur for the last two years. In 1912, the actual production of sulphur in this country was approximately 790,000 long tons, and in 1913, the actual output was nearly 500,000 tons, thus far exceeding the production of Sicily or any other country. The production in the United States in the last two years has reached a total of about 1,275,000 tons, or nearly double the amount shown in the Survey's "table of production." While the sales of Sicilian sulphur as yet exceed those of the United States, production in Sicily is steadily declining, owing to the increasing difficulty of mining. But, as previously noted in the JOURNAL, the United States is now and has been for two years the leading sulphur-producing country of the world; it is not "rapidly gaining on Sicily."

The Sicilian production for the year ended July 31, 1913, was 351,752 metric tons (346,213 long tons). Imports of sulphur of all kinds into the United States in 1913 were 22,605 long tons, of which 14,317 tons came from Japan.

Correspondence and Discussion

Develop the Prospects

A great deal has been published lately by the various mining journals in answer to the query of "What is the matter with mining," but I trust that a few more words upon the subject will not be out of place.

There is no doubt that something is radically wrong with the business, and I believe there is an opportunity at present for someone to take advantage of, in a field which is practically dormant. Conditions in the business have been greatly altered in the last 20 years. The cry is out that there are no more good mines to be found, and many engineers are out of a job. To some extent this is true; but whose fault is it, and why aren't there any more good mines being opened up? To my mind, both the investor and the engineer are together at fault for the present conditions, and it behooves them both to change their point of view.

During late years the tremendous porphyry copper promotions, and other enormous mining propositions, have largely spoiled the investor. He has demanded, and still does demand, something of the same kind—only bigger; and he has had such an easy time here in proving up the ore reserves, that the engineer has been forced to see and measure up the orebodies before any interest is taken in a property. Every one of these enormous deposits has been known for years, only no one knew how to make a profit out of them until Mr. Jackling showed the way, and now that they have become such a success, the great mining companies are scouring the world to find similar conditions, where they can rehabilitate some past failure. But most of these things are taken up, and the poor prospector is ignored. Nowadays, unless one is infernally lucky, the only way to get a mine is to go out and make it, and here is the chance for some enterprising capitalist, who has the individuality to steer away from the crowd, to use the trained engineer advantageously. It is almost impossible to persuade one of the big mining companies to risk a small sum upon an absolutely raw prospect; they would rather let the layman take the gamble, and then pay him a bigger price if he is successful. He is not going to work that way much longer, however; already there are signs that the enterprising few are undertaking this preliminary work, and when they find it they keep it without bothering the bigger companies.

As everyone knows, prospecting is practically at a standstill at present. Why is it that the large companies do not use some of their trained field engineers in this work and risk small sums upon promising looking prospects? It would not require a great deal of money to do considerable preliminary work, and the chances are that something would be developed in the course of time. After years of labor along the established lines, I am practically convinced that this prospect field offers the best solution of the mining problem today. To be sure, it means that we must become speculators again to a certain extent, but with our present geological knowledge the risk is much less than it was in the early days when it was all a grand big guess; and there are districts in this, and other countries, that are well worth spending some money on before condemning them entirely.

New York, May 20, 1914. A. P. Rogers.

The Disseminated Lead District of Southeast Missouri

In the Jan. 31 issue of the Journal, H. J. Cantwell protests against the conclusions of Dr. Buckley which seem to place a final limit to the disseminated lead field of southeast Missouri. The conditions extant in this field are fairly represented by Dr. Buckley on the one hand and by Mr. Cantwell on the other.

The disseminated-lead mining industry in southeast Missouri yields from $10,000,000 to $12,000,000 annually. Unless the boundaries of this field are extended beyond the present known limits, this great industry will become extinct within a generation. Dr. Buckley's conclusions militate powerfully against the expectations of such extension. The immediate hopeful extension is to the Northwest into Washington County. In this county, while a great tonnage of lead has been produced, the character and condition of the lead is so distinct from the disseminated ores of St. Francois County that no guiding analogy can be drawn. The productive Bonneterre limestones of St. Francois County pass under the Potosi in Washington County and are deeply buried.

The question on which turns the future of the disseminated-lead mining is whether or not, under the cover of the Davis shales and the heavy beds of the Potosi in Washington County, the Bonneterre will be as productive, or productive at all, as they are where exposed in St. Francois County. Owing to the great thickness of the Potosi cover, probably 1000 ft. at least, and from 400 ft. at least to possibly 1000 ft. below this cover to the La Motte sandstones, prospecting shafts are out of the question, and in an unknown field with no limiting guides, diamond drilling with 1500-ft. to possibly 2500-ft. depths will be too expensive to be lightly risked. Even in the exposed and shallow fields of St. Francois County, a man prominent in southeast Missouri mining states that the cost of drilling has totaled to date about $15,000,000.

The above are briefly the conditions confronting the mining situation in southeast Missouri. Yet with even these handicaps men with money and courage to face the forbidding conditions are to be found, were there assurances, not that ore is in the deeply buried Bonneterre, but that there are no final and conclusive reasons against its being there.

As an able geologist of high authority, Doctor Buckley has undertaken to resolve the phase of the question set forth in the preceding paragraph. After several years of personal study of mines and mining data in southeast Missouri his work can be, apparently, summed up in the following syllogism: The disseminated lead deposits in the Bonneterre limestones are formed by

descending solutions. The Davis clay shales are impervious to descending solutions. Therefore, Bonneterre limestone covered by the Davis clay shales will be barren.

Dr. Buckley is not alone in concluding that the disseminated ores of St. Francois County owe their origin to descending waters whose burden of lead was derived from the decomposition of the surrounding rocks. Winslow formally announces his adoption of this theory (Geological Survey of Missouri, Vol. 7, Lead and Zinc, pp. 477, 479-481), not to cite others. As Mr. Cantwell has pointed out, Dr. Buckley is apparently not quite correct in his statement, "that the Davis shale overlying the Bonneterre must have been removed, in part at least, prior to the introduction of the major lead-bearing solutions." I have reason to believe that if not the first, I was one of the first actually to prove the extension of disseminated lead under the Davis shale.

In 1901 I was engaged by the Derby Lead Co. to direct its drilling operations. Twenty-nine drill holes had been bored, only one of them showed commercial lead ore. After careful study of the situation I located a drill hole about 200 ft. to the southeast of the successful hole. This cut rich lead ore. Encouraged by this I located another drill hole 500 ft. to the southeast of the last. The elevation of this drill hole was 150 ft. above the last, and was well into the Davis shale and the Potosi, which stretched unbroken for at least six miles southeast. I was roundly cursed by my drill men for my presumption, but ore just as rich as the preceding holes was here cut.

I mention this incident as demonstrating from personal knowledge the general and fixed belief, at that time, that the disseminated ores would not be found under the Potosi. Plenty of discussions I heard, but no conclusive argument was adduced in support of the general belief. However, this and other similar demonstrations prove nothing, for it is one thing for ore to be found immediately under the eaves, as it were, of the Potosi roof, and quite another to expect similar results under the ridgepole 15 or more miles distant (in Washington County). The ridgepole is certainly 15 miles distant and the roof, everyone is practically agreed, is thick; whether or not it is leaky is an open question. It is also, as yet, an open question as to whether or not the probable roof has any direct influence on the formation of orebodies either by ascending or descending solutions.

It occurs to me that Mr. Cantwell is wasting energy in seeking possible leaks by means of supposititious fractures, erosions, or, possibly nonformations. These are but theoretical makeshifts, and even if they find a goodly clientele they only place themselves in the rank of other speculators—the descensionists or ascensionists. In the face of so formidable proposition as the prospecting of the deeply buried Bonneterre, it is well to scan closely the proposition from every possible view point and to weigh carefully all evidence pro and con. Even speculative geological theories should not be overlooked. But this caution should be rigidly observed: Geological theories as to the origin of orebodies are highly speculative, which is equivalent to a confession that on this subject there is no decisive knowledge.

In my active experience of 25 years with nearly every class of ore deposits, I have come to view with extreme scepticism a line of attack based on geological theories especially theories that deal with the origin of orebodies. Ascensional, descensional, lateral, all these are based on incomplete data of geo-chemistry. Whether mineral-bearing solutions ascend or descend is, or may, be a question of contour, and circulating solutions probably have reversed their direction of flow in obedience to these changing contours. With no violent or even gentle orographic movement a long period of erosion may so change relative elevations as to reverse underground circulation. But amid all these changes of elevation and depression, of changing contours by erosive agents, one factor remains unchanged, though sometimes modified, and this is the lines of folding, and zones of crushing.

One fact in connection with secondary deposits is generally recognized, but, or so it appeals to me, its great importance is often lost sight of in the presence of daring speculations. The fact is this: Before any secondary ore deposit can be formed, either by ascending or descending solutions, the ground must have been prepared to receive it. This statement appeals to me as axiomatic. But the trend of geological investigation appeals to me as being toward the origin, not the loci, of ore deposits.

I do not wish to be understood as decrying or even belittling purely scientific investigations, but it does strongly impress me that investigators are too prone to carry the purely academic into the field of the purely economic, and Mr. Cantwell's puzzle is a case in point. Confessedly he is a layman in matters geological and as such feels incompetent to place due economic value on a geological theory which is, in reality, only an opinion, not a demonstrated fact. Moreover, the force of any given geological opinion is weakened by a lack of harmony among professional geologists. To make direct application of this to the subject under consideration, the question of ore or no ore in the buried Bonneterre in Washington County has turned about a point which can never be finally settled and has, if not ignored, passed lightly over perfectly obviously data. Twenty-three years ago, while assistant state geologist of Missouri, I met Walter Jenny and impatiently listened to his exposition of the controlling factors of the ore deposits of Missouri. My impatience was due to youthful ignorance, for at that time I had not had nearly 20 years of activity as a professional "ore finder" to emphasize the great practical importance of his keen observations and close reasoning.

In conclusion, perhaps it will not be amiss to direct attention for a moment to another great mineral industry. Many are the theories as to the origin of petroleum and bitter and fierce are the controversies between the originators and the defenders of the various theories. Yet the oil prospector pursues the tenor of his way and searches for anticlines, i.e., geo-structural features, the loci, not the origin, of oil pools. Analogously, if disseminated ore deposits are ever found in the Bonneterre of Washington County they will be found in spite of, not because of, any ascensional or descensional theories as to origin, and in strict accord with structural features. The structural features of the lead fields of St. Francois County are well known. There are no reasons against, and many reasons in favor of, these same structural features extending not only into Washington County, but 50 miles farther northwest. The rock preparation is there. And, therefore, presumably, so are the ores. In the study of the rock preparation and its trend, lies the most hopeful field.

FRANK L. NASON.

West Haven, Conn., April, 1914.

Editorials

European vs. American Copper Buying

The American copper manufacturer appears to be betting upon the extraordinary production reported by the refiners in April, figuring that as showing the copper output of the United States to be now at the rate of about 1,800,000,000 lb. per annum, wherefore nobody need worry about there not being copper enough. On the other hand, the producers expect that the manufacturers will some day find that they have been living in a fool's paradise, inasmuch as the reports of the miners and smelters do not show any increase in the production, the conclusion being unescapable that the unusual production reported by the refiners in April was due to some temporary cause.

Whenever copper goes under 14c., Europe takes it liberally, consumers over there arguing that it is cheap at the price and safe to carry for months to come if necessary. The American consumer reasons that while copper may be cheap at 14c., the fact that it has dropped to that price implies that it may drop further, wherefore he is minded to wait until it reaches 13½c., making a mental note to buy then. But if it does go to 13½c., he waits for 13c.

In fact, after Europe has bought liberally and the price begins to rise, the American manufacturer comes into the market and buys on the scale up. When copper really starts upward from the level of about 14c., the most vigorous American buying will probably be witnessed at about 15c. The behavior of the American buyer has been so often repeated that his future actions may be prophesied with confidence. It is notorious that Europe buys copper more advantageously in America than Americans ever do.

Apropos of this some statements made by John D. Ryan, president of the Amalgamated Copper Co., in a paper read at the National Foreign Trade Convention in Washington, on May 27, are directly to the point. Mr. Ryan said:

> In 10 years ending 1913, a number of large copper-producing companies of the United States sold through their several selling agents 5,560,000,000 lb. of copper, of which 2,580,000,000 lb. was sold to domestic consumers, and 2,980,000,000 lb. to foreign consumers, bringing a total of $821,000,000. The foreign buyers paid an average price of 14.38c. per lb., delivered at foreign ports; the domestic buyers paid an average price of 15.21c. per lb. delivered at home, or 0.83c. per lb. more than the foreigners paid. This represented about one-half of the copper produced in this country, and was consumed almost one-half at home and one-half abroad. If we take it for granted that other producers sold at about the same average price, the foreign manufacturers had an advantage of fifty million dollars in that period as against the American manufacturers, in spite of the fact that producers of raw copper have had no tariff protection or any Governmental help to keep domestic prices higher. This was simply the result of the advantage combined foreign buying has had as against competitive selling, and the domestic manufacturer could not take the same advantage because the law of his country was holding him and the foreigner's law was pushing him.

Mr. Ryan was arguing in his paper against the supposed advantages of perfect competition as prescribed by the Sherman law and organization of industry as carried out in Europe. "We meet the combined buyers of Europe in selling our great treasures of the soil, the mines and the forests, and we meet them each of us fighting not only for himself but against his own countrymen, and the combined buying strength makes its terms against the divided sellers' necessity," said Mr. Ryan. "When we load our products on the pier for export, we meet the shipping combine—German-English-French. We pay the rates it fixes in its pools and combinations. We sell our products to the combined buyers of foreign nations and they fix the price at which they will trade. If our producers must sell, they will take the price offered by the foreign combination, or, by waiting until one of them is forced by necessity to sell at a sacrifice, the price for all is reduced."

We may reasonably surmise that the selling of copper during the last 10 years to which Mr. Ryan referred was a citation of the experience of the United Metals Selling Co., a subsidiary of the Amalgamated. According to Mr. Ryan's figures, the sales in 10 years were 5,560,000,000 lb. at an average of 14.82c., delivered to the buyers in Europe and America. This would be equivalent to 14.62 @ 14.67c. net cash, New York. Another great selling agency—Phelps, Dodge & Co.—in its last report gave its 10-year average for copper sold, this being 14.56c. per lb., net cash, New York. This figure includes the proceeds of some casting copper, which reduces the average as compared with electrolytic alone, while Mr. Ryan's figures probably include some Lake copper which raises the average. Allowing for these things the approximate agreement in the returns is rather striking.

These figures are interesting and important not only in bearing out the contention that the European manufacturers buy copper more cheaply than do the Americans, but also in showing what has probably been the quantitative average price received for copper during the last 10 years. Assuming the other agencies to have done about as the two reported, it may be reckoned that the quantitative average was somewhere between 14½ and 14¾c. This is less than the arithmetical mean of the quotational averages for the same period, which is 15.06c.

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Invention and Learning How

In discussions of mining and metallurgical patents, we have repeatedly pointed out the absence of invention in many of the great cases that have figured in the courts, and have argued that the success of many of the new processes, which admittedly have contributed largely to the advancement of the art, has been due not to any invention, but simply to the learning how to apply some old idea. A very instructive example of just this thing occurred last week in a matter of general interest, although it has nothing to do with mining and metallurgy.

Dr. Samuel P. Langley, for many years director of

the Smithsonian Institution, devoted much of his life to the study of aëronautics and the development of an aëroplane. More than 10 years ago he constructed an aëroplane with which attempts to fly were made. In its second and last failure to fly, on Dec. 8, 1903, the machine fell into the Potomac River, whence it was recovered, since when it has hung in the Smithsonian Institution as an exhibit. "Langley's Folly," it was called.

Recently, for purposes of study and further trials, the old machine was taken to Hammondsport, N. Y., where, on May 28, it was successfully flown by Glenn H. Curtiss, the well known aviator. Doctor Langley and Dr. Charles M. Manly, his associates, and other scientists, always believed that the earlier failures were due to the imperfect launching device and not to the machine itself. The actual flight on May 28, 1914, proved the correctness of their belief.

Here, then, we have a case of a machine that was apparently a failure, and was pronounced a failure, being found to be a success, no alteration of the original design having been made, when tried by a man who had in the meanwhile learned the art of aviating. All depended upon the knowing how to run the thing. So it is with many mining and metallurgical processes. In this case, it is particularly gratifying that the honor earned by Doctor Langley has finally come to him.

Some Reflections on the Mexican Situation

There is a phase of the Mexican question which does not seem to be sufficiently realized; i.e., the unfortunate ownership and operation of the great industries of the country by foreign capital, the dividends flowing abroad instead of being used at home for the further development of manufacturers and commerce. In this respect Chile and Argentina afford a striking contrast to most of the other Spanish-American republics, and it can hardly be accidental. They were the poorest of the old Spanish provinces, producing little or none of the precious metals, which were the food upon which Spanish colonial vices were fed.

The Spanish bureaucracy was rampant with all its evil influences in Mexico and Peru, including Bolivia, where the enormous wealth in silver created vice, as wealth does everywhere. Chile fortunately escaped because poor, and we see the results today in honest government and active industry carried on in great measure by the Chileans themselves. When Chile was at the height of its copper production in the '70s, occupying in the world relatively the same position as regards copper production as we do today, the big copper mines were owned and operated by Chileans, which used the profits for the development of the country instead of exporting them. The Mexican government, under Diaz, appreciating the necessity of controlling and owning the railroads, took perhaps the first step toward remedying this great national defect.

It is not the fault of foreign capital that the Mexicans themselves have not the courage to work their own mines and develop their own agricultural resources, for they have the ability and, when necessary, could employ foreign skill, as the Chileans did. Conditions being as they are, the Mexicans can simply grumble and vent their jealousy against the foreigner, who is doing what they ought to do themselves, but one sees no inclination on the part of the wealthier classes at large in Mexico either to combine with foreign capitalists or to follow their lead in developing their great mineral resources, and still less over the country at large to adopt modern methods of farming and utilizing the prodigious agricultural capabilities of the country south of the City of Mexico. If the revolution could stimulate Mexico as the Civil War stimulated this country, it would mark an era of progress that would be a turning point in the history of the republic. Unfortunately, however, the ideals of none of the parties who are struggling for supremacy are as elevated as those which inspired the dominant forces in this country in 1860.

What Is the Matter with Business?

During nearly two years the world's finances and business have been in an unsatisfactory, even in a dangerous, condition. The trouble has been worldwide and has been particularly discouraging because of its prolongation. Primarily, the demands on Europe's capital were stretched too far. Europe, and France in particular, had put large sums of money into enterprises, both public and private, in Brazil and Argentina. Public works and new railways in Canada had made great drafts upon British capital. Germany had been overdoing things in industrial enterprises. Conditions were sounder in the United States, but even here the banking situation was below the mark and there were forebodings of stringency of money. This was the situation when the Balkan war precipitated a crisis. Europe began immediately to liquidate securities, especially Americans, because for them there was the best market. Our stock market declined naturally, but the manner in which the United States absorbed Europe's liquidations was impressive and was indicative of the inherent soundness of American affairs. However, these events produced conditions from which American business was bound to suffer.

A little later a reduction of the tariff was passed at Washington. While this will in the end be beneficial, no doubt, disturbance and uncertainty naturally followed the readjustment of an old system. Another condition of uncertainty was introduced by the enactment of currency legislation. This was greatly needed, and what was done is probably good, but just how it is going to work nobody yet knows precisely. People have become more or less used to these things, but the program of the new administration is not yet finished, and it is uncertainty and fear regarding what is yet to be done that is causing the stagnation in business in the United States.

In a statement issued last week the President said that he was aware of the present depression of business, but thought he had abundant evidence that it is merely psychological; that there is no material condition or substantial reason why the business of the country should not be in the most prosperous and expanding condition.

His diagnosis as to the psychological condition is probably correct, but it does not take into account what produces that condition. In fact, business sees a determination to enact more and more legislation, for which there is no real demand outside of the labor unions which desire to be an exempt and privileged class of people, and

to which the administration has apparently surrendered, an endless chain of investigations, the only purpose of which is to produce headlines for the newspapers and the furthering of private ambitions, an interstate commerce commission which hesitates in playing fair with the railways, an administration of affairs by incompetent persons, and demagogues rampant. In these circumstances, the policy of business is simply to watch and wait. The country is just living. Supplies are bought in such quantities as are required for current consumption, but mere maintenance is being skimped, relatively little new work is being inaugurated, and little provision is being made for the future, in the matter of housing, transportation, etc. This is why business is dull.

Of course, the country will some day get over its fears. Increase in population is one thing that goes on unaffected by politics or even downright hard times. The work to provide for it that ought to be going on, but is being delayed, will have to be done sooner or later. The longer it is postponed the more rush to do it will there be. It is the common opinion that lately sentiment has been improving a little. Perhaps after Congress adjourns and there is a relief from irritation, everybody will begin to feel better.

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The Butte & Superior Copper Co. has just begun the system of making very full quarterly reports to its stockholders, as all of the other Jackling-Hayden-Stone producing companies have been doing for several years. It is gratifying that these companies, all of which have been such brilliant successes, have adopted the policy of promptness, fullness and frankness in the information that they communicate to their stockholders.

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Interesting plans are being made for the meeting of the American Institute of Mining Engineers in Utah next August. It is aimed to repeat the brilliant success of the Butte meeting last year. The Utah Copper Co. will, no doubt, seek to emulate the Anaconda in making a liberal contribution to the records of technical literature.

BY THE WAY

The bush and forest fires which have been raging in the country about Cobalt, have been a source of danger and annoyance. Strenuous efforts have been required to prevent the destruction of some of the plants. A complication is that these fires have been destroying the power-line poles, so that some of the plants have been compelled to shut down for periods varying from a few minutes to the greater part of a day.

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The study of efficiency is going pretty far when it makes the office boy the subject of its investigations. However, Dr. E. H. Arnold, of New Haven, Conn., has been doing just that thing, and reports that by dragging his feet along the floor, instead of allowing them to swing forward of their own momentum, the office boy makes his muscle move about 20 lb. every time he takes a step, and the average boy takes about 1500 steps a day. Doctor Arnold figures consequently that "the average office boy, through lack of control over the muscles of his legs, wastes as much energy in walking about the office each day as it would take to shovel 15 tons of coal." Let the conservationists immediately get after this terrible waste and do something about it. What is the use of letting corporations develop the unharnessed water powers, mortgaging the rights of future generations, when so much waste power may be got out of office boys?

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Several members of the Rocky Mountain Club were recently entertaining a mining engineer upon his return to New York from Honduras. The conversation turned to snakes. The engineer said: "One time I was in a surveying party when a rodman called out that there was a large snake in his vicinity, so I went over, and sure enough, there was. So I picked up a rock ———." "Yes, yes, we've hear that story before," interrupted one of the clubmen, "you noticed that the rock was heavy, looked at it and saw it was specked with gold, so you staked the 'Rattlesnake' claim on Rattlejack Creek, in Snakebite Gulch and got stung." "Not a bit," replied the engineer. "That rock was zinc, I knew it when I picked it up. I could tell by the heft of it, besides, I felt zinc in the air and felt its emanations. I didn't have to look, even if I were not perfectly aware of the fact that I was standing on the apex of the 'Blue Smoke' lode. No gentlemen, the point is this, we didn't discover that this snake had a rattle on the end of his tail until we plunked him with those zinkiferous rocks. We knew he was watching us all the time by the way he would turn his head whenever he moved. No, that yarn about a rattlesnake's always giving warning when he's going to strike is just as true, as, as——well, did you ever hear a mule bray just before he kicked."

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The cash prize of $750, offered by the Anaconda Copper Mining Co. last year to the mine foreman having the least number of serious accidents at the property in his charge for the year ended Mar. 31, was won by Dan P. Sullivan, foreman of the Original mine, the second prize of $250 was awarded to K. P. Kruger, of the West Colusa mine. This is one of the features in the "Safety-First" movement inaugurated by the company. The cash prize offer will be continued for the current year. The receipt of the first prize was acknowledged by Foreman Sullivan by the following poem, directed to General Superintendent Gillie, written by the "poet laureate" of the mine:

Your letter received and contents noted
With check inclosed and the figures quoted.
Now we rustled hard, as you all know,
To protect the heads of the lads below.
From morning till night Chope was raising hell
Because the chutes were not covered well.
And Shea was tearing around like a hound
Because the miners had not timbered bad ground.
And Donahoe, our noted safety engineer,
Into the whole gang put great fear.
And Malloy, Boehme, myself and Jay
Had to keep cases from day to day.
Watching Irish, Cornish, Finns and Norwegians,
Lest they should depart for other regions.
Yes, watching like night-owls to get them back;
Early and late we were on their track.
Our shift bosses, too, were always there with a warning,
Although they did want a big run for the morning.
We had not a serious accident until October;
Then we felt quite sure we would slip it over.
February and March seemed to look quite blue
But we knew the others were getting theirs, too.
Then April came. Oh! you know the rest,
We were told the Original came out best.
So next year we will rustle and do what we can
To be on the job and get the money again.
So many thanks, Mr. Gillie; we will be on our way,
For it takes 1000 tons daily to make the joint pay.

PERSONALS

J. Parke Channing has returned from Arizona.

Dr. James Douglas has gone to Arizona for a three-weeks tour of inspection.

Gerald Sherman, superintendent of the Copper Queen mines, has been in New York.

Horace V. Winchell, who went to Europe about the end of April, will be back in New York about June 27.

Robert E Cranston is making an examination of the Humboldt mine, near Ouray, Colo., assisted by J. H. Hooper.

R. W. Brock, Dominion Deputy Minister of Mines, and D. B. Dowling, of the Canadian Geological Survey, have made an examination of the Calgary oilfields.

William Young Westervelt, who has been in southern California, returned to New York in time to attend the celebrations of the Columbia School of Mines.

A. R. Gordon, general manager of the New York & Honduras Rosario Mining Co., at San Juancito, Honduras, has returned to the property after a vacation in the United States.

T. N. C. Nevill, of the St. Helens Smelting Company, antimony refiner, Manchester, England, sailed from New York last week after a business trip in the United States and Canada.

Percy E. Barbour has resigned as manager of the Uwarra Mining Company, Candor, N. C., and will spend the summer in Maine. H. Granger Gaither, secretary, has assumed charge of the mine.

Charles F. Rand, president of the Spanish-American Iron Co., past president of the American Institute of Mining Engineers, has been made a member of the Order of Isabella Catolica and decorated by the King of Spain with the grand cross of a Knight Commander.

B. J. Padshah, Bombay, India, managing director of the Tata Iron & Steel Co., Sakehi, Bengal, is in this country to canvass the situation with a view to shipping rails and pig iron from the Tata plant to the United States. He will also visit Canada on the same errand.

Harry P. Sweeney has been appointed general superintendent of mines for the Thomas Iron Co., with headquarters at the Richard mine, Wharton, N. J. Mr. Sweeney is a graduate of the Massachusetts Institute of Technology and has had experience in Pennsylvania and in the West.

S. W. Traylor, of the Traylor Engineering & Manufacturing Co., intends to leave in a week or two on a prolonged tour of inspection through the western mining districts. He will go out through the Northwest and will go as far as Alaska; and will return through the Southwest.

Edward T. Stotesbury has resigned from the directorate of the Cambria Steel Co., and from the executive committee of the Pennsylvania Steel Co., E. E. Slick, vice-president and general manager of the Cambria company, has been elected to the directorate of that concern, succeeding Mr. Stotesbury.

Guy M. Kerr, superintendent of the Arkansas Valley smeltery of the A. S. & R. Co., Leadville, Colo., has been transferred to the corresponding position at the Garfield, Utah, plant and will reside in Salt Lake City. J. F. Austin, recently superintendent of the company's Monterey, Mex., smelting plant, succeeds Mr. Kerr at Leadville.

E. T. Stuart, treasurer and assistant secretary of the Cambria Steel Co., has resigned to become treasurer of the Pennsylvania Steel Co., succeeding E. M. Smith, resigned. A. P. Robinson, vice-president of the Cambria Steel Co., has been made treasurer to fill the vacancy left by Mr. Stuart. Philip B. Burtes has been made assistant treasurer.

J. B. Tyrrell, who is at present in British Columbia, will stop at Calgary on his way back to Toronto in order to inspect the new oil discoveries. Nearly 30 years ago, when a member of the staff of the Geological Survey of Canada, Mr. Tyrrell made a thorough investigation of the rocks of the Province of Alberta, and his report on the geology of the country is still the standard work of reference on the subject.

Judge George Gray has resigned his position as judge of the Circuit Court of Appeals of the United States for the third judicial circuit. He retires on account of his age, 74 years, after many years service on the bench, and previously in the United States Senate. Judge Gray has acted in nearly all the suits against the anthracite coal roads and in the suit against the Steel Corporation. He was chairman of the Anthracite Strike Commission of 1902.

OBITUARY

Charles Gardner Lathrop died at Stanford University, Calif., May 24, aged 65 years. He was a brother of Mrs. Leland Stanford and had been treasurer and business manager of the University for a number of years, retiring only a few months ago on account of ill health.

SOCIETIES

Montana State School of Mines—The junior and senior classes of the school left for the Black Hills, May 18, to study mining, metallurgy and geology for two weeks. The professors in charge of this trip were President C. H. Bowman, Professor Theodore Simons, for mining, and Professor D. C. Bard, for geology.

Engineers' Society of Pennsylvania—The regular monthly meeting of the Engineers' Society of Pennsylvania will be held on Friday evening, June 12, 1914, at the rooms of the Society at 31 South Front Street, Harrisburg, Penn A lecture, illustrated by stereopticon slides, will be delivered by J. H. Tracy, assistant chief engineer of the Electric Storage Battery Co., of Philadelphia, on the subject of "Storage Batteries."

Stanford University—Out of the 275 graduates Stanford University has sent forth from the geological department, 70 answered the roll-call for a reunion during the commencement week exercises. The reunion was in honor of President John C. Branner, formerly head of the geological department and Professor James Perrin Smith. A campfire dinner was served in the hills back of the university grounds. Prof. Smith was presented with a gold watch and fob, the latter a replica of an ammonite fossil, found in Northern California by him. The trail to the camp fire was blazed with signs representing the old mining camp days of the state.

University of Illinois—The senior class in mining engineering at the university has recently returned from a trip of inspection, including the cement quarries, underground mines, and manufacturing plants near Oglesby, Ill. The longwall mines near LaSalle were also visited and the geology of the LaSalle anticline was studied; and the zinc plants and rolling mills of LaSalle visited. The party also visited the steel works at South Chicago and Gary, Ind., and various plants in Chicago, where mining machinery is made; and thoroughly inspected the accounting systems of some of the large coal companies, whose offices are in Chicago.

NEW PATENTS

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

CRUSHING—Shaft Coupling for Grinding Mills. Charles E. Needham, Allentown, Penn., assignor to Bradley Pulverizer Co., Boston, Mass. (U. S. No. 1,095,986; May 5, 1914.)

CYANIDING—Process of Dislodging Slime Cakes. George W. Shepherd, New York, N. Y., assignor to the Butters Patent Vacuum Filter Co., Inc. (U. S. No. 1,096,132; May 12, 1914.)

DRILL—Fluid-Presure-Actuated Tool. George H. Gilman, Claremont, N. H., assignor, by mesne assignments, to Sullivan Machinery Co., Boston, Mass. (U. S. No. 1,095,848; May 5, 1914.)

DRILL-BIT—Expansible Drill-Bit. Albert J. Snow, Los Angeles, Calif. (U. S. No. 1,095,475; May 5, 1914.)

DRILL-BIT—Fluid-Actuated Drill-Bit Forming, Sharpening and Shanking Machine. John George Leyner, Denver, Colo. (U. S. No. 1,096,437; May 12, 1914.)

DRILL SHARPENING—Dolly-Driving Mechanism for Drill-Sharpening and Other Machines. John George Leyner, Denver, Colo. (U. S. No. 1,096,438; May 12, 1914.)

DUMPING CAR. John Karhu, Calumet, Mich., assignor of one-half to Richard T. Looney, Hancock, Mich. (U. S. No. 1,095,879; May 5, 1914.)

ELECTRIC FURNACES—Improvements in or Relating to Electrode Holders for Electric Furnaces. Fried. Krupp Akt., Essen, Germany. (Brit. No. 5414 of 1914.)

EXCAVATION—Point for Dipper Teeth. Frank A. Tipping and Frank R. Tipping, St. Paul, Minn. (U. S. No. 1,095,605; May 5, 1914.)

FERRO-ALLOYS—A Process for Increasing the Yield of Chromium in the Alumino-thermic Production of Carbon-Free Ferro-Chromium Alloys from Chrome-Iron Ores. Th. Goldschmidt, A. G., Essen-on-the-Ruhr, Germany. (Brit. No. 10,879 of 1913.)

Editorial Correspondence

DENVER—May 28

Coal Miners' Strike is being given an unusual amount of attention by metal-mining men. Although Federal troops are maintaining quiet in the coal districts, it is generally conceded that the good behavior of the strikers is so forced that it cannot long endure, or, at any rate, that it will vanish with any removal of the troops. Disinterested observers wonder how long it will be until the anarchistic tendencies of the ignorant strikers will be expressed in violent terms toward the U. S. troops as they were toward the militia. Military rule does not agree with the doctrines that have been preached to the dupes of the agitators. So zealous have been these itinerant trouble-makers during the last few years that there has been developed a following of irresponsible strikers whose lawlessness is well nigh beyond the control of the leaders. Investigating minds have been deciding that the labor trouble is not properly nor exclusively a Colorado affair. It appears that this state has been seized upon as the stage for putting on an act that is national in its scope. This being so, it would seem that the Government's military and judicial branches should assume absolute authority and should make it known generally that the trouble is of national significance. Small progress is being made by the mediation committee appointed by the recent special sessions of the Colorado legislature. Mine operators maintain the attitude, in which they are well fortified, that they have nothing to arbitrate, while the leaders of the United Mine Workers adroitly avoid pledging themselves to abide by any mediation.

State Metallurgical Works are proposed and a petition is being circulated calling for the submission to Colorado's voters, next November, of a constitutional amendment bill that, if enacted, will establish a $4,000,000 bonded indebtedness against the state. The funds so derived are to be used "to promote the general prosperity of the State by constructing and operating two State ore milling, smelting, sampling and assaying plants and works, and one State ore milling, smelting, refining, radium extracting, sampling and assaying plant and works in the State of Colorado, to be used for assaying, sampling, milling, smelting, refining or otherwise treating the various ores of the state." The bill provides for the creation of the State smelting commission to consist of the governor, attorney-general and state treasurer, with two other members whom these three shall appoint. One of these appointees must be a skilled supervising engineer, while the other must be a skilled metallurgist and assayer. Each skilled official will receive a salary of $5000. The only remaining salaried official provided for in the bill is a secretary at $2500. All officers and employees are to be allowed legitimate traveling expenses. Bonds will be required from all persons holding responsible positions. The commission will have power to build, lease or purchase plants, and activities must start within 90 days of the enactment. A sinking fund to retire the bonds will be derived from a 5% royalty to be charged on the net value of all ores treated, and for this purpose "net value" is defined as the amount remaining after all transportation and actual treatment costs have been deducted from the gross value of the ore treated. When all bonds have been canceled, the royalty charge will be discontinued. Sites for the proposed plants are Denver, Pueblo and Durango. All materials, equipment and supplies must be purchased within the state.

SALT LAKE CITY—May 28

Bingham & Garfield R.R. Bonds amounting to $913,500 have recently been exchanged for Utah Copper stock. The conversion right expires July 1 and bonds are subject to call at $110. It is expected that when all the bonds have been converted, the cost of copper production will be reduced ¾c. per lb. At the present price of the stock, there is a profit of $6 to $7 per share on the exchange.

International Smelting Co. of Montana is the name of the company now operating the Tooele smelting plant. On May 26 this company took over the interests of the International Smelting & Refining Co. Articles of incorporation of the new company have been filed with the secretary of state. The capitalization is $15,000,000, divided into shares of $100 each. Cornelius F. Kelly, of Butte, is president and David B. Hennessy, secretary. The directors are John D. Ryan, C. H. Sabin, Dennis Sheedy, B. B. Thayer, W. D. Thornton, A. H. Melin. William Wraith continues as manager, and there will be no change in operation. The taking over of the International Smelting & Refining Co. was authorized by the Anaconda directors, on the basis of 3.3 shares of Anaconda for one share of International. This offer was accepted by the International stockholders.

BUTTE—May 27

Barnard Realty Co. vs. J. P. Nolan & Albert O'Brien suit in equity to quiet title to 34 acres of mining ground in Missoula gulch on the west side of Butte, began in the Federal court May 22. The plaintiffs obtained a placer patent to the ground in dispute in 1875, giving them the right to mine all except quartz in a strip 4000 ft. long and 300 ft. wide. The defendants have within the last two years located six lode claims, the Syndicate, Triumph, Gagnon Extension, Original Extension, Modern, and Original-Gagnon. A number of the claims parallel each other and cross the placer ground from side to side. The defendants are seeking to prove that the plaintiffs knew of quartz on the property when it was patented as placer ground, and that the placer patent does not prohibit quartz mining.

HOUGHTON—May 29

Old Colony shareholders in the Lake Superior copper country believe that the management should follow exploration and development, which have shown commercial rock by shaft work. It is generally expected that the first shaft will be started some time this summer. The recent assessment of $1 per share provides funds for such work. Following the drill results at both the Old Colony and the Mayflower, a shaft could be situated as to prove up the lode in each.

Mass Consolidated is turning out a larger rock tonnage now than at any time in the history of the property. When the strike was called this property was in good shape. For two years the manager had been making every effort to bring the underground openings to such a state that he could materially increase rock shipments to a point where the tonnage would result in a maximum of copper output, realizing that the Mass's only salvation rested in operation on a scale at least twice as large as formerly. In the meantime stamp-mill work had been conducted with the same idea in view and the milling plant was remodeled. At present the Mass has three years' of underground openings in advance. It has a larger force of men at work underground than ever before. It is getting out more rock and it is securing more copper from the rock. The production of copper for the month of June will break all records. The month of May will show a larger output than any month in the last three years. Altogether there is only one possible contingency that can interfere with the assured success of the Mass under its present management and that is a sharp decline in the price of copper.

DULUTH—June 1

In Case of W. D. Washburn, Jr., vs. Gregory Co., it has been held by the Minnesota supreme court that where mineral interests in real estate are owned separately from surface interests, such mineral interests are land taxable as such, and should be taxed separately from surface interests. It was further held that, in case such land be sold for nonpayment of the taxes levied on the surface (there being none levied on the mineral), and the tax certificate issued gives the Government description of the land without mentioning any mineral interests held separately from the surface, nevertheless the tax sale does not include the mineral interest. Much land on the Minnesota iron ranges is held in this manner and the question of taxation of mineral rights has long been a subject of contention.

NEGAUNEE—May 29

Iron Furnaces to Go Out of Blast within a month include the furnace of the Stephenson Charcoal Iron Co. at Wells, a suburb of Escanaba, Mich., which will go out of blast June 20, according to present plans. The Mashek Chemical Co., operating at the same place and which furnishes the charcoal for the Stephenson stack, will also stop work. The suspensions will be for at least three months, and may be longer, unless

market conditions improve. The Stephenson company has in stock 7000 tons of pig iron. The Mashek company has on hand 1,500,000 lb. of acetate of lime. More acetate is said to be in storage in the United States than at any previous time. The stocks of pig iron are also said to be unprecedented. Officials of the Wells companies are quoted as saying that their operations the last few months have not been profitable. There will be a partial suspension at the plant of the Pioneer Iron Co., at Marquette, July 1, a month later than the date announced recently. The production of pig iron will then be stopped, but the operation of the chemical plant will continue and the curtailment of the working force will not be material. Furthermore, it is said to be likely that the furnace will not be out of blast for more than a few weeks, although this is not definitely known as yet. The stack is in need of repairs. Like other furnaces in the Lake Superior district the Pioneer plant is now carrying a heavy stock of iron. By July 1, the Lake Superior Iron & Chemical Co.'s plants both at Manistique and Newberry, Mich., will go out of commission. The Steel Corporation's production of iron will not be greatly curtailed, however, for the reason the furnaces at Ashland, Wis., and Elk Rapids, Mich., will be in blast. While repair work is to be done, the suspension at Newberry will affect 150 men. The plant produces approximately 2500 tons of charcoal iron, 35,000 gal. of wood alcohol and 900,000 lb. of acetate monthly. Much repair work will be done at Manistique and a start made with the installation of the proposed retort system.

IRON RIVER—May 30

Shipments from the D. S. S. & A. R.R. Dock at Marquette are being made after a suspension of a fortnight. The traffic on the Duluth South Shore and Atlantic is, however, much less than normal. On the Menominee range, the Pewabic mine at Iron Mountain has curtailed production and is operating at present on half time.

SEATTLE—May 25

Data for the Government Railroad in Alaska will be gathered by a commission, the first member of which to be appointed is Thomas Riggs, Jr., formerly chief engineer for the Alaska boundary survey. He arrived at Seattle recently where he made the following statement: "I will leave Seattle June 3, ahead of my colleagues, and will go direct to Fairbanks to take charge of the northern section of the work, covering the territory from that city to Broad Pass. Lieutenant F. Mears, formerly chief engineer of the Panama R.R., will have charge of the survey from Broad Pass to the mouth of the Susitna River, and from there to Seward the work will be in charge of W. C. Edes. Our surveys will be location surveys merely, and our selection will not necessarily mean that the proposed road will be built on the line selected by us. The line we are to survey is the one about which there is the least information. There will be eleven locating parties in the field, and our work will take until the middle of October, when, in all probability the locating engineers will meet at some point on Prince William Sound. No construction work will be done until the surveys have been completed and the President has decided upon a route. We will first develop the harbor of Portage Bay, using that as a possibility. Less is known of it than of the other proposed terminals. No surveys will be made from Haines to Valdez. The objection to that route is that it runs through Canadian territory, and the Valdez route is already well known. A branch line survey will be run from Mile 140 on the Alaska Northern survey to the Matanuska coal fields, and another will be run from Chitina on the Copper River & Northwestern R.R. to the same points. A third survey will be run from Healy Crossing on the Nenana River through the Bonnifield and Nenana coal fields to Fairbanks. A reconnaissance party will be sent to look for a possible route from Seward, on the Alaska Northwestern line, to the valleys of the Kuskowim and across to Iditarod. This party will try to locate a pass. After the surveys are completed, the engineers in charge of the parties will meet at some point on Prince William Sound to gather data on harbor facilities and to check up surveys already well known. Data will be gathered on local conditions and estimates prepared for the cost of construeting a Government road over the lines surveyed. We do not expect to do any work between the Copper River & Northwestern R.R. and the Bering River coal field this summer, as a good survey of this route is already at our disposal. The proposed survey will extend up the broad valley of the Susitna, across into Cholitna, go up that river to its head, over into Broad Pass and down the Nenana to the Tanana River. The survey may then follow the Tanana to Fairbanks or may leave the Nenana River at Healy Crossing and go through the Nenana coal field into Fairbanks. This feature will be determined after a visit to the ground. A probable northern terminal is Fairbanks, and Portage Bay or Seward may be decided on as a southern terminal. The Cordova and Valdez routes which are better known are also possibilities. If the road is extended to the Yukon the main line would either cross at Nenana, or by going from Healy Crossing would cross the Tanana at Fairbanks. The personnel of the party already is practically completed, and we have more than 5000 applications in. We will need 100 men, and, as far as possible, we have chosen from Alaska, or men who have had Alaskan experience. The survey parties will be compelled to depend upon the game in the country for fresh meat." Riggs, who went to Alaska first in 1898, joining the rush to the Klondike, has more recently and since 1906 until last year been a member of the Alaska boundary survey, which had charge of the running of the 141st meridian boundary line between Alaska and Canada. He is 40 years old and a native of Maryland. He graduated from the scientific school of Princeton in 1894. Lieutenant F. Mears, who will sail for Alaska June 15, was chief engineer of the Panama R.R., and was recommended to the President by Colonel Goethals. Before he entered the Army he was engineer under John F. Stevens on the Great Northern R.R. William C. Edes, the other member of the commission, carried the Santa Fé and Southern Pacific through some of the most difficult stretches of southern Arizona and New Mexico and has served on those roads as chief locating engineer for the last 25 years.

TORONTO—June 1

Inspection of the Calgary Oil Fields has been made by R. W. Brock, Canadian Deputy Minister of Mines, and he has issued an important statement as to the value of the strike at the Dingman well and its bearing on the problem of the occurrence of oil in commercial quantities. He states that it strengthens if it does not justify the conviction always held by the survey, that the Northwest affords one of the most promising fields for oil prospecting still remaining undeveloped. The well while much more profitable as a producer than a well of similar capacity of ordinary crude oil would be, is not as satisfactory an indication. At a depth of 2700 ft. oil was struck that quickly rose to a height of from 2000 to 2200 ft. in the well. With it is some gas which occasionally causes a spurt of gas and oil from the mouth of the well. The oil is a "white oil" like the small amount of oil encountered higher up in this well last fall. It is 64.5° Beaumé, almost pure gasoline, so that in its crude state it is a satisfactory substitute in motors for the refined gasoline of commerce, merely having to be strained. The well is situated at the base of the foothills on the apex of a saddle-like fold in the rocks which is roughly a mile or more wide, dipping steeply on both its eastern and western limbs. Its direction is northwest and southeast, or about parallel to the front of the mountains. It is cut off by a fault on its western limb. This break is followed by several small folds before the rocks become badly folded and broken toward the mountain front. These folds bring to the surface rocks, lower in the geological scale than those found on the basins. While tertiary rocks are found on the plains and on the eastern and western limbs of the Dingman fold, the surface rock is the underlying cretaceous, an important feature, as the possible oil-bearing rocks are low down in the cretaceous. The structure or altitude of the rocks is favorable, for oil will rise to the highest point permitted by underground conditions. This structure determined the location of the well. When "white oil," almost pure gasoline, was encountered last fall it confirmed previous favorable indications, representing the lighter portions of the oil that had filtered from the main body. The present strike leads naturally to the supposition that the drill has made an approach to an oil reservoir. There may perhaps be a notable quantity of the high-grade oil, but this is still to be demonstrated. The history of other fields has been that these white oils are limited in quantity. The strike while encouraging, has not demonstrated an important commercial field. The area for prospecting is limited east and west. Immediately east of this anticline, not only is the structure unfavorable, but the possible oil-bearing rocks are too deeply buried for much hope of the oil horizon being reached by the drill. The belt of highly disturbed and broken ground in the foothills puts a western limit to any possible oil zone. It is therefore a comparatively narrow belt with a trend roughly parallel with the mountains that affords any reasonable prospect for oil. Brock concludes with a warning to investors that drilling in these formations is extraordinarily expensive and that prospecting should be undertaken only under intelligent technical direction. Investors should assure themselves that the company has sufficient capital to put down several wells and that an expert of repute has examined the ground and pronounced it worth prospecting.

The Mining News

ALASKA

ALASKA MEXICAN (Douglas)—In April, 19,845 tons of ore milled yielded $46,477 or $2.37 per ton; net profit, $18,873.

ALASKA TREADWELL (Douglas)—In April, 80,724 tons of ore yielded $187,155 or $2.34 per ton; net profit, $103,952.

ALASKA UNITED (Douglas)—In April, 18,984 tons of Ready Bullion ore yielded $46,262 or $2.46; 700 Claim ore, 17,703 tons milled, yielded $25,914 or $1.48, net profit and net loss being $20,630 and $7312 respectively.

ARIZONA

Gila County

IRON CAP (Globe)—Because of development work, mine showed a reduced output during first part of May. It shipped one carload daily in latter part of month from 800 drift alone, reaching a yield for month of 16 cars. The 800 east drift has been prepared for stoping by raises and building of chutes for a distance of 300 ft. and preparation for similar opening is in progress for still another 100 ft. beyond. On same level drifting has been started westward to prospect vein in that direction.

SUPERIOR & BOSTON (Globe)—Shipments to El Paso smelter continue at rate of 100 tons daily. No. 84 stope now has a solid showing of ore in back for 200 ft. and to east development on same level is showing up well. No. 1 sublevel has ore in west drift, and in east drift, where drifting is in progress to connect with raise recently started from 800 toward 600, ore has also been encountered. As soon as drift connects with raise, now at the height of the former, the latter will be continued to the upper level. On 1000 work still continues in foot wall where drifting will probably continue 200 ft. to eastward before vein is encountered. Quo Vadis fault, which was struck on 600 some time ago, is about that distance from present workings on 1000.

INSPIRATION CONSOLIDATED (Miami)—Riveting was started on concentrator building May 25, eight gangs of four men each being employed at this work. Hanging of bin plates for concentrator, ore and pebble bins is completed and riveters will be put to work on them in a few days. An interesting fact in connection with riveting is that 140,000 rivets will have been driven when American Bridge Co. completes its contract. All columns of concentrator building are being wedged to proper elevations preparatory to grouting. Forge shop at concentrator is nearly finished, forges, hammers, rolls, punching and shearing machines being in place and all in use. A 640-cu.ft. air compressor, which supplies air for forges, hammers, etc., is also supplying air required by riveters.

MIAMI SMELTING PLANT (Miami)—Oscar Daniels company has a force of 40 men at work at smelter site. Concentrates receiving pocket is completed and steel is being erected on 12,000-ton bedding bins, also on boiler house of power plant. Steel is arriving daily for various units of plant. There will be over 6000 tons, or nearly as much as required by Inspiration Consolidated mill. Excavations are completed for two oil-storage tanks situated on top of hill just to east of power-plant site. These tanks will have a combined capacity of 30,000 bbl., or nearly 1,000,000 gal. An idea of their size may be gained from fact that a cylindrical tank 20 ft. in diameter would have to be 400 ft. in height in order to have same capacity. Eight carloads of Stirling boilers and accessories have been received and 13 more are due to arrive soon. These boilers, of which there will be seven units, are to be heated from waste gases from reverberatories. Available power, which will aproximate 2000 hp., will be used for various purposes about plant.

Pinal County

KELVIN-SULTANA (Kelvin)—Excavations for new concentrator are practically completed. In mine, work has been suspended on 300-ft. level. Drifting continues on 400 ft. Diamond Jo shaft is being retimbered. Sinking has been stopped on main working shaft while station is being cut on 500-ft. level.

Santa Cruz County

RUBY COPPER (Patagonia)—Lee shaft is now down 500 ft. At bottom, ore is 4 ft. wide assaying up to 6½% copper. A crosscut has been driven 50 ft. in 2% ore on this level.

Yavapai County

EMPORIA (Prescott)—Drifts recently extended from old workings continue in ore. Shaft has reached a depth of 200 ft. A car of ore was shipped to Douglas recently.

R. A. M. (Prescott)—Work has been resumed on mine in Little Copper Creek section, 10 miles south of Prescott. Shaft is to be sunk 75 ft. further to get under old workings and if results justify it a new working shaft will be sunk.

Yuma County

CLIP (Yuma)—J. P. Jones, of Los Angeles, has purchased this mine and tailings dumps. Mine and mill have been closed for 25 years. Old dumps will be worked over by cyanidation. Mine will be opened up and later mill will probably be remodeled.

CALIFORNIA

Amador County

SOUTH EUREKA (Sutter Creek)—Shaft repairs are nearly completed. Work will greatly facilitate handling ore for 80-stamp mill.

EUREKA (Sutter Creek)—Representatives of owners of this property have been making an examination. Offers of purchase have been made several times, but owner, Hetty Green, asked too high a price.

Butte County

LITTLE JOE (Hurleton)—Rich quartz strike is reported at this property, owned by Oroville interests.

Calaveras County

CALAVERAS COPPER CO. (Copperopolis)—Financial difficulties which have hindered effective operation of this property, are being cleared. Boston interests which control property have paid 60% of indebtedness and expect to clear remainder within three months. All surface equipment is modern, but extensive repairs will have to be made to smelting works before operations are resumed.

Lassen County

LASSEN (Hayden Hill)—This property has been leased by S. A. Knapp, of San Francisco, who expects to build a cyanide plant to treat ores formerly considered unprofitable. Experimental mill will be built.

Nevada County

IDAHO-MARYLAND (Grass Valley)—Operations will be resumed soon, following several months' shutdown.

Placer County

ALABAMA (Penryn)—Huntington mill and concentrator are to be installed on this property by new owners. Mill will be used on old tailings.

BELLEVUE (Ophir)—It is reported that W. P. Black and George H. Hyde, who have been working Bellevue and Bullion mines under lease and bond during past year, have purchased them and will build a modern mill.

Plumas County

ROSE QUARTZ (Onion Valley)—Five stamps will be added to present equipment of five.

PLUMAS BONANZA (Nelson Point)—A lower tunnel will be driven to tap vein, to facilitate handling of ore to mill.

Yuba County

BLUE POINT (Smartsville)—This property, comprising eight claims, has been bonded by Eastern men.

COLORADO

Chaffee County

MARY MURPHY (St. Elmo)—Contracts have been let for several hundred feet of raising.

GRANITE TUNNEL (Granite)—Ore is reported in a recent strike in this old adit that is nearly 1700 ft. long. Shoot is probably in D.C.C. vein.

Clear Creek County

FRENCH FLAG (Idaho Springs)—Boston men will develop this property.

QUITO (Idaho Springs)—Trial lot of ore has been treated in Combination mill. Allen mill is to be equipped to handle Quito ore.

MERIT MINING CO. (Idaho Springs)—Gladstone claim near Stanley mine, Bruce claim, near Little Mattie mine, and eight locations in various parts of district are to be developed by this new company principally of Lincoln, Neb., stockholders.

Gilpin County

BUCKEYE NO. 1 (Central City)—John C. Jenkins and Oscar Williams have installed a small steam hoisting plant. Property has lain idle for years.

SQUARE DEAL (Central City)—East Notaway shaft is so wet, due to abnormal climate this spring, that sinking has been stopped. Sinking has been continuous for over a year. There are 335 lessees making good profits in the upper levels.

SUN TUNNEL (Tolland)—Driving of tunnel has been resumed. It is expected that a few more hundred feet will reach objective vein. Company has erected 50-ton concentrator, steam and compressor plant, and good buildings for miners.

BARNES (Central City)—With reopening of Gilpin County tramway from its long snow blockade, shipments were resumed recently. It is planned to ship about 100 tons per week hereafter. Development has been in good reserves. A compressor plant to operate machine drills is contemplated.

SARATOGA (Central City)—New mill containing Blake crusher, ten 1000-lb. stamps, two amalgamating pans, hydraulic classifier, vanner and three Wilfley tables will be ready to run as soon as electrical connections are established. Stamping will be done in cyanide solution to 24 mesh. Capacity is 50 tons.

Lake County

SILVER (Leadville)—J. B. McDonald is retimbering shaft and repairing surface plant preparatory to attacking body of low-grade zinc carbonate.

Ouray County

WANAKAH (Ouray)—Development of good orebodies in various properties of company gives assurance of continuous operation of smelting plant. Extensive improvements and enlargement of plant are in progress.

Summit County

PUZZLE (Breckenridge)—Local and Leadville men are reopening this old-time high-grade property.

IDAHO

Cœur d'Alene District

HAPPY DAY (Wallace)—Good showing has been made in crosscut. A stringer is being followed and for some distance it has carried a little ore.

RAY-JEFFERSON (Wallace)—A large oreshoot was opened in No. 1 tunnel some time ago, and operations are being centered in No. 2 tunnel, approximately 450 ft. lower than No. 1, to cut this shoot. It is estimated that 800 ft. will have to be driven to reach ore. Arrangements are being made for an extension of transmission line of Washington Water Power Co. from Consolidated Interstate-Callahan property to Ray-Jefferson, and it is hoped to have current connected with new compressor plant by June 1. In event of oreshoot opened on No. 1 level continuing to No. 2 level more than 700 ft. will have been opened ready for stoping operations, and with Amazon-Manhattan group, Tuscumbia, Idora Hill and numerous other properties in Sunset district having large orebodies exposed and ready to commence active shipping, necessity of construction of a branch line from Murray branch of Oregon-Washington R.R. & Navigation Co. to facilitate these mining operations and to secure hauling of heavy tonnage from that district seems almost a certainty. Distance to a connection with Murray branch would be approximately 10 miles and affords an easy water grade.

MICHIGAN

Copper

TAMARACK (Calumet)—This property has Nos. 2, 3 and 5 shafts in operation which have materially aided in clearing up labor situation in district. Property was opened primarily with object in view of giving employment to a number of former strikers, who could not secure work elsewhere.

ISLE ROYALE (Houghton)—Work of putting No. 1 shaft in commission has been started. It will require considerable time to complete work, for it will be necessary to replace half the timbering in shaft. Shafts Nos. 2, 4, 5 and 6 are operating at full capacity and making records in way of production. Nothing has been done so far toward resumption of sinking at new No. 7 shaft where operations were suspended when strike was called last July. This shaft is bottomed in sand and sinking is difficult.

VICTORIA (Victoria)—Property is developing a promising amygdaloid lode from 22nd to 25th levels. It is well mineralized and of unusual width. Developments on this formation will be watched with much interest for it may bring ultimate success. Company has been working low-grade rock. Low costs at mine and mill have allowed it to accumulate a small surplus at times of high metal prices only to be used up during periods of depression. This, together with assessments, has allowed company to continue to operate.

Iron

MINE-VALUATION HEARINGS—Mining companies of Michigan that protested against valuations placed on property by state tax commission were given hearings in Lansing recently. It will be some time before commission announces whether any reductions will be made. Pioneer Iron Co., which is protesting valuation placed on Pioneer furnace at Marquette, was also given an opportunity to be heard.

BRISTOL (Crystal Falls)—Over 100 men have been let out at this mine of Ogelbay-Norton & Co. No ore is being shipped, and it will not be long before other Iron County mines will have to adopt same policy.

STEPHENSON (Gwinn)—About 100 men were laid off at property of Cleveland-Cliffs company June 1, but employment for 60 was found at Gwinn and Mackinaw-Gardner mines in same district. There are over 500,000 tons of ore in stock at Stephenson, with no sales being made. Part of ore is low-grade and does not find a ready market. All of available stocking room is filled and mine will now be worked only one shift.

MINNESOTA

Duluth

SOO LINE is assembling material at Ashland, Wis., for reconstruction of its wooden ore-dock at close of navigation. Dock will be lengthened and modern pockets and chutes built. Last autumn company announced plans for a modern steel and concrete dock here, but has now changed its plans.

INDEPENDENT VESSEL OWNERS in ore-carrying trade will have an unprofitable season, from present outlook. Practically no season chartering has been done to date, and probably not to exceed 25% of season's tonnage will be shipped in chartered vessels. Offsetting this to some extent, upward movement of coal has been heavy, due to unseasonably cold weather in Northwest. A number of boats have been tied up awaiting better freight rates or heavier tonnage movement.

MINNESOTA STEEL CO.—The model town will be ready for occupation June 1, and 175 modern concrete-block houses will all be occupied shortly thereafter. Company has fixed rents at $15 to $25 per month, houses being rented to employees only. These rents are considerably below prevailing rents in the city.

Cuyuna Range

CUYUNA IRON & MANGANESE ORE CO. (Crosby)—At annual stockholders' meeting held May 21 several offers for property were considered and a definite plan will be decided on. About 10,000 ft. of drilling has been done in last year, developing a large body of manganiferous and non-manganiferous iron ore. Overburden averages 65 ft. depth, and property will be operated as a pit.

Mesabi Range

MADRID (Virginia)—Mine closed down May 18, throwing 60 men out of employment; low price of ore is reason given. It was operated by Eureka Ore Co.

CORSICA (Elba)—Fire destroyed wooden shafthouse and part of upper timbers of shaft on night of May 17. As mine is working only day shift, nobody was underground at time. Mine is owned by Pickands-Mather & Co.

Vermilion Range

ONAHMAN IRON CO.—Company has purchased compressor from Westinghouse company, and this together with other machinery is being shipped to North Star mine.

GRAND MARAIS & NORTHWESTERN R.R.—A railroad from Ely, Minn., on Vermilion range, to Grand Marais, Cook County, Minn., is planned. Arthur Mitchell, of Duluth, is president. Such a road offers an eastern outlet for Vermilion range ores, effecting a considerable saving in vessel haul to lower lake ports. This, however, is partly offset by longer rail haul from Ely. Road will tap a large section of virgin territory and open for possible exploration an immense area of magnetite iron ore land, running near Gunflint district described by George A. St. Clair in a recent issue of American Iron & Steel Institute bulletin as possessing a vast tonnage of magnetite ore. Incidentally road makes possible a new harbor on Lake Superior, for Grand Marais is well located and has a fair natural harbor although there is no dockage there at present.

MISSOURI-KANSAS-OKLAHOMA

Joplin District

COÖPERATION IN A DRILLING CAMPAIGN is planned by citizens of Miami, Okla., following example set by residents of Aurora, Mo. They will work with mining company to determine more fully extent of orebodies in Miami field.

FEDERAL (Aurora, Mo.)—Concentrator was started up after lengthy shutdown.

REYNOLDS & CO. (Aurora, Mo.)—This company has entered good zinc ore run at 25-ft. level. Said to assay 40 per cent.

McCONNELL & BARNES (Miami, Okla.)—Ten tons of blende concentrates were produced in initial run of new concentrator on Pascal land.

EAGLE MINING & MILLING CO. (Carl Junction, Mo.)—Mine on Evans land is producing better than ever; mostly blende ore being milled in Betsy Jane concentrator.

SHOEMAKER (Joplin, Mo.)—This mine seems to have entered one of the richest orebodies developed in this district recently. Operators now report 32-ft. face of calamine at 115-ft. level.

GRANBY MINING & SMELTING CO. (Joplin, Mo.)—Gouverneur concentrator has been purchased and will be removed from Excelsior Lead & Zinc Co.'s tract to B. & H. lease near Joplin; it is of 150 tons capacity.

MONTANA

Lewis and Clark County

MULLAN TUNNEL OF NORTHERN PACIFIC RY. near Blossburg is 3875 ft. long and pierces continental divide at an elevation of 5548 ft. It has been provided with a ventilating plant to drive out noxious gases and smoke. These have been a frequent source of annoyance to company and have been cause of several accidents. Tunnel was built in 1884 to replace a switchback line on surface. In 1886 timbering was burnt and trains followed surface line again until timbering was replaced by concrete. Ventilating plant consists of two large fans each driven by a 250-hp. engine. It cost $50,000 and took six months to put in plant.

Madison County

LITTLE GOLDIE—A vein of gold ore was opened in this mine in Georgie gulch, a few miles from Twin Bridges. It is estimated that first carload shipment of this ore will yield more than price paid for property.

VINEYARD & PAIGE (Twin Bridges)—Bielenberg & Higgins have added to their holdings at head of Bear gulch, 10 miles from Twin Bridges, by purchasing half interest in this mine. Mine adjoins their own properties on which they have expended nearly $100,000 in improvements and development work.

Silver Bow County

WEST STEWART (Butte)—This property of Anaconda company which has been closed for several months, to make necessary repairs and improvements, is soon to resume operations. This will increase output of company by 800 to 1000 tons per day and make up for shortage caused by recent closing of Mountain View mine.

BUTTE & LONDON (Butte)—Work of unwatering shaft by Cole interests is proceeding more rapidly than was anticipated. Water stood at 200-ft. level when work was started May 21, and in less than one week it was lowered to 650-ft. point. As soon as unwatered an electric pump will be installed on 1100-ft. level, which is 30 ft. above present sump, and sinking will begin.

NEVADA

Churchill County

NEVADA WONDER (Wonder)—Nevada Wonder shaft is now 1300 ft. deep and development work is being done on that level. Hidden Treasure shaft has been sunk to a depth corresponding to 700-ft. level of Nevada Wonder shaft, and is connected with 600-ft. level of that shaft. Old West Extension shaft is being sunk and is connected to 500-ft. level and will be connected to 1000-ft. level of Nevada Wonder shaft.

Clark County

PRELIMINARY SURVEY OF BOULDER CAÑON POWER SITE has been made. It is proposed to utilize water of Colorado River for power purposes before it enters Grand Cañon. River is now too high to make soundings; this will be done later this summer.

Esmeralda County

DIAMONDFIELD BLACK BUTTE (Goldfield)—Development work is progressing with satisfactory results on 100-ft. level of Millard lease. West drift is now being driven to oreshoot.

SANDSTORM KENDALL (Goldfield)—Ore is being stoped at contact of andesite and rhyolite on 200-ft. level. Contact is being prospected on 100- and 350-ft. levels for extension of 200-ft. level oreshoot.

SILVER PICK CONSOLIDATED (Goldfield) — Assessment of 1c. per share has been levied. Money will be spent in development work. Present work is confined to 500-ft. level and results are reported to be encouraging.

GOLDFIELD CONSOLIDATED MINES CO. (Goldfield) — Good progress is being made in crosscutting from 700-ft. level of Laguna shaft to Kewanas ground, which will be prospected by drifts, crosscuts and a raise. Beginning June 1 ore of Jumbo Extension Mining Co. will be milled at Consolidated company's mill instead of at leased mill at Bonnie Clare. This can be done at a slightly lower cost and with better extraction.

Eureka County

EUREKA HILL (Eureka)—Entire mine will be leased in blocks. As shaft is not in condition for use, work will be done through Beck mine.

Humboldt County

BUCKSKIN NATIONAL (National)—A shoot of high-grade gold ore with some rich, native-gold specimens, has been discovered, causing a rush to Buckskin Mountain. Several sets of lessees will start work soon.

OKLAHOMA—Plans for construction this summer of a 10-stamp mill on this property in Pine Forest range have been completed. Crude-oil engines will furnish power. Development work consists of crosscut tunnel to Dorothy vein at depth of 500 ft. and drifts on vein, a 120-ft. winze in ore from this level, and tunnels on 100- and 200-ft. levels. Crosscut tunnel was recently advanced 125 ft. where it cut a second vein 5 ft. wide. It will now be driven to Oklahoma vein, 120 to 150 ft. farther.

Lander County

CONSIDERABLE ACTIVITY IN LYNN DISTRICT is reported. One group consisting of Black Horse No. 1, Black Horse No. 2, Rain Bow, Dexter and Victoria, was reported to have been sold for $12,500. Pepper claims were also sold. Lynn-Big Six is operating steadily and has acquired considerable new property.

RUBY SILVER CO. (Lewis, via Battle Mountain)—Lower tunnel has cut shoot of good-grade silver ore at 583 ft. from portal. Raising in ore is now being done. A total of 1400 ft. of development work has been done, and, it is reported, last year four cars of high-grade silver ore were shipped. Property is equipped with compressor and drills. It is stated that construction of mill will commence within 60 days. Fuel oil will be used to furnish power. Starr & Grove mine in this district is also operating.

Lyon County

WHEELER (Yerington)—Development work will be resumed at once.

MASON VALLEY MINES CO. (Thompson) — Report for quarter ended Mar. 31, 1914 is as follows: Mason Valley ore mined, 22,229 tons; smelting plant treated, 45,008 tons, producing 212 tons matte and 1386 tons blister copper, which yielded 2,742,032 lb. refined copper. Gross operating profit, $54,632; depreciation and deferred charges, $28,216; bond interest, $13,410; exploration, $3878; total, $45,504; net profit, $9128.

Nye County

TONOPAH MINING CO. (Tonopah)—Remodeling of milling plant at Millers has been completed. It is stated that changes made have eliminated all conflicts with Moore filter patents.

WALL-BLAKER (Manhattan)—Six claims are under option, first payment to be made within 30 days. Exploration work is being done from three shafts. Churn-drill prospecting will also be done, Keystone drill of 500-ft. capacity having been ordered.

NORTH STAR (Tonopah)—Oreshoot of milling grade, 5 ft. wide, has been opened on intermediate level between 950- and 1050-ft. levels. This shoot was discovered in driving east, and is parallel to Belmont vein. South Crosscut on 1130-ft. level has cut downward extension of foot-wall vein.

Storey County

SIERRA NEVADA (Virginia City)—Vein being prospected by winze below 2500-ft. level is steadily improving, as depth is attained, both in width and grade.

SUTRO TUNNEL (Virginia City)—Thorough inspection of the tunnel was made recently by several Virginia City mine superintendents and it was found to be in good condition throughout. Wood-stave pipe is carrying off water, pumped from lower levels of mines, satisfactorily and has capacity for considerably greater volume.

White Pine County

NEW CUT-OFF ROAD TO HAMILTON is being built. Road starts at Boston-Ely property and runs west and then south to connect with old road. When completed, it will be a part of Lincoln Highway.

NEW MEXICO

Grant County

LUCKY BILL MINING CO.—Company has applied for admission to transact business in New Mexico. It is a Wisconsin corporation. B. A. Statz is agent.

NOVEMBER MINING CO. (Steins)—Exploration work is in progress with compressor and drills. Discoveries of importance have been made on fifth level. Silver-lead ore is produced.

NATIONAL GOLD & SILVER MINING CO. (Steins)—Company is installing a 5-drill compressor and other equipment for development work. Shaft is 300 ft. deep, and underground workings total two miles. Company owns a 30-ton mill.

OAKS CO. (Mogollon)—Work on Eberle mine, recently taken over under bond and lease, is proving satisfactory. A complete line of tools and equipment has been supplied and a hoist will probably be installed in near future. Several shipments of good ore have been made to local custom mill.

GOLD EAGLE (Mogollon)—These claims lie north from central portion of district and a bond and lease was recently given to Denver men, who started work May 5. It is reported that 2½ ft. of a good grade milling ore was recently exposed, from which shipments will be made to custom works.

DEADWOOD (Mogollon)—A pocket of rich bornite was recently encountered in one of upper stopes; first copper ever discovered in mine. A crosscut in 400 level south has opened into a vein not previously known to exist, grade of which is quite promising. Milling plant is treating considerable custom ores.

SOCORRO MINING & MILLING CO. (Mogollon)—On May 18 this company took charge of Pacific mines, on which option is held, after making a substantial payment on account of purchase. An aërial tramway will be erected between mine and Socorro mill and will be completed by September or October. A water and power line will also be installed in meantime, from main plant.

Lincoln County

EAGLE MINING CO. (Nogal)—Company has construction of power plant under consideration.

NORTH & SOUTH HOMESTAKE MINES (White Oaks)—Property is under lease and bond. Stamp mill is in operation treating 40 tons of ore daily.

AMERICAN MINING CO. (Nogal)—All machinery at mines is being overhauled. Shaft house is being built and shaft unwatered and retimbered. The 20-stamp mill will be put in condition to crush ore.

Luna County

VICTOR SMELTING & MINING CO. (Deming)—Company has been admitted to do business in state of New Mexico. Incorporated for $2,000,000 under laws of Arizona. F. K. Wyman is agent.

Otero County

UNITED MINE CO. (Orogrande)—Company has filed corporation papers. Capitalization $50,000. J. H. Parker, of Orogrande, statutory agent.

Sierra County

SOUTH PERCHA (Kingston)—Lead ore containing vanadium has been encountered in recent workings.

READY PAY GROUP (Lake Valley)—Survey is being made preparatory to patent application proceedings.

ZINC KING & ZINC QUEEN (Kingston)—Large shoots of copper, zinc, silver and lead ore are showing, situated in well defined contact of limestone and porphyry with outcrop of pyrolusite extending length of claims. Property may be worked thoroughly this summer.

NORTH CAROLINA

Montgomery County

MARTHA WASHINGTON (Candor)—Work has been commenced again at this mine, owned by Washington, D. C., men. A vertical shaft 4x9 ft. in the clear is being sunk. At 100 ft. depth a crosscut will be driven to cut vein, and shaft will be sunk deeper if results are favorable. This property lies to the southwest of Iola mine and may have same vein. If development results in discovering ore, a mill will be built.

Rowan County

GOLD HILL CONSOLIDATED CO. (Gold Hill)—Mines after lying idle for seven years, are again being worked. Property consists of 1100 acres. Mine was unwatered last October. Since then development work and repairing has been going on at a rapid rate. Mill contains 40 stamps, concentrating tables, rock crusher, and other equipment. Owing to development work being done, only 20% of the stamps are kept dropping full time. It is expected to have 40 stamps in operation in near future. Mine has been opened to a depth of 800 ft. One shaft is down 600 ft., where sufficient crosscutting has been done to prove three good veins from 3 to 5 ft. in width. These oreshoots are several hundred feet long and reach to surface. Another shaft is 800 ft. deep with 856 ft. of crosscuts at bottom, which cut six veins. These veins are from 3 to 8 ft. wide. Some stoping has been done on two of these veins and several hundred feet of drifting, proving continuity of veins to 800-ft. level. Ores are sulphides; 80% of the gold is saved by amalgamation, remainder is saved on concentrating tables. Concentrates are shipped to New Jersey to smelters.

Yadkin County

GROSS & DIXON—This mine is now being worked. An incline is being sunk on vein. Mill is to be remodeled and arranged for cyaniding. Compressor and air drills will be installed.

SOUTH CAROLINA

Abbeville County

EUREKA MANGANESE CO.—A few men are at work on old Dorn gold-mine property exploring and getting out manganese ore for shipment to Birmingham, Ala. This deposit is reported to be high-grade manganese, from 8 to 25 ft. wide, and has been opened by pits and shafts for ¾ mile on strike.

SOUTH DAKOTA

Lawrence County

HOMESTAKE (Lead)—Regrinding plant has been enlarged by addition of a Hardinge mill.

BISMARK (Flat Iron)—Better than 85% recovery is being made in dry-crushing, direct-leaching mill, operating on ores carrying less than $2 per ton gold, and a profit is being earned.

ORO HONDO (Lead)—Two boilers of 100 hp. capacity each, have been received, and are being installed. This will increase boiler capacity to 400 hp, and will permit sinking below 1000-ft. level.

WASP NO. 2 (Flatiron)—Steam-operated churn drill for prospecting and drilling holes for heavy blasts has been

ordered. Mine is operating full capacity, 500 tons daily, and is earning profits on $2 ore.

HIDDEN TREASURE (Deadwood)—Nebraska men, interested in this company, recently visited property and announced intention of sinking shaft, which is now 200 ft. deep, a distance of 200 or 300 ft. additional. Shaft is equipped with gasoline driven hoist and compressor.

TITANIC (Carbonate)—Work of development will be resumed shortly after June 1, after a suspension for six weeks, when bad roads made delivery of coal impracticable. In meanwhile water has been kept pumped out, cordwood, cut on property, being used under boilers. An assay outfit has been purchased, and assayer and surveyor engaged.

GOLDEN REWARD (Deadwood)—Cyanide mill is being improved by addition of a 60-ton tube mill and three additional tanks. It has been discovered that roasted sulphide ores carry enough sulphates to cause some difficulty and thorough tests on a large scale are to be made involving washing with water preliminary to cyaniding and to determine proper time for addition of lime; these matters cannot be satisfactorily determined in laboratory. In meanwhile plant is running at full capacity on oxidized ores.

HEIDELBERG (Two Bit)—This company, promoted as a partnership by Deadwood Business Club, is to be incorporated. Plans, not yet fully matured, contemplate organizing company of 500,000 shares of par value of 25c. per share. Half of this will pay owners for property, balance will be put in treasury. Mine is looking well. ore vertical has now been followed for 300 ft., and in running this drift nearly 100 tons of $20 ore has been sorted and much greater quantity of milling ore put on dump. Further funds will be required to continue development in hopes of blocking out enough ore to warrant construction of cyanide plant.

UTAH

Beaver County

SHEEP ROCK (Beaver City)—Mill is treating 10 tons of ore daily.

BEAVER GOLD (Beaver City)—Work has been resumed at this property adjoining Sheep Rock.

OLD CAVE (Milford)—Ore hauling from this mine has begun, and steady shipments are looked for. Working force has been increased to 15 men.

MAJESTIC (Milford)—Development of this company's Hoosier Boy property continues; shaft, which is being sunk is in ore at a depth of 400 ft. Drifting for main orebody has been started. Later shaft will be sunk to 1000 level. Buildings have been erected on property.

Juab County

TINTIC SHIPMENTS for week ended May 22 were 133 cars.

MAY DAY (Eureka)—All leases expired June 1, and from that date operations will be carried on by company. There is a good surplus in treasury.

BROOKLYN (Silver City)—A promising vein carrying manganese, talc and iron has been opened by working from 800-ft. level of Dragon Consolidated.

Summit County

PARK CITY SHIPMENTS for week ended May 23 were 2,118,490 pounds.

THOMPSON-QUINCY (Park City)—Ore is being mined from hedding north of fissure, and drift from west raise also shows ore.

MINES OPERATING CO. (Park City)—This company's mill is doing satisfactory work on old stope fillings left in upper levels of Ontario.

DALY-JUDGE (Park City—At annual meeting held recently old board of directors was reëlected. Dividends for 1914 have thus far amounted to $45,000, paid Apr. 1. Next dividend of like amount will be paid July 1. There is over $500,000 in treasury. Shipment of 2000 to 3000 tons of ore and concentrates monthly are being made.

SILVER KING COALITION (Park City)—Annual stockholders' meeting was held, May 18, in Salt Lake City, and old board of directors reëlected. A report covering period from May 1, 1913, to Dec. 31, 1913, read at meeting will be sent to stockholders within 60 days. Fiscal year has been changed to end with calendar year, instead of Mar. 31. On May 23, new hoist machinery was warmed up, and cage lowered on its first trip. Owing to water on 1300 level a number of men were laid off for several days. Complete force is again at work, and water is being taken care of by a Prescott duplex electric pump with a capacity of 500 gal. per minute.

WASHINGTON

Ferry County

SAN POIL (Republic)—Contract for sale of this property has been canceled, and work will be continued under present management. Some rich ore has been encountered, and company expects to be able to pay dividends.

Stevens County

COPPER QUEEN (Chewelah)—This property has been bonded to a new company, which will in near future start development work.

MILWAUKEE LTD. MINING CO. (Metaline)—Company has been organized with a capital of $1,500,000 for development of a group of claims near Metaline. Work will begin soon.

CANADA

British Columbia

ZINC SHIPMENTS from Slocan for April this year amounted to 567 tons. Standard and Van Roi at Silverton were principal shippers.

MICA DEPOSITS in the vicinity of Tete Jaune Cache are expected to receive more attention this summer than usual. A number of claims are owned in New York, New Brunswick and Calgary.

Ontario

TOUGH-OAKES (Kirkland Lake)—Mine has shipped a car of $400 ore. Drifting on main vein has started at 300-ft. level. Hydro-electric power to camp is to be turned on within one week.

NORTHERN ONTARIO LIGHT & POWER CO.—One unit of Fountain Falls plant of company is now in commission and 1500 hp. is developed. Total development of this plant will be 5000 horsepower.

KERR LAKE (Cobalt)—Trenching on bottom of Kerr Lake has exposed some high-grade ore which is supposed to be outcrop of No. 10 vein system from which large amounts of silver have been produced.

CONIAGAS (Cobalt)—Shaft on corner of Silver St. and Prospect Ave., which is 60 ft. deep, is to be sunk to fourth level. Crosscuts are to be driven to prospect for veins which are believed to run into Coniagas property from City of Cobalt.

PETERSON LAKE (Cobalt)—For year 1913, company received $207,114 in royalties from Seneca Superior lease, which company produced 1,406,772 oz. of silver. Gould lease has produced 60,000 oz. of silver. Developments at Nos. 1 and 2 shafts have reached a stage where important results may be looked for. Several headings are being driven in attractive looking conglomerate.

DOME LAKE (South Porcupine)—At a recent special meeting of shareholders the bylaw to sell 100,000 shares of treasury stock at 50c. per share was ratified and offer will remain open to shareholders until June 9. Stock which is not taken up on this date, will be subscribed for by Timiskaming & Hudson Bay Mines, which owns control of property. Profits of stock offering will be used to erect a cyanide plant.

DOME (South Porcupine)—At annual meeting held May 26, Ambrose Monell, president, said: "It is my desire to see the Dome placed on an industrial basis, where the question of ore reserves will be definitely settled for many years ahead. The efforts of myself and associates will be directed toward this end and toward the establishment in a new country of a large enterprise of substantial merit. The question of dividends together with the policy of future enlargements and the method of financing same will receive the most serious consideration by the directors as soon as they are in possession of the necessary information on which to act."

CHAMBERS FERLAND (Cobalt)—Minority shareholders expect that a cash offer will be made for amount of stock not yet transferred to Aladdin company. Shareholders who are looking for a cash payment base their theory on amendment of Ontario companies act which passed its third reading at end of last month. Amendment gives right to any shareholder or any body of shareholders who claim to suffer unfairness at hands of a majority of shareholders which is shown to be due to relations of company which has an interlocking directorate or shareholding agreement with any other company, to appeal to courts. It is said this act may be invoked by Chambers-Ferland shareholders who are opposed to Aladdin deal.

MEXICO

Hidalgo

SANTA GERTRUDIS (Pachuca)—It is reported that recently, while a heavy piece of machinery was being lowered into a shaft it fell, killing 25 Mexican miners below. Several mine bosses were arrested.

GUATEMALA

LAS QUEBRADAS DE ORO (Morales)—This property, also known as the Potts & Knight placer, is working this season; 50 men being employed.

MINAS DE ALOTEPEQUE (Horta y Cia, Concepcion, Dpt. de Chiquimula, or care of Cia. Belga de C. A., Guatemala City)—This group of copper-lead-zinc properties is being developed under direction of W. H. Paul for Minor C. Keith and associates. It is understood that over 150,000 tons of zinc ore have been developed. Properties are in same region as San Pantaleon mine of Guatemala Mining & Development Co.

GUATEMALA MINING & DEVELOPMENT CO. (115 Broadway, New York)—Company is driving a long adit to tap San Pantaleon and other silver-lead oreshoots at depth of 1750 ft. Adit is now in 3000 ft. and is to be driven 2000 ft. further. San Pantaleon mine is at Socorro, equi-distant from Alotepeque and Concepcion in Department of Chiquimula and 72 miles from Zacapa on Guatemala R.R. This mine was worked from 1860 to 1873 by an English company which sent silver to the value of $40,000,000 to mint in Guatemala City besides rich ore sent to Swansea, and Belgium, which was transported overland to Salvador Pacific coast ports. Company stopped work because of drop in price for silver, attended by increased drainage costs, and especially because greatly increased zinc tenor of ores at depth made smelting in small lead furnace impracticable. Guatemala Mining & Development Co. also has a white-marble deposit near Zacapa from which trial shipments have been made. For commercial production a 9000-ft. incline must be built and 12 miles of railroad. Grading for road is nearly completed.

HUNGARY

OIL HAS BEEN DISCOVERED NEAR VIENNA, it is reported, in borings for natural gas undertaken by order of government. In opinion of geologists, oil horizon extends through a large part of Hungarian county of Neutra, beginning near town of Egbell and ending within province of Lower Austria. Experts who have examined fields, say they bid fair to surpass Galician oil fields and may become an important factor in world's oil markets. Vacuum Oil Co., of Vienna, a branch of Standard Oil Co., is reported to have a large interest in new fields. Deposits of potash have recently been discovered near Galician town of Kalusz, and, according to experts, its quality is fully equal to best German product from Stassfurt.

The Market Report

METAL MARKETS

NEW YORK—June 3

There has been no considerable change in the metal markets, which continue quiet, with only moderate business reported, and few fluctuations.

Copper, Tin, Lead and Zinc

Copper—Again has passed a week during which the market was characterized by excessive dullness and the position is established rather by offers to sell than by actual transactions. During the early part of the week copper was freely offered at 14⅛c., delivered, usual terms; during the latter half it was offered from several quarters, including first hands, at 14c., with intimations of probable concessions from that figure. The average of quotations for the week is 13.885 cents.

The London market for standard copper has been quiet and weakish. On May 28, spot was £63 2s. 6d., and three months £63 15s.; it declined about 2s. on May 29, and on Tuesday, June 2, spot was £62 6s. 3d., three months, £62 18s. 9d. On June 3, the market closed at £61 16s. 3d. for spot and £62 7s. 6d. for three months.

Base price of copper sheets is now 19¼c. per lb. for hot rolled and 20¼c. for cold rolled. The usual extras are charged and higher prices for small quantities. Copper wire is 15@15¼c. per lb., carload lots at mill.

Copper exports from New York for the week were 4907 long tons. Our special correspondent reports exports from Baltimore for the week at 1067 tons.

Visible Stocks of Copper in Europe, May 31, are reported as follows: Great Britain, 12,680; France, 5930; Rotterdam, 3100; Hamburg, 3870; Bremen, 1080; other European ports, 600; total, 27,260 long tons, or 61,062,400 lb. This is an increase of 3150 tons over the May 15 report. In addition to the stocks above given, 1700 tons are reported afloat from Chile and 4000 tons from Australia, making a total of 32,960 tons.

Tin—The weakness in the market became more pronounced during the past week, and on Tuesday of this week bordered on panicky conditions. Tin from every quarter was pressed for sale; not only were London bears sellers on the Metal Exchange there, but East Indian interests were also liberal offerers of the material. Domestic dealers who anticipated the subsequent declines were sellers at below the import cost and accepted from ¼ to ⅜c. below that at which tin could be purchased in London on the day sales were made here. Domestic consumers bought some tin late last week, but since then have remained out of the market. The constantly declining prices naturally tend to scare off any buying movement. It is difficult to ascertain any reason for the continuous decline in this metal, which doubtless is due more to speculative activity than to anything else. It is true, statistices have deteriorated somewhat, but not sufficiently to warrant the enermous decline of the last six months. The market closes somewhat firmer at £139 for spot and £141 for three months, and about 30¾c. for June tin here.

Tin shipments from the Straits, five months ended May 31, were 25,906 long tons in 1913, and 26,086 in 1914; increase, 180 tons.

Tin supplies outside of statistics for the four months ended Apr. 30 are estimated as follows by Walter H. Burnard, London: Bolivia, 8784; China, 662; other countries, 38; total metallic tin, 9484 long tons. Ore and concentrates, tin contents: South Africa, 229; Nigeria, 2099; other countries, 361; total metallic contents, 2689. The total tin included was 12,173 tons.

Visible Stocks of Tin on May 31 are reported as follows: London, 11,158; Holland, 2538; United States, excluding Pacific ports, 4166; total, 17,862 long tons, an increase of 2415 tons during May. The statement includes tin afloat, amounting to 7935 tons.

Lead—This has been the strongest of the metals, there having been more inquiry and considerable transactions, including some sales for export from New York at the price of 3.90c., f.o.b. ship. The market at St. Louis has been a little stronger, closing at 3.82½ cents.

At London, Spanish lead has advanced to £19; English lead 5s. higher.

Exports from Baltimore for the week included 280,241 lb. lead to Rotterdam.

Spelter—This market has been dull and weaker, the leading consumers exhibiting no interest at all. Producers think there is no use in radically cutting the price for the reason that even at a materially lower level business would not be forthcoming.

The London market for good ordinaries is quoted £21 7s. 6d.; specials, £22 2s. 6d. per ton.

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

DAILY PRICES OF METALS

NEW YORK

May June	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc	
			Electrolytic, Cts. per Lb.	Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.
28	4.8850	57	13.95 @14.00	32	3.90	3.80 @3.82½	5.07½ @5.10	4.92½ @4.95
29	4.8825	56⅞	13.95 @14.00	31½	3.90	3.80 @3.82½	5.07½ @5.10	4.92½ @4.95
30	.....	...	.....	...	....	.....	.....	.....
1	4.8835	56½	13.80 @13.90	31½	3.90	3.80 @3.82½	5.05 @5.10	4.90 @4.95
2	4.8850	56⅛	13.80 @13.85	30½	3.90	3.82½	5.05 @5.10	4.90 @4.95
3	4.8855	56⅛	13.75 @13.85	30¼	3.90	3.82½	5.05 @5.07½	4.90 @4.92½

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

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumer. To reduce to New York basis we deduct an average of 0.15c. representing delivery charges. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic; of casting copper 0.15 to 0.25c. below. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

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

LONDON

May-June	Silver	Copper				Tin		Lead		Zinc	
		Spot									
		£ per Ton	Cts. per Lb.	3 Mos.	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
28	26 3/16	63⅛	13.71	63⅞	67⅞	144⅜	146⅜	18⅞	4.10	21½	4.67
29	26¼	63	13.69	63 3/16	67¾	143	145	19⅛	4.16	21½	4.67
30	26	...	.....	.....	...	.....	.....	.....	.....	.....	.....
1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2	25 15/16	62 5/16	13.54	62 15/16	67½	138	140	19⅛	4.16	21⅜	4.64
3	25¾	61 15/16	13.43	62⅜	67	139	141	19	4.13	21⅜	4.64

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latte being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.2 = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21¾c.

Other Metals

Aluminum—Business shows little change and prices remain about the same, with some competition for orders. Current quotations are 17¾@18c. per lb. for No. 1 ingots, New York.

Antimony—Business is quiet and prices are unchanged. Quotations for ordinary antimony—Chinese, Hungarian, etc.—are 5.70@5.90c. per lb. For special brands 6.90 up to 7.50c. is asked.

Quicksilver—The New York quotation is rather better, at $37.50@38.50 per flask of 75 lb. for large lots; 54c. per lb. for jobbing lots. San Francisco, $37 for domestic orders, and special terms—usually about $2 less—for export. The London price is £7 per flask with £6 17s. 6d. asked from second hands.

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

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

Gold, Silver and Platinum

Gold—While there is still a strong demand for gold, no premiums were paid on the open market in London, and the price remained at the Bank level, 77s. 9d. per oz. for bars. In New York, $2,500,000 more gold was taken for export to France. New York seems to have the most available gold just now, and its supplies are being drawn upon by the attraction of high interest rates abroad.

Platinum—There is no special demand, but the market remains steady and prices are unchanged. Dealers ask $43@44 for refined platinum. Hard metal—platinum-iridium alloy—is higher, at $47@51 per oz., according to grade.

Our Russian correspondent writes under date of May 22, that the market and prices are unchanged. Current quotations are 9.65 rubles per zolotnik at Ekaterinburg and 37,100 @37,200 rubles per pood at St. Petersburg—$36.28 and $36.41 per oz. respectively—for crude metal, 83% platinum. The offering of small lots of metal at Ekaterinburg is less than usual, the owners of placer ground having reserved to themselves many lots heretofore leased to the starateli. Extensive prospecting and development work is in progress, which will show results later.

Iridium—Current price is $76@79 per oz., New York.

Silver—The market has been dull, with declining tendency. No new feature is apparent in the situation. At the moment the price seems to be dependent on China.

Shipments of silver from London to the East, Jan. 1 to May 21, as reported by Messrs. Pixley & Abell:

	1913	1914	Changes
India	£2,884,000	£2,871,000	D. £13,000
China	299,500	40,000	D. 259,500
Total	£3,183,500	£2,911,000	D. £272,500

Stocks of silver in Shanghai are reported at £5,812,500 in sycee or silver current in China.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—May 30

The market showed practically no change this week; 60% zinc ore sold at a base price of $39@39.50 per ton, while 80% lead ore sold at a base price of $48 per ton.

SHIPMENTS WEEK ENDED MAY 30

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	3,420,430	50,000	574,400
Year	62,508,610	2,489,000	18,718,030

Shipped during week to separating plants, 2,237,270 lb. zinc ore.

MONTANA ZINC ORE

The Butte & Superior in May produced 9850 tons of blende concentrate, averaging 53.6% zinc.

JOPLIN, MO.—May 30

Blende sold at $43, the base ranging from $38@41 per ton of 60% zinc, while metal base prices were suspended, owing to the sharp competition. Calamine sold on a base price of $22@23.50 per ton of 40% zinc. The average price of all grades is $36.96 per ton. No lead ore sold higher than $48, on a base of $46 per ton of 80% metal content, and the average of all grades is $46.36 per ton. Producers of the higher-grade ores are holding.

SHIPMENTS WEEK ENDED MAY 30

	Blende	Calamine	Lead	Value
Totals this week....	8,995,870	871,470	1,889,590	$226,180
Totals 22 weeks.....	228,362,820	14,905,310	39,769,370	5,606,305

Blende value, the week, $172,010; 22 weeks, $4,477,580.
Calamine value, the week, $10,400; 22 weeks, $167,795.
Lead value, the week, $43,770; 22 weeks, $961,135.

IRON TRADE REVIEW

NEW YORK—June 3

While there is little change in the actual situation in the iron and steel markets, there seems to be a better feeling, and an expectation of approaching improvement, which is quite general. This does not rest upon any specific news, though some lines of trade showed actual gains in May.

Steel mill operations have lately dropped to an average of about 50% of capacity, and the process of curtailment, which began early in March, appears to be about over, as from several quarters come reports of current bookings being slightly in excess of shipments, and there is reported a better inquiry from many quarters. The expectation is now not uncommon that business in June will make a somewhat better showing than for April or May. No large improvement is expected, however, for the present, since July is invariably a dull month.

A sale has been made on the Pacific Coast of 16,000 tons of rails made by the Tata Iron & Steel Co., of Sakchi, India. The sale is made possible by low freight rates from Bombay to San Francisco.

A contract for 1000 tons girder rails for the electric railroad at San Antonio, Texas, has been taken by a Belgian mill.

Pig iron is reported rather more active. A number of foundry iron sales are reported both in the East and the West. These sales have been small as a rule, but make up a fair total. Basic iron continues to be in some demand, especially in the East.

PITTSBURGH—June 2

While mill operations are not over 50% of capacity, orders are coming in at a little higher rate.

Steel prices, while not firm, show only a slight receding tendency. Plates can be done at 1.10c., and bars and shapes at 1.12½c., but only on quite desirable business, 1.15c. being the ordinary quotation on all three products. Steel pipe and steel boiler tubes are fairly well held at the published prices. Sheets are a shade easier. Wire nails are being sold at $1.50, the nominal or open price being $1.60, but plain wire is only shaded about one-half as much as nails. Chain is down to a basis of 3.00c., against 3.05c. formerly quoted.

Pig Iron—The market continues very quiet, though some large consumers are expected to buy foundry iron in a moderate way before the month is out. W. P. Snyder & Co. announce the average prices of basic and bessemer pig iron for May at $13 and $14 respectively at Valley furnaces, showing no change from April. These averages are computed from actual market sales, in lots of 1000 tons and over, but the tonnages of the past two months have been light. Of the 16 merchant furnaces in the Mahoning and Shenango Valleys eight are in operation. One of the idle furnaces has not operated since 1907. The market stands as follows: Bessemer, $14; basic, $13; malleable, $13@13.25; No. 2 foundry, $13@13.50; forge, $12.50@12.75, at Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—The market continues dull, with English and German quoted at $38, Baltimore, for either prompt or forward delivery with $2.16 freight to Pittsburgh.

Steel—The market has lately been altogether nominal, at $20 for billets, $21 for sheet bars and $26 for rods, at maker's mill, Pittsburgh or Youngstown. There has been no serious inquiry to test the market, but it has become well established that consumers could buy at 50c. concession from these figures. At such concessions there is no interest, and the third-quarter contracts soon to be negotiated may go at even lower prices.

Pig-Iron Production in Germany in April is reported by the German Iron & Steel Union at 1,534,429 metric tons. For the four months ended Apr. 30 the total make was 6,323,386 tons in 1913, and 6,149,690 in 1914; decrease, 173,696 tons. Of the total this year 4,022,824 tons, or 65.4%, was Thomas or basic pig.

Steel Production in Austria-Hungary for the year 1913 was, in metric tons:

	Austria	Hungary	Bosnia
Acid converter	843	41,738	.....
Basic converter	232,900	.....	.....
Openhearth	1,500,452	749,711	33,656
Crucible, etc	36,653	3,089	.....
Electric	24,902	1,935	.....
Total	1,795,750	796,473	33,656

The production of wrought or puddled iron was: Austria, 44,675; Hungary, 12,065; total, 56,740 tons.

IRON ORE

Three cargoes of iron ore are reported to be on the way to Philadelphia from the mines in Chile, owned by the Bethlehem Steel Co.

A cargo of 7000 tons of Wabana iron ore from Newfoundland has arrived at Philadelphia. It represents deliveries on contracts made last year. Business is very quiet, so far as contracts for the summer are concerned.

Imports at Baltimore for the past week included 6800 tons manganese ore from Batum, Russia.

Hearings have been resumed by the Interstate Commerce Commission on the iron-ore-rate cases. There are two cases —or rather groups of cases—included. The first is on the rates from mines on the Vermillion, Mesabi and Cuyuna ranges to Lake Superior ports, the independent companies desiring a lower rate than the 60c. now charged, which, it is claimed, leaves an enormous profit to the carriers, which are owned by the Steel Corporation. The other case relates to the rates from Lake Erie ports to furnaces in the Pittsburgh and Wheeling districts.

COKE

Production in the Connellsville region for the week is reported by the "Courier" at 294,715 short tons; shipments, 276,072 tons. Production in the Greensburg and Upper Connellsville districts was 34,194 tons.

The Interstate Commerce Commission has decided against the complaint of iron companies in the Buffalo district, and holds that the rate of $1.85 per ton from Connellsville to Buffalo is not unreasonable. This supports a previous decision.

Connellsville Coke—The market is almost stagnant. While more than half the merchant tonnage now being delivered is on contracts which expire at the end of this month it is unlikely that much coke will be bought on contract for the second half to take its place, as consumers seem disposed to buy from hand to mouth. Prompt furnace coke can be had at $1.75@1.90 according to grade. Most producers quote $2 on contract, but some cokes of fair grade could be had down to $1.85. Foundry coke is quotable at $2.35@2.65 according to grade and the position of the seller.

CHEMICALS

NEW YORK—June 3

The general market remains quiet but generally steady, so far as prices are concerned.

Arsenic—Business is moderate only. The speculative features have been entirely eliminated and the price is steady at $3 per 100 lb. for both spot and futures.

Copper Sulphate—Business remains on a fair scale. Prices are unchanged, $4.65 per 100 lb. being quoted for carload lots, and $4.90 per 100 lb. for smaller parcels.

Nitrate of Soda—Trade is moderate, as usual at this season. The current quotation is 2.15c. per lb. for both spot and futures.

Potash Salts—Exports of potash salts from Germany for the quarter ended March 31 were as below, in metric tons:

	1913	1914	Changes
Crude salts	474,341	431,178	D. 43,163
Potassium chloride	126,838	85,987	D. 40,851
Potassium sulphide	48,065	28,485	D. 19,580
Pot.-magnesium sulphide	29,038	27,241	D. 1,797
Totals	678,282	572,891	D. 105,391

Of the total reported this year 207,934 tons were shipped to the United States.

Pyrites—Imports at Baltimore for the past week included 5148 tons of pyrites from Huelva, Spain.

PETROLEUM

California oil production in April is estimated at 8,669,022 bbl.; shipments, 8,705,553 bbl.; stocks Apr. 30 were 51,217,508 bbl. There were 33 new producing wells completed during the month.

The monthly statement of the "Oil City Derrick" reports new wells completed in May as follows: Pennsylvania grade, 710; Lima Indiana, 208; Central Ohio gas, 49; Kentucky, 12; Illinois, 154; Kansas-Oklahoma, 1327; Texas-Louisiana, 139. A grand total of 2594 wells was completed with an initial production of 149,710 bbl. There were 470 dry holes and 208 gas wells. Compared with the April report there was an increase of 87 in completions and of 25,086 bbl. in new production. There were 34 fewer failures and 33 less gas wells. At the close of May the new work consisted of 663 rigs and 2573 drilling wells.

A new bill to regulate the transportation of oil by pipe lines in interstate trade has been introduced in Congress by Representative Davenport and appears to be receiving serious consideration. The main features of the bill are that it puts oil-pipe lines on the same footing as railroads and puts them under the control of the Interstate Commerce Commission; also requiring them to receive all oil offered and to make through and joint rates as railroads are required to do.

COPPER SMELTER'S REPORTS

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

	January	February	March	April	May
Alaska shipments	2,701,258	1,803,579	2,069,960	1,279,537	.....
Anaconda	24,400,000	21,300,000	23,800,000	22,900,000	23,500,000
Arizona, Ltd.	3,474,000	3,062,000	3,286,000	3,570,000	.....
Copper Queen	8,796,358	6,987,366	7,637,042	7,562,723	.....
Calumet & Ariz.	5,975,000	5,596,850	5,875,000	5,450,000	.....
Chino	6,488,220	5,642,426	5,399,814	5,926,591	.....
Detroit	1,590,681	1,814,214	1,973,725	1,790,926	.....
East Butte	1,256,000	1,193,960	1,546,180	1,178,000	.....
Giroux	148,411	90,017	287,980	45,948	.....
Mason Valley	944,000	1,254,000	1,250,000	.....	.....
Mammoth	1,625,000	1,400,000	1,800,000	1,850,000	1,750,000
Nevada Con.	5,791,122	4,588,243	5,218,257	4,880,043	.....
Ohio	700,728	582,000	597,520	610,518	.....
Old Dominion	2,797,000	3,066,000	2,997,000	2,779,000	.....
Ray	5,705,000	5,432,000	6,036,908	6,089,362	.....
Shannon	937,432	903,761	1,082,000	1,012,000	.....
South Utah	275,569	333,874	406,381	247,641	.....
Tennessee	1,474,890	1,232,812	1,262,184	1,370,800	.....
United Verde*	3,000,000	2,700,000	3,100,000	3,000,000	.....
Utah Copper Co.	10,329,564	9,207,111	12,323,493	12,739,757	.....
Lake Superior*	7,400,000	8,500,000	11,000,000	13,000,000	.....
Non-rep. mines*	6,200,000	5,600,000	6,200,000	6,000,000	.....
Total prod.	102,100,233	92,290,213	102,536,667	.....	.....
Imp., bars, etc.	24,504,249	19,918,448	22,676,605	.....	.....
Total blister	126,604,482	12,208,661	125,213,272	.....	.....
Imp. ore & matte	10,893,969	9,713,164	7,029,646	.....	.....
Total Amer.	137,498,451	121,921,825	132,242,918	.....	.....
Miami†	3,258,950	3,316,482	3,361,100	3,130,772	3,347,000
Shattuck-Arizona	1,276,636	1,134,480	1,136,458	1,386,594	.....
Brit. Col. Cos.:					
British Col. Cop.	607,930	.....	.....	.....	.....
Granby	1,793,840	1,661,212	1,775,852	1,692,102	.....
Mexican Cos.:					
Boleo†	2,369,920	1,984,080	2,535,680	2,204,720	.....
Cananea	3,460,000	2,688,000	4,260,000	2,632,000	.....
Moctezuma	3,024,556	2,642,543	2,882,884	2,654,926	.....
Other Foreign:					
Braden, Chile	2,430,000	2,362,000	1,810,000	2,720,000	.....
Cape Cop., S. Af.	519,680	459,200	660,800	468,160	.....
Kyshtim, Russia	1,559,040	1,534,400	.....	.....	.....
Spassky, Russia	902,720	902,720	896,000	.....	.....
Exports from					
Chile	5,488,000	6,720,000	6,944,000	9,072,000	.....
Australia	5,712,000	7,952,000	8,176,000	7,168,000	.....
Arrivals-Europe‡	8,599,360	18,354,560	17,572,800	17,299,520	.....

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.
‡ Does not include the arrivals from the United States, Australia or Chile.

	United States			Visible Stocks.		
Month	U.S.Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
VI, '13.	121,860,853	68,362,571	68,067,901	67,474,227	77,235,200	144,709,425
VII.	138,074,602	58,904,192	78,480,071	52,814,606	77,904,000	124,808,606
VIII.	131,632,362	73,649,801	73,263,469	53,594,945	66,420,480	120,015,385
IX.	131,401,229	66,836,897	73,085,275	38,314,037	63,716,800	102,030,837
X.	139,070,481	68,173,720	68,123,473	29,793,094	53,625,600	83,418,692
XI.	134,087,708	48,656,858	70,067,803	32,566,382	48,787,200	81,353,582
XII.	138,990,421	21,938,570	73,542,413	47,929,429	46,592,000	94,521,429
Yr., '13	1,622,450,829	767,261,760	869,062,784	.....	.....	.....
I, 1914.	131,770,274	47,956,955	87,955,501	91,438,867	53,916,800	145,355,667
II.	122,561,007	47,586,657	83,899,183	87,296,685	50,108,800	137,405,485
III.	145,651,982	69,852,349	89,562,166	78,371,852	47,376,000	125,747,852
IV.	151,500,531	63,427,633	82,345,216	64,609,319	46,435,200	111,044,519
V.	.....	.....	.....	70,337,001	52,371,200	122,708,201
VI.	.....	.....	.....	.....	61,062,400	.....

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

Assessments

Company	Delinq.	Sale	Amt.
Argenta, Ida.	June 1	July 2	$0.001
Bellerophon, Utah	May 30	June 20	0.002
Booth, Nev.	May 11	June 15	0.02
Buffalo, Mont.	May 6	July 2	0.004
Bullion, Nev.	May 28	June 18	0.02
Cedar Talisman, Utah	June 12	July 6	0.005
Cons. Virginia	June 16	July 7	0.10
Dry Canon, Utah	June 10	July 6	0.01
Eagle's Nest, Nev.	May 18	June 18	0.005
Ely Gibraltar, Nev.	May 18	June 15	0.0025
Great Eastern, Ida.	June 1	July 2	0.002
Hale & Norcross, Nev.	May 19	June 9	0.03
Hamburg-American, Ida.	June 6	July 6	0.001
Idaho-Los Angeles, Ida.	June 19	July 17	0.003
Manhattan Cons.	June 9	July 9	0.01
Mayflower, Ida.	June 9	July 2	0.005
Mineral Flat Ext., Utah	June 2	June 20	0.002
Nabob, Ida.	May 13	June 8	0.005
O.K. Silver, Utah	May 30	June 16	0.005
Ophir, Nev.	June 8	June 30	0.10
Revelator, Utah	May 18	June 18	0.0075
Santaquin Central, Utah	June 10	June 30	0.0025
Sierra Nevada, Nev.	May 25	June 15	0.10
Silver Mountain, Ida.	May 22	June 22	0.003
Snowstorm Ext., Ida.	May 22	June 22	0.003
Springfield, Ida.	May 18	June 15	0.002
Spring Lake, Utah	May 25	June 15	0.0075
Sunset, Nev.	May 25	June 29	0.02
Syndicate, Utah	May 22	June 13	0.0005
Yellow Jacket, Nev.	May 25	June 16	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1912	1913	1914	1912	1913	1914
January	56.260	62.938	57.572	25.887	28.983	26.553
February	59.043	61.642	57.506	27.190	28.357	26.573
March	58.375	57.870	58.067	26.875	26.669	26.788
April	59.207	59.490	58.519	28.284	27.416	26.958
May	60.880	60.361	58.175	28.038	27.825	26.704
June	61.290	58.990	.....	28.215	27.199	.....
July	60.654	58.721	.....	27.919	27.074	.....
August	61.606	59.293	.....	28.375	27.335	.....
September	63.078	60.640	.....	29.088	27.986	.....
October	63.471	60.793	.....	29.299	28.083	.....
November	62.792	58.995	.....	29.012	27.263	.....
December	63.365	57.760	.....	29.320	26.720	.....
Year	60.835	59.791	.....	28.042	27.576	.....

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

COPPER

Month	New York				London Standard	
	Electrolytic		Lake			
	1913	1914	1913	1914	1913	1914
January	16.488	14.223	16.767	14.772	71.741	64.304
February	14.971	14.491	15.253	14.929	65.519	65.259
March	14.713	14.131	14.930	14.625	65.329	64.276
April	15.291	14.211	15.565	14.563	68.111	64.747
May	15.436	13.996	15.738	.....	68.807	63.182
June	14.672	.....	14.871	.....	67.140	.....
July	14.190	.....	14.563	.....	64.166	.....
August	15.400	.....	15.904	.....	69.209	.....
September	16.328	.....	16.799	.....	73.125	.....
October	16.337	.....	16.913	.....	73.383	.....
November	15.182	.....	16.022	.....	68.275	.....
December	14.224	.....	14.904	.....	65.223	.....
Year	15.269	.....	15.686	.....	68.335	.....

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

TIN

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

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

LEAD

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

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

SPELTER

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	6.931	5.262	6.854	5.112	26.114	21.533
February	6.239	5.377	6.089	5.228	25.338	21.413
March	6.078	5.250	5.926	5.100	24.605	21.460
April	5.641	5.113	5.491	4.963	25.313	21.569
May	5.406	5.074	5.256	4.924	24.583	21.393
June	5.124	.....	4.974	.....	22.143	.....
July	5.278	.....	5.128	.....	20.592	.....
August	5.658	.....	5.508	.....	20.706	.....
September	5.694	.....	5.444	.....	21.148	.....
October	5.340	.....	5.188	.....	20.614	.....
November	5.229	.....	5.083	.....	20.581	.....
December	5.156	.....	5.004	.....	21.214	.....
Year	5.648	.....	5.504	.....	22.746	.....

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

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1913	1914	1913	1914	1913	1914
January	$18.15	$14.94	$17.35	$13.23	$18.59	$13.90
February	18.15	15.06	17.22	14.12	18.13	14.09
March	18.15	15.07	16.96	13.94	17.53	14.18
April	17.90	14.90	16.71	13.90	16.40	14.10
May	17.68	14.90	15.80	13.90	15.40	14.23
June	17.14	.....	15.40	.....	15.10	.....
July	16.31	.....	15.13	.....	14.74	.....
August	16.63	.....	15.00	.....	14.88	.....
September	16.65	.....	15.04	.....	14.93	.....
October	16.60	.....	14.61	.....	14.80	.....
November	16.03	.....	13.91	.....	14.40	.....
December	15.71	.....	13.71	.....	14.28	.....
Year	$17.09	.....	$15.57	.....	$15.77	.....

STOCK QUOTATIONS

COLO. SPRINGS June 2

Name of Comp.	Bid.
Acacia	.02½
Cripple Cr'k Con.	.006
C. K. & N.	.06
Doctor Jack Pot	.05½
Elkton Con.	.40½
El Paso	1.35
Findlay	.00½
Gold Dollar	.03
Gold Sovereign	.02
Golden Cycle	1.00
Isabella	.10
Jack Pot	.05
Jennie Sample	.03
Jerry Johnson	.03
Lexington	.003
Old Gold	.01
Mary McKinney	.47½
Pharmacist	.009
Portland	1.11
Vindicator	.95½

SALT LAKE May 29

Name of Comp.	Bid.
Beck Tunnel	.04¼
Black Jack	.05
Cedar Talisman	‡.00¼
Colorado Mining	.12
Crown Point	‡.01½
Daly-Judge	5.00
Gold Chain	.13½
Grand Central	.53
Iron Blossom	1.30
Little Bell	‡.10
Lower Mammoth	.01½
Mason Valley	2.25
May Day	‡.06
Nevada Hills	.33
Prince Con.	.18
Silver King Coal'n	2.97½
Silver King Cons.	1.87½
Sioux Con.	.03
Uncle Sam	.02
Yankee	.02

TORONTO June 2

Name of Comp.	Bid.
Bailey	.01
Conlagas	7.00
Peterson Lake	.37½
Right of Way	.04
T. & Hudson Bay	72.00
Timiskaming	.15½
Wettlaufer-Lor.	.05¼
Big Dome	8.65
Crown Chartered	‡.00½
Dome Exten.	.08
Foley O'Brien	.28
Hollinger	17.20
Imperial	.01½
Jupiter	.16
Pearl Lake	.04
Porcu. Gold	‡.01
Preston E. D.	.01½
Rea	.10
Swastika	‡.01½
West Dome	‡.05

SAN FRANCISCO June 2

Name of Comp.	Bid.	Name of Comp.	Bid.
Comstock Stocks		Misc. Nev. & Cal.	
Alta	.08	Belmont	7.20
Belcher	.29	Jim Butler	1.00
Best & Belcher	.02	MacNamara	.03
Caledonia	.40	Midway	.23
Challenge Con.	‡.09	Mont.-Tonopah	.75
Chollar	‡.05	North Star	.31
Confidence	.23	West End Con.	.84
Con. Virginia	.05	Atlanta	.15
Crown Point (Nev.)	.23	Booth	.05
Gould & Curry	.01	C.O.D. Con.	.03
Hale & Norcross	.04	Comb. Frac.	.06
Mexican	.85	Jumbo Extension	.23
Occidental	.70	Pitts.-Silver Peak	.35
Ophir	.05	Round Mountain	.35
Overman	.23	Sandstorm Kendall	.15
Potosi	.01	Silver Pick	.04
Savage	.04	Argonaut	2.85
Sierra Nevada	.15	Bunker Hill	‡.13
Union Con.	.06	Central Eureka	.18
Yellow Jacket	.34	So. Eureka	1.25

N. Y. EXCH. June 2

Name of Comp.	Clg.
Amalgamated	70¼
Am.Sm.&Ref. com	62¼
Am. Sm. & Ref., pf.	101½
Am. Sm. Sec., pf. B.	82
Anaconda	31½
Batopilas Min.	⅛
Bethlehem Steel, pf.	84½
Chino	41½
Colo. Fuel & Iron	27
Federal M. & S., pf.	28½
Great Nor., ore., ctf.	31½
Guggen. Exp.	53
Homestake	116
Inspiration Con.	16¼
Mex. Petroleum	61¼
Miami Copper	22
Nat'l Lead, com.	46
National Lead, pf.	106½
Nev. Consol.	14⅜
Ontario Min	2⅜
Phelps Dodge	179
Quicksilver, pf.	1½
Ray Con.	21½
Republic I&S, com.	23½
Republic I&S, pf.	85½
SlossSheffl'd, com.	26
Sloss Sheffield, pf.	85
Tennessee Copper	34⅜
Utah Copper	56
U. S. Steel, com.	60
U. S. Steel, pf.	109½

N. Y CURB June 2

Name of Comp.	Clg.
Beaver Con.	.29
Big Four	.07
Boston Montana	9½
Braden Copper	7⅞
B. C. Copper	1⅛
Buffalo Mines	1 3/16
Can. Cop. Corpn.	2½
Can G. & S.	.09
Caribou	.66
Chambers Ferland	‡.20
Con. Ariz. Sm.	7/16
Coppermines Cons.	1 9/16
Davis-Daly	.70
Diam'field-Daisy	.05
Ely Con.	.02½
Florence	.52
Gold Hill Con.	.50
Goldfield Con.	1 7/16
Greene Cananea	33⅛
Greenwater	.06½
Internat. S. & R.	‡105
Kerr Lake	4⅛
La Rose	1 7/16
McKinley-Dar-Sa.	.75
Mines of Am.	2⅞
New Utah Bingham	‡.68
Nipissing Mines	6¼
Ohio Copper	⅝
Oro	.12
Puebla S. & R.	2½
Stand'd Oil of N.J.	409
Stand'd Silver Lead	1 1/16
Stewart	1⅛
Stewart Min.T't C.	1 3/16
Tonopah	6 1/16
Tonopah Ex.	2 1/16
Tonopah Merger	.49
Tularosa	⅜
West End Ex.	.04
Yukon Gold	2½

LONDON May 22

Name of Comp.	Clg.
Camp Bird	£0 10s 0d
El Oro	0 12 0
Esperanza	0 15 7½
Mexico Mines	4 12 6
Oroville	0 11 9
Santa Gert'dis.	0 12 6
Stratton's	‡0 0 6
Tomboy	1 0 0

BOSTON EXCH June 2

Name of Comp.	Clg.
Adventure	1 3/16
Ahmeek	270
Alaska Gold M.	27½
Algomah	.95
Allouez	40
Am. Zinc	16½
Ariz. Com., ctfs.	4½
Bonanza	.51
Butte & Balak	2½
Calumet & Ariz.	64½
Calumet & Hecla	410
Centennial	16½
Cliff	1
Copper Range	36½
Daly West	1⅝
East Butte	10½
Franklin	4½
Granby	81⅛
Hancock	15
Hedley Gold	‡15
Helvetia	.25
Indiana	4
Island Cr'k, com.	48
Island Cr'k, pfd.	86
Isle Royale	20
Keweenaw	3⅛
Lake	6½
La Salle	4½
Mass.	5
Mayflower	4½
Michigan	.60
Mohawk	44
New Arcadian	5½
New Idria Quick	3½
North Butte	25½
North Lake	1½
Ojibway	.90
Old Dominion	47
Osceola	76
Quincy	55
Shannon	5½
Shattuck-Ariz.	24½
Superior	28
Superior & Bost.	2
Tamarack	35
Trinity	3½
Trihumne	.50
U. S. Smelting	33⅛
U. S. Smelt'g, pf.	45½
Utah Apex	1⅛
Utah Con.	10½
Victoria	2⅜
Winona	3
Wolverine	40
Wyandot	.40

BOSTON CURB June 2

Name of Comp.	Bid.
Bingham Mines	.04⅜
Boston & Corbin	.28
Boston Ely	.26
Butte & Lon'n Dev.	.38
Calaveras	1 3/16
Chief Cons.	.90
Contact Copper	‡.05
Corbin	.85
Cortez	.18
Crown Reserve	1¼
Eagle & Blue Bell	1
First Nat. Cop.	2
Houghton Copper	2½
Majestic	.19
Mexican Metals	.22
Moneta Pore	‡.02
Nevada-Douglas	1 1/16
New Baltic	1⅛
Oneco	.75
Raven Copper	.12
Smokey Dev.	.25
So. Lake	3¼
S. W. Miami	1
Tonopah Victor	.33
Trethewey	.17
United Verde Ext.	.49

‡Last Quotation.

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted, the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

COPPER

25,241—AFRICA—Ueber Kupfererze der Khangrube, Deutsch-Südwestafrika. O. Stutzer. (Metall u. Erz, Mar. 22, 1914; ½ p.) 40c.

25,242—ARSENIC IN COPPER—Du Role de l'Arsenic dans les Cuivres Industriels. P. Jolibois and P. Thomas. (Rev. de Mét., Nov., 1913; 7 pp., illus.)

25,243—ASSAYING—Kinks for the Copper Laboratory. E. H. Dickenson. (Eng. and Min. Journ., Apr. 25, 1914; ¾ p., illus.) 20c.

25,244—CASTING MACHINES—Straight-Line Copper Casting Machines. (Eng. and Min. Journ., Apr. 25, 1914; 1⅞ pp., illus.) Describes machines installed in Arizona plants by Repath & McGregor. 20c.

25,245—CHILE—Sampling and Testing the Chuquicamata Orebody. E. A. Cappelen Smith. (Eng. and Min. Journ., May 16, 1914; 1½ pp., illus.) 20c.

25,246—HYDROMETALLURGICAL TREATMENT of Copper. Edward Ray Weidlein. (Min. and Eng. Wld., Mar. 28, 1914; 1½ pp.) From U. S. patent 1,089,096.

25,247—HYDROMETALLURGY — The Hydro-Electrolytic Treatment of Copper Ores. Robert Rhea Goodrich. (Advance copy, Am. Electrochem, Soc., Apr., 1914; 36 pp.)

25,248—LEACHING—Stuart Croasdale. Precipitation of Copper-Leaching Solutions. (Eng. and Min. Journ., Apr. 25, 1914; 1¼ pp.) 20c.

25,249—LEACHING—The Weidlein Leaching Process. (Min. and Sci. Press, Apr. 4, 1914; 1¾ pp.) 20c.

25,250—LEACHING PLANT of the Butte-Duluth Co. Peter E. Peterson. (Min. and Eng. Wld., Apr. 4, 1914; 1¼ pp.) 20c.

25,251—MONTANA—Recent Observations in Butte and Anaconda. W. R. Ingalls. (Eng. and Min. Journ., May 9, 1914; 6½ pp., illus.) 20c.

25,252—PYRITIC SMELTING—Igneous Concentration of Metallic Values from Mixed Sulphides. F. L. Clerc. (Met. and Chem. Eng., Apr. and May, 1914; 6 pp.) Outlines the progress of the application of the pyritic idea to the metallurgy of copper and considers its application in the treatment of zinc ores. 80c.

25,253—TRANSVAAL—Mining Copper Ores at Messina. J. Allan Woodburn. (Journ., Chem., Met. and Min. Soc. of South Africa, Mar., 1914; 1¼ pp., illus.) Author's reply to discussion. 60c.

GOLD AND SILVER—GEOLOGY

25,254—BOLIVIA—The Incaoro Gold Mine and Mill, Pallaya, Bolivia. Francis Church Lincoln. (Min. and Sci. Press, Apr. 4, 1914; 4¼ pp., illus.) 20c.

25,255—ONTARIO—Geological Sketch of the Property of the Hayden Gold Mines, Ltd. W. S. Dobes. (Min. and Sci. Press, Mar. 28, 1914; 1½ pp., illus.) 20c.

25,256—ONTARIO—The Ore Deposits of Cobalt. J. Mackintosh Bell. (Min. Mag., Feb., 1914; 7 pp., illus.) 60c.

25,257—ONTARIO—Tourmaline-Bearing Gold Quartz Veins of the Michipicoten District, Ontario. A. H. Means. (Econ. Geol., Mar., 1914; 14 pp., illus.) 60c.

GOLD DREDGING AND PLACER MINING

25,258—ALASKA—Some Notes on Gold Dredging in Alaska. Frederick Powell. (Min. and Eng. Wld., Mar. 7, 1914; 1¾ pp.) 20c.

25,259—CALIFORNIA—Gold-Dredging Operations of the Ashburton Mining Co., Lewis H. Eddy. (Eng. and Min. Journ., May 9, 1914; 2¼ pp.) 20c.

25,260—DUTCH GUIANA—Gold Dredging at Surinam, Dutch Guiana. J. B. Percival. (Min. and Sci. Press, May 2, 1914; 1 p.) 20c.

25,261—FINE-GOLD RECOVERY—The Recovery of Fine Gold and Black Sand. Carney Hartley. (Eng. and Min. Journ., Apr. 25, 1914; 1 p.) 20c.

25,262—KLONDIKE—Placer Mining in the Klondike. D. D. Cairnes. (Can. Min. Journ., Mar. 1, 1914; 2¼ pp.) 20c.

25,263—LEVEE BUILDING With Bucket Elevator Dredge Equipped with Stern Delivery Stacker. C. G. Leeson. (Min. and Sci. Press, Apr. 18, 1914; 2½ pp., illus.) 20c.

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